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Urban Railway Hub Freight Expansion Feasibility Study

Action 8 Output 3

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
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UNIVERSITY OF WESTMINSTER

Urban Railway Hub Freight Expansion Feasibility Study

Final Report

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EXECUTIVE SUMMARY

Study aim and objectives

The University of Westminster has undertaken this feasibility study to develop a clearer understanding of the role that urban railway hubs could play in last mile logistics solutions. The study is a component of the Last Mile Logistics (LaMiLo) project with the Cross River Partnership (CRP) as the primary client. The specific objectives are:

- To assess three categories of railway hub use for freight: (i) dedicated rail freight services, (ii) carriage of freight on passenger trains. and (iii) use of the stations themselves as freight hubs (usually receiving deliveries and collections by road but with the potential for the use of rail freight)
- To broadly consider the most promising urban freight initiatives within these three categories so as to better understand the opportunities and barriers for using urban railway hubs as part of last mile logistics solutions
- Through a case study focusing on central London railway hubs, to develop a Central London Action Plan incorporating recommendations for action by key stakeholder groups
- Reflecting that this is a feasibility study, to make recommendations for further detailed research to more fully understand the potential role for urban railway hubs in promoting sustainable urban freight

Methodology

The study was based on the following methodological elements:

- An international review of literature of urban freight initiatives with relevance to rail freight services and the use of stations as freight hubs
- The direct targeting by email of international rail and/or urban freight experts to seek additional information not easily identified from the literature review; of the 88 experts contacted, 39 responses were received (i.e. 44 per cent) from a total of 16 countries
- Interviews with a range of stakeholders in the UK to identify the main opportunities and barriers influencing urban freight transport using rail infrastructure and services; a total of 24 interviewees participated in the study
- The development of an assessment framework to structure the analysis of the information obtained from the previous three elements of the study methodology

Based around the three categories and eight urban freight transport initiatives considered to stimulate rail freight and stations as freight hubs, Figure A shows the structure of the assessment framework developed for the study (with the freight categories and initiatives colour-coded and these same colours used in Figure B). Given that LaMiLo is an INTERREG IVB NWE project, the assessment framework has been applied at both a generic (i.e. international, large urban areas) level, providing general guidance to those seeking to influence urban freight activity, and at a detailed level, considering key issues in the London context.

Findings of the literature review

The following general conclusions can be drawn from the literature that has been reviewed:

- **Much of the literature focuses either on last mile (road-based) solutions or on urban rail initiatives.** There has been some previous consideration of interrelationships between the two, but this has been quite limited
- **Many of the urban rail freight initiatives identified appear to have characteristics which may limit their transferability**, although the scope for transferability is often not discussed

Figure A: Assessment framework for the study

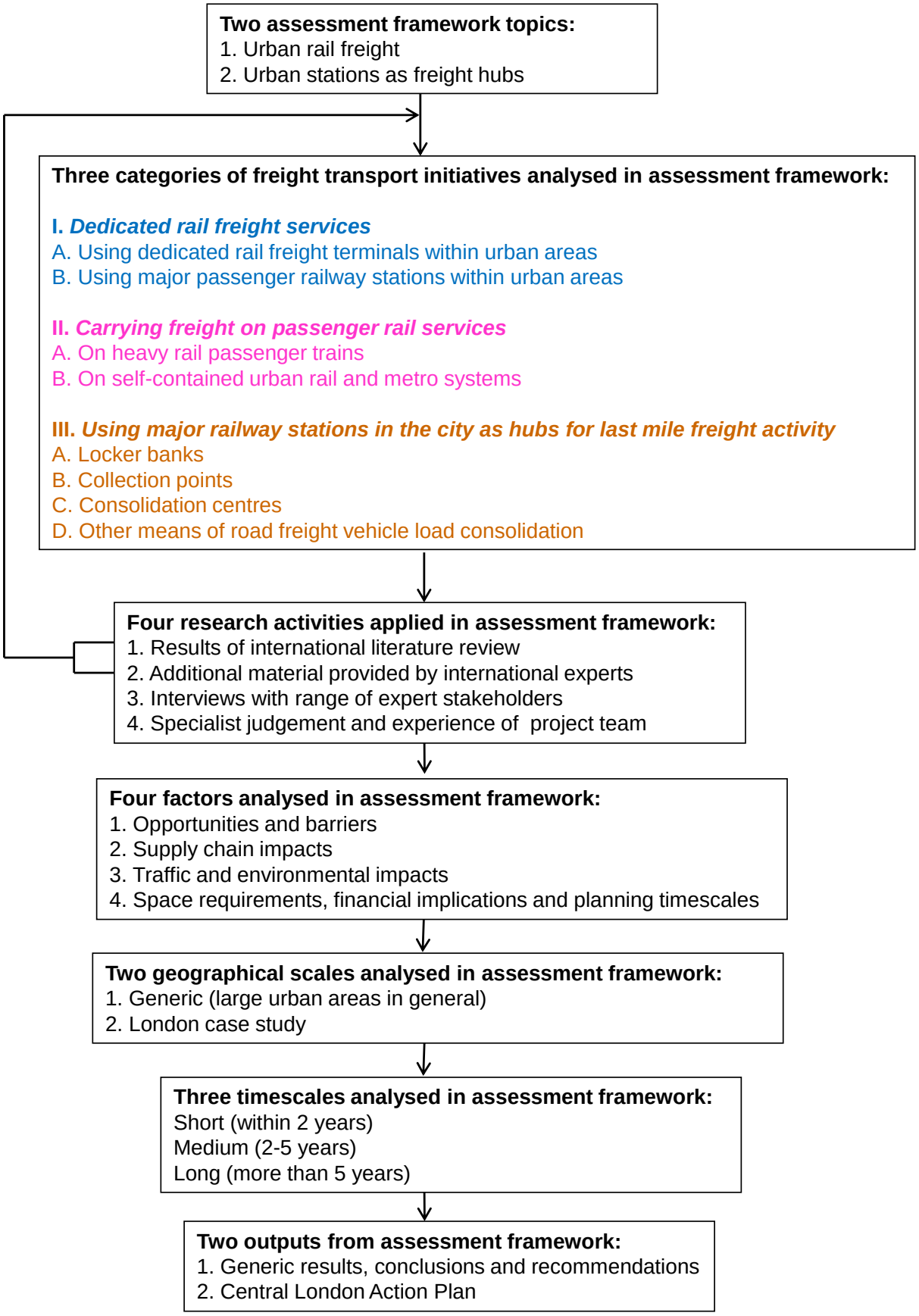
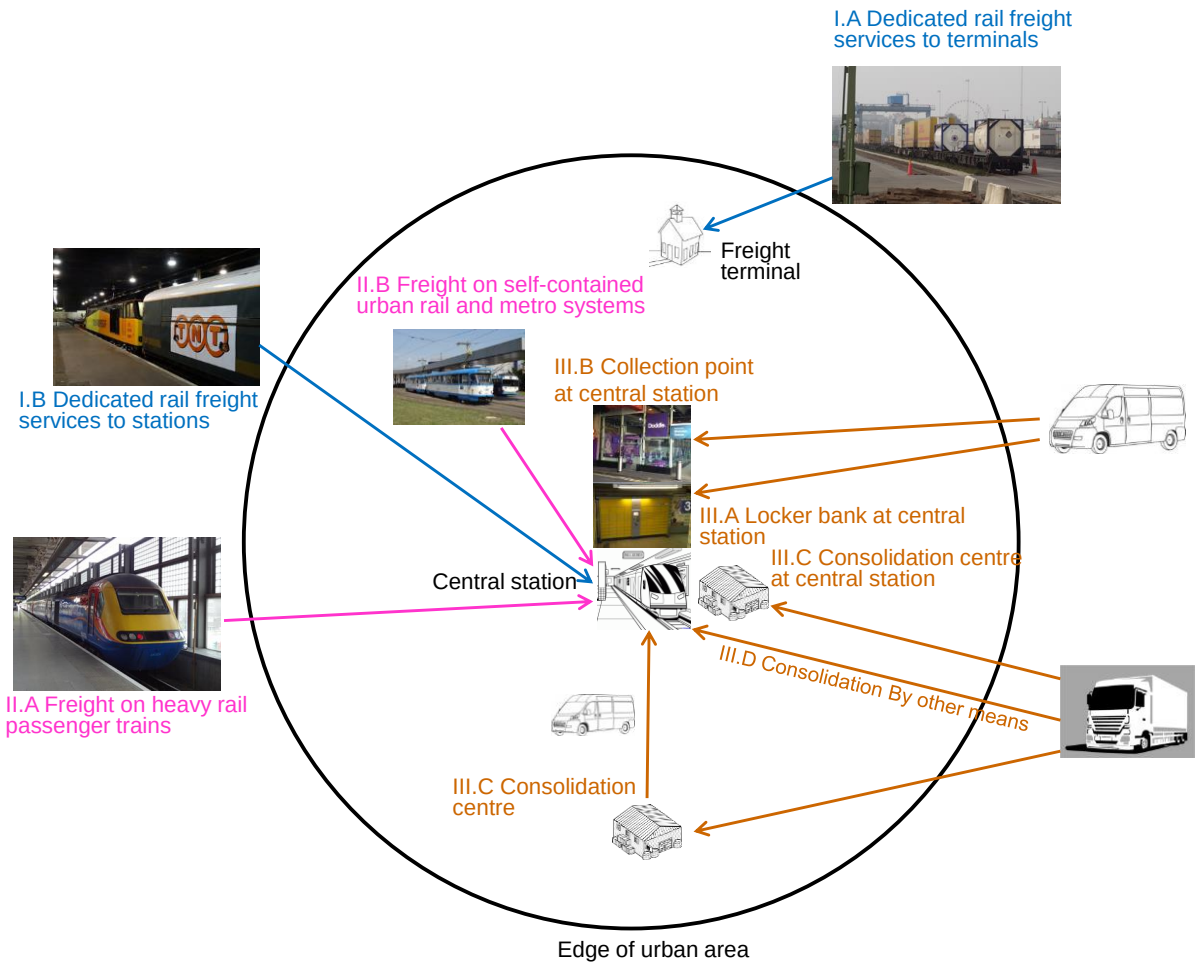


Figure B provides a spatial representation of the eight freight transport initiatives that were identified from the literature review and subjected to further investigation.

Figure B: Spatial representation of freight transport initiatives



Role of rail freight in urban areas

The feasibility study has shown that using central railway stations as freight hubs has potential merit and applicability. The applicability will increase in future as central urban areas continue to grow in terms of building and population density and levels of economic activity, as this will resulting in ever-greater concerns about traffic and its environmental impacts.

This study has identified opportunities for central urban rail freight involving new product markets and services but there is no consensus for a single solution. To realise the opportunities, several barriers will need to be overcome.

In general, dedicated freight trains seem to be better suited to dedicated terminals. There are possibilities for dedicated freight trains to service central stations but more scope exists to carry small quantities of freight on long distance passenger trains. However, there is no obvious catalyst to implement these freight initiatives at central

stations, meaning they are unlikely to become commercially viable in the short-term (i.e. within 2 years).

A key barrier to the provision of rail freight in urban areas, as well as to improving the consolidation of goods destined for stations and businesses, is the availability of suitable land where these activities take place. The loss of logistics land in central urban areas has been a common feature of western European cities in recent decades due to rising demand for land and the relatively low returns offered by logistics activities. However, unless such suitable land is safeguarded and made available at suitable prices, then both rail and road freight facilities will continue to be suburbanised and de-urbanised.

Carrying out trials is important in the investigation of the technological and commercial feasibility of urban rail freight services, as well as demonstrating the opportunities provided by these services to potential users.

Self-contained urban rail and metro systems give a high level of access to central areas of cities. However, there are considerable obstacles to overcome in developing viable freight initiatives and there seems to be little or no potential to expand this type of rail-based freight operation within the next five years.

Role of urban railway stations as freight hubs

Station-based locker banks and collection points are already being implemented by last mile operators and there is scope for them to be more-widely established at central stations in the short-term (i.e. within 2 years). They have an important role to play in changing the supply chain for online orders and helping replace home deliveries and deliveries to workplace with a more sustainable alternative. They could also be used to provide service engineers travelling around central urban areas by rail a convenient place from which to collect parts and equipment.

Central urban stations are unlikely to be suitable places from which to collect large items and groceries ordered online given the cost of storage space at these sites, and the lack of commuter train facilities for the storage of boxes and carrier bags. Therefore, it is important to ensure that these facilities do not inadvertently attract dedicated car trips unconnected with passenger rail travel.

Improved load consolidation on goods vehicles serving stations either through upstream collaboration between shippers, receivers and logistics service providers (LSPs), or through the use of urban consolidation centres (UCCs) would be beneficial in reducing vehicle trip generation at stations (as well as in the surrounding areas). There have been many trials and experiments involving UCCs in European cities in recent years in non-station contexts but few have managed to achieve long-term commercial viability.

A UCC serving a central station would almost certainly have to provide goods to businesses in the surrounding area in order to generate the necessary quantities of product throughput. In terms of the potential location of a UCC that serves central stations, the assessment suggests that it may be easier and better to locate in close proximity to, but not at, the stations due to their lack of affordable land, and so that stations benefit from the goods vehicle trip reduction associated with UCC use. However, locating the UCC away from the station would prevent its ability to directly handle rail freight.

Other means of vehicle load consolidation require a collaborative approach to distribution management so there is a need for companies to commit to close working relationships with others, who may traditionally have been viewed as competitors. Unless such relationships already exist between supply chain parties it will take considerable time to establish them.

Responsibilities for actions by stakeholder groups

Almost all of the stakeholder experts interviewed as part of this study are of the opinion that rail freight in urban areas has a role to play in future. Around three quarters of respondents identified obvious potential for dedicated rail freight services and for the use of major stations in urban areas for last mile freight activity. Half of all participants felt that there is potential to carry freight on passenger rail services. There is less of a convergence of views as to who is responsible for taking action to increase the role of rail-related freight activity, either on trains or at stations.

In order to develop this rail potential there is a need for national and local (urban) government and station operators to take the lead in terms of strategy development. A key aspect of developing such strategy will be to bring the various private and public sector stakeholders together to discuss the opportunities and barriers. For this to happen, national and urban government would need to facilitate this dialogue and discussion between relevant stakeholders. An important role for private sector stakeholders is to think in innovative and imaginative ways about new urban freight transport solutions including the use of rail freight and how these solutions can be made operationally and commercially successful to the mutual benefit of all parties concerned.

The use of major railway stations as hubs for last mile freight activity has fewer strategic requirements than rail freight services and solutions are primarily LSP-led. The major role for public policy makers (and station operators where appropriate) is to identify, safeguard and provide space for the infrastructure required to support these solutions. In the case of consolidation centres, this will also involve broader consideration of suitable sites within the locality in addition to stations themselves. The case of road freight vehicle consolidation by other means requires little, if any, public sector involvement.

Practical recommendations

Six specific recommendations for action are made on the basis of the preceding analysis:

- National (or, where appropriate, urban) government should develop clearer strategic policy guidance to safeguard and/or allocate space for logistics activities in urban areas, setting the framework within which rail-related freight is promoted and local decisions are made; audits of suitable land for safeguarding should be carried out by local government
- A more coordinated approach to station redevelopment should be implemented by national government to ensure that Network Rail takes account of opportunities to improve freight transport activity in and around major railway stations
- More widespread conveyance of small freight consignments on passenger trains needs to be incentivised, most likely through a top-down approach whereby national government establishes regulatory and operational requirements through the franchising process for passenger train operators
- Future trials for rail-related freight initiatives in urban areas should focus on providing evidence to fill gaps in understanding of operational aspects (i.e. proof-of-concept) and, more particularly, on developing stronger business cases for initiatives that are known to work operationally; the results of trials should be clearly disseminated to key decision makers to raise the profile of these initiatives
- The potential for collection points and locker banks at railway stations should be considered in the wider context to establish since stations are often, but not always, among the most appropriate location for these facilities; local circumstances should be taken into account within a broad assessment framework
- Establish a stakeholder group with a remit to determine responsibilities for action

Focus on London

- Rail freight already plays a considerable role in London for certain commodities and in certain supply chains, particularly construction materials and waste, but this role is often overlooked. However, rail freight activity in central London is very limited, and almost non-existent for flows of retail goods and parcels.

- 21 central London stations were evaluated based on published information to provide insight into three topics: rail network access, station characteristics and local area characteristics (see Table 7.2 in main report for full details).

- The viability of rail freight services into central London depends on the availability of appropriate facilities and the ability to aggregate sufficiently large volumes: suburban locations may offer greater potential. Freight on inter-city passenger services may offer more central London possibilities, given the journey speed and city centre access benefits.

- Central London stations offer considerable opportunities for locker banks / collection points for small packages, primarily for online shopping but also for spare parts for field engineers.

- Table B sets out some of the main considerations in the Central London Action Plan developed as part of this project (see section 7.5 for full details of this Plan).

Table B: Central London Action Plan (abridged version)

Freight transport initiative	Financial implications	Planning timescale	Key responsibility for action
I. Dedicated rail freight services			
A. Using dedicated rail freight terminals within urban areas	Major	Medium - Long-term	National govt. TfL/boroughs Network Rail FOCs
B. Using major passenger railway stations within urban areas	Minor - Major	Short - Long-term	National govt. Network Rail FOCs
II. Carrying freight on passenger rail services			
A. On heavy rail passenger trains	Minor – Moderate	Short - Long-term	National govt. Network Rail TOCs LSPs
B. On self-contained urban rail and metro systems	Minor-Major	Short - Long-term	TfL LSPs
III. Using major railway stations in the city as hubs for last mile freight activity			
A. Locker banks	Minor	Short-term	Network Rail/TfL LSPs
B. Collection points	Minor-Moderate	Short-term	Network Rail/TfL LSPs
C.1 Consolidation centre (located at station)	Minor-Major	Medium - Long-term	TfL/boroughs Network Rail LSPs
C.2 Consolidation centre (serving station, located elsewhere)	Minor-Major	Medium - Long-term	TfL/boroughs LSPs
D. Other means of road freight vehicle consolidation	Minor-Major	Short - Long-term	LSPs Shippers/receivers

N.B. Short-term: Within 2 years; Medium-term: 2-5 years; Long-term: More than 5 years

1. INTRODUCTION

1.1 Context

The University of Westminster has undertaken this feasibility study to understand the potential role that urban railway hubs could play in regard to last mile logistics solutions, using Central London railway hubs as a case study. The study is a component of the Last Mile Logistics (LaMiLo) project with the Cross River Partnership (CRP) as the primary client.

Road freight transport typically dominates in urban delivery operations. However, an increasing number of trials and commercial operations have started in the past 10 years attempting to use rail transport in a range of cities. That said, urban rail freight, particularly in relation to last mile freight activity, is largely neglected in policy documents. In the UK, policy has tended to focus on the development of more traditional rail freight markets where goods' flow characteristics such as volume and distance tend to be better suited to movement by rail. Network Rail (2013a) highlighted the expansion of rail activity in retail markets, though most of this growth has been upstream in the supply chain (e.g. intermodal flows linking ports with distribution centres) and not directly serving urban areas. From the consultation phase of the development of the Freight Market Study (Network Rail, 2013b), new rail freight flows using disused station facilities that formerly served motorail, newspaper and parcels traffic were identified as offering potential, together with scope for carrying express parcels on passenger trains. A rail freight strategy for London was published in 2007 (TfL, 2007a), supporting modal shift from road to rail. Much of the focus related to rail flows transiting London (e.g. to/from East of England deep sea ports) but there were also initiatives to promote terminal developments within London. The emphasis here was primarily on dedicated rail freight facilities to service bulk markets such as construction. The possibility of serving retailers through major stations such as Euston was also raised, but the development of strategic rail freight interchanges within and around London (near to the M25 and radial motorways) to handle consumer goods received more attention in the strategy.

At the European Union (EU) level, attention devoted to shifting freight activity from road to rail increased with the 2011 EU White Paper on Transport (European Commission, 2011), which set a number of challenging goals for freight activity. Specifically for rail, the emphasis is very much on the distance flows, particularly those of more than 300 kilometres, where modal shift from road is seen as being particularly achievable. A separate goal is to achieve essentially CO_2-free city logistics in major urban centres by 2030, substantially reducing other harmful emissions in the process. In general, there is a lack of policy integration of long distance transport and urban transport, so the relationship between the two is relatively under-explored and the scope to use rail in combination with CO_2-free road vehicles for last mile deliveries is poorly understood.

Concerns about the relationship between road transport activity and air quality is another factor that in causing concern in both London and other urban areas in European countries. Research shows that many urban areas in Europe are still far from achieving levels of air quality that do not pose unacceptable risks to humans and the environment (EEA, 2014). In addition to being the key cause of premature death and increasing the incidence of many diseases in Europe, air pollution also imposes several environmental impacts, damaging vegetation and ecosystems (EEA, 2014). In an effort to further improve air quality in London, the Mayor has launched a manifesto which includes measures to reduce air pollution from road freight (and other) vehicles through tightening the existing London Low Emission Zone (LEZ), and introducing an Ultra Low Emission Zone (ULEZ) in central London from 2020 and clean public sector vehicle fleets, and improved road traffic management and regulation. He has also called on national government to promote clean vehicles through fiscal incentives and the European Commission to improve Euro engine emission standard

testing (Mayor of London, 2014; TfL, 2014a). Using railway hubs for freight transport can play a role in helping improve urban air quality.

1.2 Study aims and objectives

As stated above, the study seeks to understand the potential role that urban railway hubs could play in regard to last mile logistics solutions, using Central London railway hubs as a case study. In essence, therefore, the study aims to develop a clearer understanding of the potential role of such hubs to help freight activity become more sustainable. It does this at both a generic (i.e. international) level, providing general guidance to those seeking to influence urban freight activity, and at a detailed level, considering key issues in the London context. The specific study objectives are as follows:

- To assess three categories of railway hub use for freight: (i) dedicated rail freight services, (ii) carriage of freight on passenger trains, and (iii) use of the stations themselves as freight hubs (usually receiving deliveries and collections by road but with the potential for the use of rail freight)
- To broadly consider the most promising urban freight initiatives within these three categories so as to better understand the opportunities and barriers for using urban railway hubs as part of last mile logistics solutions
- Through a case study focusing on central London railway hubs, to develop a Central London Action Plan incorporating recommendations for action by key stakeholder groups
- Reflecting that this is a feasibility study, to make recommendations for more detailed research to more fully understand the potential role for urban railway hubs in promoting sustainable urban freight

1.3 Study methodology

To meet the study aims and objectives, the methodology is based on four elements:

- An international review of literature relating specifically to urban rail freight initiatives and of that with broader relevance to the scope for greater use of urban rail infrastructure and services
- The direct targeting by email of international rail and/or urban freight experts to seek additional information not easily identified from the literature review
- Interviews with a range of stakeholders in the UK to identify the key opportunities and barriers influencing urban freight transport using rail infrastructure and services
- The development of an assessment framework to structure the analysis of the information obtained from the previous three elements of the study methodology

Each of these elements is elaborated in the following sub-sections.

1.3.1 Identification and review of published international literature

The principal means of searching for relevant international literature were as follows:

- Academic literature, using keyword searches on the University of Westminster library search facility (which interrogates a range of databases of journal articles)
- Best practice examples and case studies (e.g. from BESTFACT, ELTIS, European Intermodal Association)

- Rail industry literature from relevant specialist international publications (e.g. International Railway Journal, Railway Gazette, Today's Railways Europe)

1.3.2 International rail and/or urban freight experts request

The request sought information about relevant initiatives known to the recipients (see Appendix 1 for the email template). The request was sent initially to 81 international respondents, with a further 7 targeted after receiving recommendations for additional experts from respondents of the original email. The initial list of 81 experts was compiled from the authors' existing network of contacts with expertise in the topics involved (i.e. urban freight transport and rail freight transport), supplemented with a search for other international experts from published material (i.e. journal and conference papers). Of the 88 experts contacted, 39 responses were received (response rate of 44 per cent). Table 1.1 summarises the geographical distribution of the sample and responses. Almost half of those from Europe and North America who were emailed responded to the request, representing good coverage of these regions. Within Europe, the Netherlands and Sweden represented almost half of the responses, with responses also from eight other European countries. While some respondents had no knowledge of specific initiatives, the majority sent published literature and/or links to web-based sources.

Table 1.1: Breakdown of sample of and responses from international urban/rail experts

Region	**Sample**	**No. of responses**	**Response rate (%)**
Europe, of which:	58	29	50
Netherlands	*12*	*8*	*67*
Sweden	*7*	*5*	*71*
Belgium	*6*	*4*	*67*
Germany	*7*	*3*	*43*
Italy	*3*	*3*	*100*
Switzerland	*2*	*2*	*100*
France	*4*	*1*	*25*
Poland	*3*	*1*	*33*
Portugal	*2*	*1*	*50*
Norway	*1*	*1*	*100*
North America	13	6	46
Asia	11	3	27
Africa	3	1	33
South America	2	0	0
Australasia	1	0	0
Total	**88**	**39**	**44**

1.3.3 Interviews with UK stakeholders

Interviews were conducted with a range of expert stakeholders based in the UK representing a range of important stakeholder groups from both the private and public sector. The interview process was largely designed to inform the analysis addressing the third and fourth study objectives (i.e. with a London focus). A total of 24 interviewees participated in the study, with the distribution of participants to stakeholder groups as shown in Table 1.2. Of the industry associations, one represented retailers while the other was focused on the rail freight sector.

Table 1.2: Number of interview participants, by stakeholder group

Stakeholder group	No. of participants
Logistics service providers (LSPs)	4
Rail freight operators	5
Public authorities	8
Shippers/receivers (incl. retailers)	2
Industry associations	3
Rail infrastructure provider	1
Consultant	1
Total	**24**

Prior to each interview, the participant was sent a pre-interview questionnaire to complete. This allowed the collection of some key standardised information across the entire sample and also formed the basis for discussion in the interview itself. The questionnaire and interview process was designed to incorporate both the views of differing stakeholder groups to the general issues relating to the use of rail infrastructure and services and to explore issues of particular relevance to their area of operations and expertise.

1.3.4 Development of an assessment framework

An assessment framework was developed based on the four research components, these being the international literature review, the interviews with a range of expert stakeholders and the specialist judgement and experience of the research team. The assessment framework was developed and applied in two stages, as follows:

1. A generic assessment of rail-related urban freight: this identifies and classifies the range of different ways in which rail services and infrastructure can play a role in enhancing the sustainability of urban freight requirements, particularly focusing on the characteristics of urban railway hubs. This generic assessment includes consideration of: (i) opportunities and barriers, (ii) the supply chain impacts, (iii) the traffic and related environmental impacts, and (iv) the space requirements, financial implications and planning timescales

2. A specific assessment of the role of central London railway hubs, identifying the potential for use of stations for different types of freight use

Following these assessments, a Central London Action Plan in relation to the central London railway hubs identified in the project brief was developed.

Further details of the assessment framework are provided in section 3.

1.4 Report structure

Following on from this introduction, Section 2 summarises the range of urban rail freight examples identified in the literature and from the international experts. Section 3 presents the assessment framework developed and applied in the study. The application of this assessment framework in relation to large urban areas (i.e. the generic assessment) is presented in Sections 4-6. This consists of the views of interviewees together with the expert judgement of the project team concerning the opportunities and barriers for rail freight (in Section 4) and urban railway stations as freight hubs (in Section 5), and the overall assessment of traffic and environmental impacts, and timescales, financial and planning implications (in Section 6). Section 7 contains the London case study, which consists of an

overview of existing rail freight activity in London (Section 7.2), the outcomes of the assessment work into the opportunities for greater rail freight (Section 7.3) and greater use of stations as freight hubs (Section 7.4) and the Central London Action Plan (Section 7.5). Conclusions and recommendation for further work are provided in Section 8.

2. LITERATURE REVIEW

2.1 Introduction

As set out in the brief, the literature review is based around the three options to stimulate rail freight in rail stations, with sub-divisions as follows:

- Rail freight services in urban areas (Section 2.2):
  - Urban rail freight services using passenger stations
  - Urban rail freight services using dedicated terminals
- Freight on urban passenger rail services (Section 2.3):
  - Freight on heavy rail urban passenger services
  - Freight on urban rail and metro systems
- Use of railway stations for road-based freight operations (Section 2.4)

Where identified in the literature as being of importance, regulations and policies related to the different types of freight activities are discussed. Despite much of the literature referring to the sustainability benefits associated with greater use of rail services and facilities in urban areas, there is little explicit coverage of regulations and policies that may assist in effecting modal shift from road to rail in the urban context. Several authors (notably Behrends (2011), De Langhe (2013), Marinov et al. (2013)) have carried out reviews and evaluations of urban rail freight initiatives and the key findings are reported in the appropriate subsequent sections. In addition, details of a range of case studies of current rail freight initiatives are presented to demonstrate the range of ways in which rail freight is used in urban areas. At times, different literature sources contain conflicting information (which sometimes is evidently incorrect) so judgment has been exercised when summarising the case studies; this does not affect the core principles of the different initiatives. The role for regulations and policies features in the subsequent assessment framework (Section 4).

There are many 'best practice' rail freight examples, particularly for intermodal transport where rail fits into supply chains of consumer goods, but while many make use of rail facilities in and around urban areas few of them are specifically urban in nature (see, for example, EIA, 2010 and the 'heavy rail' section of the BESTFACT website). Similarly, there are many examples of 'best practice' urban freight (see, for example, the various road categories on the BESTFACT website, or other project websites such as BESTUFS and SUGAR) but few explicitly relate to the use of rail. Several urban rail freight examples have been found on the ELTIS website.

2.2 Rail freight services in urban areas

This section discusses the use of passenger stations for urban rail freight services, although few specific examples have been identified from the literature or correspondence with international experts. It then turns its attention to urban rail freight services using dedicated terminals, of which more examples have been identified. First, though, some general issues relating to modal shift from road to rail in urban areas that have been identified in the literature are discussed.

Diziain et al. (2012) emphasised the need for an holistic approach to regional logistics planning for large urban areas and for the public sector to use land use planning policies and the regulatory framework to assist with shifting freight to rail (and water) to meet urban logistics requirements in a more sustainable way. They argued that, in the case of Paris, limited land use controls have led to logistics sprawl and that greater regional planning is required from public authorities, working with private partners such as property developers,

and logistics practitioners, so as to develop more efficient and sustainable urban logistics infrastructure. Specifically in the context of urban rail, Haywood & Hebbert (2008) highlight the widespread loss of the formerly close relationship between urban form and rail freight activity with the redevelopment for other uses of many former goods yards and warehouses near to urban railway stations. They highlight the challenges involved in gaining a consensus to integrate rail development, particularly urban rail hubs, into the land use planning process.

Recognising the pressures on logistics land in large, high cost cities, Diziain et al. (2012) developed a hierarchy of terminals to serve large urban regions. They were applied to the Parisian context, but may be applicable elsewhere, as follows:

- Level 1: large peripheral multimodal terminals
- Level 2: medium-sized peripheral road terminals, often within logistics parks but also spread along major roads
- Level 3: urban gateways, around 5 to 10 kilometres from the city centre
- Level 4: urban terminals within or near the inner ring road
- Level 5: Last mile delivery terminals in the city centre

In general terms, it becomes more challenging to incorporate rail solutions as the level increases (i.e. as the terminal becomes smaller and more central). The development of intermodal logistics zones on the periphery of large urban areas features heavily in the literature (e.g. Behrends (2011), MDS Transmodal/CTL (2012)), but some attention has also been devoted to trying to bring rail freight closer to the city centre particularly for niche flows that may offer better viability than for general freight movements. Policy guidance on rail freight terminal development in Britain (DfT, 2011) focuses mainly on large, strategic terminals which are unlikely to be located within urban areas, though with a recognition that there is a role for smaller scale facilities serving a more localised catchment area. In particular, mention is made of urban terminals of between 10 and 30 hectares, either catering for intermodal transfer or rail-linked warehousing, but nothing is said about the possible use of existing passenger stations.

Many cities have redundant rail land that could offer potential. In Paris, for example, Diziain et al. (2012) highlight that many city sites that may offer scope for city logistics projects are owned by RFF, the public agency responsible for French rail infrastructure, and SNCF, the state-owned railway company) although there are often competing demands for development at these valuable city locations. The same is sometimes true of former urban rail routes, where alternative uses that may remove the scope for reuse for rail freight into inner city areas are being discussed (see, for example, La Petite Ceinture in Paris, which circles much of Paris city centre (The Guardian, 2014)). In Paris at least, the Sogaris case study detailed later (in Section 2.2.2) demonstrates that there is a growing recognition of the need to give greater priority to urban logistics activity.

2.2.1 Urban rail freight services using passenger stations

Very little literature has been found relating to rail freight activity at passenger stations in urban areas, either for serving stations themselves or for using stations as modal interchanges to serve the surrounding areas. For stations themselves, and in the British context, Network Rail's Guide to Station Planning and Design highlights the need to "plan spatial allocation to provide for the needs of equipment and vehicles such as bicycles, luggage trolleys and goods vehicles" (Network Rail, 2011, 42). However, all of the points discussed relate to road-borne activity with no mention at all of the option to serve railway station freight and servicing requirements by rail itself. In the Japanese context, Muramatsu

et al. (2013) argue that the growth of retailing activity within railway stations may lead to negative impacts on the surrounding road transport network. This was borne out by their study of Shinagawa station in the Tokyo metropolitan area, where they recommended greater cooperation to reduce the number of deliveries. In the future, though, they suggested that the use of freight trains to make deliveries to the stations be considered.

Railway station modernisation projects often require considerable volumes of building materials to be brought to the site and waste materials to be taken away. UIC (2013) considered how railway stations could adapt to future society, emphasising the evolution of key stations away from simply providing rail travel opportunities to also offering business, shopping, leisure and restaurant functions. The report analyses the renovation of 11 major stations around the world, but use of rail freight is not mentioned. Numerous other recent examples of major station rebuilding projects have been identified elsewhere in the literature, including Salzburg Hbf (Austria), Wien Hbf (Austria), Praha hl. n. (Czech Republic), Leipzig Hbf (Germany), Parma (Italy) and Rotterdam Centraal (Netherlands) and Birmingham New Street (UK). Of these, the only one where the use of rail has been mentioned in the literature is Birmingham Street (see case study 1). Of course, it may be that rail has been used elsewhere but that this has not been seen as important enough to mention in the literature.

Case study 1: Birmingham New Street rebuilding project (UK)

The rebuilding of New Street focuses on the pedestrian areas of the station, both at and above platform level, with one platform out of use at a time. The project commenced in 2010 and is scheduled for completion in 2015. Two sets of wagons are being used to bring in construction materials and take away spoil twice per week. The trains operate between Small Heath yard, around two miles away, and whichever platform area at New Street is under reconstruction at the particular time. Redundant sidings at Small Heath yard were refurbished, with a materials storage area located alongside. Over the life off the project, 10,000 lorry journeys are expected to be kept off the road network.

Source: Modern Railways (2011, 2013), Network Rail (n.d.)

In terms of rail freight services using railway stations, two trials at Euston station (London) are relevant and are discussed in Section 4.2. As part of MOBILMED, a European INTERREG IIIB project, Nuzzolo et al. (2008) carried out a technical and economic feasibility study into the use of rail freight to serve retailers on the Sorrentina Peninsula near Naples (Italy), given the poor road accessibility (and associated congestion problems) of this popular tourist area. Focusing on the current rail system, particularly the line from Naples to the peninsula, the study investigated the suitability of both the existing railway stations and modified passenger rolling stock characteristics for freight traffic. This led to the selection of San Giovanni a Teduccio station in Naples as the loading point for freight brought in by road and rail and Piano di Sorrento station on the peninsula as the unloading point for last mile road distribution. The availability of available tracks and storage/circulation space for goods traffic led to these stations being selected. The analysis suggested that the rail service would be technically feasible but the cost per tonne would be around twice the equivalent road cost.

2.2.2 Urban rail freight services using dedicated terminals

A number of initiatives have been identified, with several case studies representing urban rail freight services using dedicated facilities. The case studies progress from those that are

very clearly serving an urban freight transport requirement (case studies 2 to 4) to others that serve wider logistics requirements but within the urban framework (case studies 5 to 9).

Case study 2: waste materials, Kawasaki City (Japan)

A rail-borne flow of waste materials has operated within Kawasaki City since 1995. The distance between the loading terminal in the north of the city and the Ukishima waste disposal centre in the city's southern region is just 23 kilometres, with the waste being conveyed in dedicated containers. Different types of waste, including general waste, incinerated ash, cans and bottles, are carried. Road transport is required at both ends of the rail journey, with many collection points served by the pre-haulage while the post-haulage links the destination rail terminal with the waste disposal centre.

Source: Diziain et al. (2014), Taniguchi & Nemoto (2008)

Case study 3: Monoprix, Paris (France)

The scheme has been in operation since November 2007 and was initiated by Monoprix, a French retail group owning 300 shops. Samada, the in-house logistics provider, manages the delivery operation. The concept makes use of a logistics centre located in Paris-Bercy and rail carries 30 per cent of flows (120,000 tonnes or 210,000 pallets a year) destined for 90 shops in central Paris. When established, 27 stores were served but this has since increased dramatically. The key characteristics of the initiative are as follows:

- a train of 16-18 wagons operates each evening (Monday-Friday) carrying palletised non-perishable goods (such as textiles, beauty products, household products and soft drinks) from distribution centres at Combs-la-Ville and Lieusaint to a terminal next to Paris-Bercy station, close to the city centre.
- the rail journey covers a distance of 30 kilometres and onward distribution to shops is carried out by CNG-powered road vehicles.
- the loaded train operates into the city in the early evening, returning early the following morning; the shop deliveries are made from 07:00 with each vehicle serving one or two shops.
- availability of a suitable inner city rail terminal was critical to the launch of the initiative.
- city terminal only needs enough space for direct transhipment from rail to road, with other activities taking place at the out-of-town end of the rail route.
- currently more expensive option than road-only solution, but environmental and social benefits are substantial: financial viability is dependent on the extent to which road's external costs are internalised; the scheme is technically acceptable but its operation is about 25 per cent more expensive than the previous all road solution, but taking into account fuel prices and road pricing the balance can quickly change.
- annual savings of 70,000 litres of fuel, 337 tonnes of CO_2 emissions, 25 tonnes of NOx emissions, and 12,000 fewer lorry journeys entering Paris city centre.

Source: Alessandrini et al. (2012), Charlier (2008), Dablanc (2009), De Langhe (2013); Diziain et al. (2014), Maes and Vanelslander (2010), Marinov et al. (2013)

Case study 4: Sogaris, Paris (France)

Sogaris is a public-private property company, 80 per cent owned by local government, which focuses on urban logistics activity. Sogaris is aiming to develop urban logistics facilities based on the following integrated strategy:

- whole urban areas, with logistics platforms as points of entry
- consolidation centres (known as 'logistics hotels') in the densest parts of urban areas
- final delivery points within neighbourhoods

Multimodal terminals feature as components of the first two categories of facilities with the large Sogaris Rungis (Paris) logistics gateway as an example of the former and the planned logistics hotels in Paris (and Brussels) are examples of the latter. While multimodal urban logistics gateways are reasonably well established, and usually located at the edge of large urban areas, the logistics hotel concept is more innovative and aims to bring rail freight closer to city centre areas. A new rail terminal is under construction at Chapelle International, near to Gare du Nord, which is part of a development including logistics support activities, a business incubator and public facilities. The development has 20,000 m^2 of land and 40,000 m^2 of buildings housing logistics activities, offices and community facilities.

Source: Diziain et al. (2014), Sogaris (2012)

Use of the former dedicated Mail Rail system in central London for retail deliveries was investigated but found not to be commercially viable due to small volumes and short distances (MDS Transmodal/CTL, 2012).

With examples from France and Japan, Diziain et al. (2014) have highlighted the problems associated with the loss over time of logistics land, particularly rail-connected sites, in and near to city centres. Even where urban rail-connected sites exist, such as the GVZ (Güterverkehrszentrum) 'logistics village' concept in some German cities, it has generally proved difficult to integrate rail into urban supply chains. MDS Transmodal/CTL (2012) summarised the problems that have been experienced in Bremen over the last 20 years, although the Westhafen example in Berlin appears to have been more successful (see case study 5). Other case study examples of urban rail freight terminals catering for longer distance flows are then provided (in case studies 6 to 9). This includes two examples from the USA which reflect the particular transport challenges associated with cities that have seaports within their urban boundary.

Case study 5: Berlin Westhafen (Germany)

Westhafen is a trimodal inner-city logistics centre operated by the Berlin harbour and storage company (BEHALA), located just to the north west of the city centre and served by road, rail and inland waterway. The centre has been in operation since 1923 and handles both containers and bulk commodities. Hinterland container train services operate to/from Bremen and intermodal services run to/from other locations in Germany and to/from Poland. Some services are operated in conjunction with DHL. More than 100,000 TEUs were handled in 2013.

Source: BEHALA (n.d.)

Case study 6: La Poste (France)

For the last 30 years, La Poste has moved mail in dedicated TGVs at speeds of up to 270 km/h, using a terminal at Paris-Charolais (next to Gare de Lyon). This service will cease in 2015, however, when a new €23 million terminal will open at Bonneuil-sur-Marne near Paris to carry bulk mail, newspapers, magazines and small freight consignments in intermodal units to/from other parts of France. Overall investment will be €100 million and by 2017 the volumes carried are expected to be 30 per cent higher than the current TGV capacity. The Charolais site is earmarked for redevelopment by SNCF/RFF.

Source: Railway Gazette (2014b), Today's Railways Europe (2014)

Case study 7: Brookhaven Rail Terminal, Long Island, New York (USA)

The Brookhaven Rail Terminal (BRT) opened in 2011 in response to severe road congestion on the main arterial highway and rail's negligible mode share (less than 1 per cent) of freight activity in Long Island, which has a population of almost 3 million. Since opening, the terminal has handled a range of commodities including bulk aggregates materials, products for Home Depot stores, biodiesel and flour. There are plans to expand the facility and it is expected to handle around 1 million tonnes of freight per annum by 2016.

Source: BRT (n.d.)

Case study 8: ExpressRail, Port of New York and New Jersey (USA)

Major investment has been taking place at each of the container terminals within the overall Port of New York and New Jersey to provide better facilities and additional capacity to achieve modal shift to rail for the hinterland container traffic. There is capacity at present to handle over one million containers by rail and this is planned to increase to 1.5 million capacity by 2020. Rail mode share has been increasing and is currently more than 14 per cent.

Source: PANYNJ (2014a, 2014b)

Case study 9: Alameda Corridor, Long Beach/Los Angeles (USA)

Construction of a 20 mile long rail cargo expressway linking the ports of Long Beach and Los Angeles to the main US rail network started in 1997 and trains began operating in 2002. The corridor provides segregation from both passenger trains and road traffic, with a 10 mile open trench (33 feet deep and 50 feet wide) forming a key part of the infrastructure. The new corridor consolidated four rail branch lines and removed more than 200 level crossings, leading to more efficient rail and road flows. Container trains form the major part of the traffic. The corridor was funded from both private and public sources, with the railroads paying for each container carried on the route. Work is currently underway to extend the segregated rail corridor through the San Gabriel Valley.

Source: ACECA (2014), ACTA (2014)

Dinwoodie (2006) considered the scope for rail freight to play a greater role in urban distribution in Plymouth (UK), focusing on long-distance movements to/from the city and

considering city sites with road and sea links. Other examples have been identified in the literature, but with limited details provided relating to their urban characteristics. In many cases, the relationship between the rail freight activity and the urban area is not explicit. For example, Diziain et al. (2014) refer to an 80 kilometre rail shuttle for container traffic in the Bordeaux (France) region.

2.2.3 Summary

The majority of the literature relating to urban rail freight services focuses on the use of dedicated rail freight terminals. There is very little evidence of regular freight trains using passenger stations as their point of loading or unloading within the urban area, although there is some limited discussion of this in specific circumstances.

2.3 Freight on urban passenger rail services

There is a long history of freight (especially parcels traffic) being carried on passenger trains. In Britain, this almost entirely died out with the cessation of Red Star Parcels in the late 1990s following rail privatisation and it appears that the use of passenger trains for freight flows elsewhere is limited. This section first discusses freight flows on traditional heavy rail passenger services and then considers the use of rail and metro systems for the movement of freight.

2.3.1 Freight on heavy rail passenger services

Perhaps because historically it was quite common, there is remarkably little discussion in the recent literature of freight being carried on heavy rail passenger trains and just three specific examples have been identified (see case studies 10 to 12).

Case study 10: Esprit Europe, Eurostar (Belgium/France/UK)

Esprit Europe offers a station-to-station parcels service using timetabled Eurostar trains between London and Brussels/Paris. Customers drop off or collect their parcels from the EuroDespatch Centre at St Pancras International. Larger volume, time-sensitive goods such as newspapers, print material, film, computer equipment and mail are also carried. Both the Eurostar terminals and the trains are controlled environments, with the consignments travelling in security sealed compartments on the train.

Source: Esprit Europe (n.d.)

Case study 11: Keltic Seafare and the Caledonian Sleeper train (UK)

Live seafood is transported by rail from the Scottish Highlands to London using the Caledonian Sleeper overnight train between Inverness and London Euston. The service is used on Monday to Friday nights. Onward deliveries are made the following morning by road to restaurants in central London, in time for the lunch menu.

Source: Keltic Seafare (n.d.)

Case study 12: 5PL and East Midlands Trains (EMT) (UK)

Starting as a trial in 2010 and expanded in 2011, 5PL and EMT have worked in partnership to offer a same-day service for small volume freight (e.g. food and drink, legal documents, computer equipment) in secure compartments on High Speed Trains (HSTs) operating between Nottingham and London St Pancras International. Door-to-door services are provided through the integration of first and last mile courier operations, sometimes using cycle couriers. The initiative has been a success although the sphere of operation is limited: to ensure passenger disruption is avoided no intermediate stations were served initially (although EMT has agreed to the inclusion of Leicester following trials in 2013), nor are services operated by other types of train on the route included. The initiative provides a very high quality of service to customers but with no impact on train punctuality. In the first two years of operation there was only one major disruption to the freight flow, caused by rail infrastructure failure, but quick response limited the impacts on customers.

Source: 5PL (2013), ELTIS (2013), Screeton (2013)

In contrast to former network-wide parcels service offerings, these examples offer a niche rail-borne service which fits around specific passenger train operations and meets customer requirements for a premium, highly time-sensitive transport service.

2.3.2 Freight on urban rail and metro systems

In contrast to heavy rail, there is considerable discussion of the use of urban rail and metro systems for the carriage of freight and several initiatives have been identified from the literature. Five current schemes, in Germany, Japan (two schemes), India and Switzerland, are presented as case studies, together with discussion of a number of other schemes that have either been implemented and then abandoned or have failed to proceed beyond the planning stages.

Case study 13: CarGoTram, Dresden (Germany)

Since 2001, cargo trams have been used to supply automotive components to Volkswagen's "transparent factory" located close to Dresden city centre. This location was chosen so as to be easily accessible to the general public, but this posed challenges for freight flows. A distribution centre to serve the factory on a just-in-time basis was established in a logistics zone around 4 kilometres west of the factory, linked by the tram network. Short sections of tram route were constructed at either end to connect in to the city's existing tram network and two bespoke 60 metre long trams were constructed. The route from distribution centre to factory is 5 kilometres in length, takes 15-25 minutes and trams run every 40-60 minutes, operated by DVG (the operator of the city's tram system). Each tram can carry 60 tonnes, avoiding the need for three lorries per journey and around 60 lorries per day. The trams are unloaded in 20 minutes using forklift trucks. A diversionary route is available in the event of non-availability of the direct route. The unusual characteristics of this operation are recognised, limiting transferability to other cities.

Source: Arvidsson & Browne (2013), De Langhe (2013), DVB (2002), ELTIS (2007)

Case study 14: Cargo Tram and E-Tram, Zürich (Switzerland)

The Cargo Tram is a non-commercial municipal service operated by ERZ (Entsorgung und Recycling Zürich) in cooperation with VBZ, the public transport operator, which started in 2003 with the collection of bulky household waste from four tram stops in the Zürich suburbs. The number of collection points quickly increased and then, from 2006, the collection of electrical and electronic waste commenced with the E-Tram initiative. A new container design was developed, with the containers being carried on flat wagons and pulled along by a converted tram. Nine tram stops are now served; at each location there are additional tracks which allow segregation of passenger and freight operations. Originally, the Cargo Tram operated only four times per month, but this has since increased to almost daily operation. The trams take the waste to the Werdhölzli terminus which is near to an ERZ depot.

Source: Arvidsson & Browne (2013), De Langhe (2013), ELTIS (2012a), Marinov et al. (2013)

Case study 15: Parcels, Kyoto (Japan)

In Kyoto, a freight operation using light rail has existed since 2011. Accompanied by staff from the Yamato parcels company, parcels are carried on regular vehicles on the Keifuku Electric Railroad on a daily service from the city centre to Arashiyama (10 kilometres to the west) prior to the morning peak period. Onward delivery of parcels is made by electric bicycles.

Source: Diziain et al. (2014)

Case study 16: Sapporo (Japan)

For the primary purpose of trying to reduce urban transport problems during severe winter weather, a pilot project was conducted in 2010 making use of the metro system in Sapporo (Japan) in the off-peak period to carry freight on a hand cart. The experiment used the metro for approximately 10 kilometres between the Yamato Transport Sapporo Base in the suburbs and the Odori Home Delivery Center in the city centre. The goods were carried in the cart throughout the journey. It seems that at least some of the goods were destined for underground shops, but it is not clear whether these shops were within the metro stations. In addition to the experiment itself, a questionnaire survey and an on-board monitoring survey were carried out to test the public acceptability. Almost 90 per cent of respondents supported the initiative, though with some concerns relating to project profitability and to safety and congestion at subway stations. The principle of separating freight and passengers by dedicating one car to freight was well-supported. There was also a strong view that subway stations should "be renovated to effectively perform the operation". Further experiments were planned, in particular considering the integration of the freight by subway and the city centre deliveries, but it is not clear whether they have taken place. The importance of the regulatory framework was specifically mentioned in this case study, primarily that permission for freight to be transported on the passenger subway system would be required but also that greater restrictions on on-street unloading of vehicles would be beneficial to maximise social and economic benefits.

Source: Kikuta et al. (2012)

Case study 17: Dabbawallahs, Mumbai (India)

Every day, 150,000 lunch boxes are collected from homes and transported to office locations in the morning period, with the empty lunch boxes being moved back from offices to homes in the late afternoon period. The Dabbawallahs have operated since 1890 and they travel with the lunch boxes on the Mumbai suburban rail network. Each Dabawallah is responsible for up to 30 customers; up to eight Dabbawallahs make up a team and up to eight teams form a group. There are 120 groups in total. Lunch boxes are brought to the origin railway station and are sorted based on their destination. At the destination station, the boxes are sorted according to their precise destination, with sorting taking place in carts in public places. The entire operation is highly time sensitive, with collections from homes typically taking place around 08:30-09:00. The lunch boxes arrive at the destination station by around 11:30 and deliveries are made by 13:00. The lunch boxes are accompanied by the Dabbawallahs on the train journey. The high frequency of train services, generally around one per minute, is crucial to the success of the operation.

Source: Agarwal (n.d.), Ravichandran (2005)

Considerable mention is made in the literature of two 'failed' schemes, in Amsterdam and Vienna (see, for example, Arvidsson & Browne, 2013, De Langhe, 2013). In Amsterdam, a four-week trial took place in 2007 with goods loaded onto trams at the terminus of one tram route and offloaded at two stops along the route, using two specially adapted trams. The trial was technically successful but the initiative was abandoned in 2009 due to a requirement from the city authorities that it operate without subsidy (ELTIS, 2012b). The Vienna concept was planned to become a truly intermodal solution with heavy rail offering long-distance freight service into one of three city terminals linked by a cargo tram circle line while a final delivery into the city centre was to be completed from the most convenient transfer point by small environmentally friendly trucks. Despite feasibility studies and operational tests, the implementation of the concept proved difficult for the following reasons (Robinson and Mortimer, 2004):

- perceived systems and level of service disadvantages
- continuous requirement for road vehicles carrying out last mile operations
- required co-operation between parties who could also be competitors
- expected environmental benefits did not materially influence commercial decisions
- higher cost and complexity when compared with road transport

Two hypothetical freight tram schemes in Barcelona were evaluated by Regué and Bristow (2013), one for retail deliveries and the other for the collection of domestic waste. Their key conclusion was that "freight tram schemes can only be feasible if they take advantage of economies of scale, serving a minimum demand and have highly efficient UCCs [urban consolidation centres], or exploit niche markets where current operational costs are high and little or no additional infrastructure is required" (Regué and Bristow, 2013). A scheme was also developed to link seven towns on Reunion Island, a French territory in the Indian Ocean (Luciano, 2011). This scheme was different in that there was no pre-existing tram system, so from the outset it was designed for both passengers and freight. Flows of kerosene, coal, sugar and containers were identified where transport costs were likely to be lower than by road, but the entire project was cancelled after regional elections in 2010.

Additional feasibility studies have been identified. For example, He et al. (2009) considered the Beijing metro system and argued that, with considerable underutilisation during off-peak hours and overnight, there was plenty of scope to cater for urban logistics deliveries. Given that metro stations are less than 1 kilometre apart, they estimated that goods can be

delivered to surrounding neighbourhoods within 10 minutes even on foot, but that the metro stations themselves would require rebuilding to make them better suited to freight flows; this would have not inconsiderable cost implications. While there has been no widespread application to date, a large internet bookshop (Dangdang.com) has been using the metro to deliver orders in the Beijing area using a mix of ground staff and subway staff. A similar study has been conducted in New York, where the New York State Energy Research and Development Authority (NYSERDA, 2014) has been investigating the feasibility of an intermodal freight system in New York City which would make use of the subway network to bring freight into the city area, with last mile deliveries made by small electric vehicles. The concept was shown to be feasible and worthy of further investigation.

A variation on the potential use of an urban rail network was a San Francisco Bay Area study to use the Bay Area Rapid Transit (BART) system to move air cargo consignments (Lu, 2007). While a number of positive characteristics were identified, it was argued that further investigation was required particularly relating to three key aspects:

- efficient use of existing facilities when considering a combination of passenger and freight flows
- the nature of relationships, particularly with regard to dynamic cooperation, between the public transport system and private companies
- broader issues relating to achieving an integrated, seamless transport operation linked with optimised land use so as to achieve environmental, safety and efficiency benefits

As far as can be ascertained, this proposal has not been developed any further.

2.3.3 Summary

Considerably more literature has been found relating to the carriage of freight on urban rail/metro systems than on standard heavy rail trains (such as those operating over the national rail network in Britain). All of the case studies feature operations that are very specific in their geographical coverage and/or commodities carried. The operating principles are therefore interesting but the degree of transferability of the case studies to other urban areas is unclear. These issues are discussed later in the assessment sections of the report.

2.4 Use of railway stations for road-based freight operations

This section considers the use of railway stations for road-freight based operations. It starts by reviewing research into road freight activity to provide goods for train catering and to retail outlets at terminus stations in London (section 2.4.1). Specific actions taken to improve load factors on goods vehicles delivering to London railway stations are reviewed in section 2.4.2.

The rise in online shopping is considered (in section 2.4.3) as this is a possible new source of freight flows to and from railway stations (as passengers opt to collect their goods at stations as part of their existing rail journeys). These online shopping collection services including collection points and locker banks are then reviewed in section 2.4.4.

2.4.1 Road freight transport activity at urban railway hubs

Using information from previous research projects it is possible to summarise information about road freight transport deliveries and collections to five London terminus railway stations: Euston, St. Pancras International, Victoria, Charing Cross and King's Cross

(Browne et al., 2013; JMP, 2012; Peter Brett, 2012; TfL, 2007b; TTR, 2012a; TTR, 2012b). The road freight transport activities at these stations are generated by two sources: (i) the retail outlets located in the stations, and (ii) the goods requirements for the train services operated from the stations. The former generates far more goods vehicle activity at these stations than the latter. Road freight waste collection services generated by these activities are also collected from the stations. Table 2.1 summarises the scale and pattern of road freight transport activity generated by the five central London railway stations reviewed.
Key points to emerge for the review of road freight transport at five central London terminus stations are:

- The total road freight transport activity generated by the railway stations is substantial.
- The road freight transport activity generated by retail tenants at the stations varies markedly depending on the type and scale of retailing involved.
- The railway stations have limited storage space available for retail tenants, which contributes to the level of road freight transport activity.
- The time taken to carry out collection and delivery activity is typically between 10-20 minutes per vehicle arrival. In some cases goods have to be transferred substantial distances from vehicles to point of delivery.
- Despite the stations having off-street loading/unloading facilities a substantial proportion of this road freight delivery and collection activity takes place with the vehicles stopping on-street.
- Vehicle queuing can occur during busy periods as vehicles wait to enter in some cases limited off-street loading/unloading areas.
- A substantial proportion of vehicle collections and deliveries take place out-of-hours (i.e. 19:00-07:00).
- The vehicles most commonly used to make deliveries are light goods vehicles (LGVs), followed by rigid heavy goods vehicles (HGVs). Some articulated HGVs are used to make deliveries to stations (especially to retail tenants with large stores). However deliveries by these articulated HGVs typically take place out-of-hours when the stations are stores are quiet.

2.4.2 Improving vehicle load factors through consolidation

There are two UK examples of improving vehicle load factors through consolidating flows of product in freight operations serving railway stations. The first of these is an example of goods from shippers being grouped together on a single vehicle destined for different receivers with outlets at a railway station. This is the case of Select Service Partner (SSP - a food service company) that operates food outlets for several retailers in railway stations. In the case of Euston station, for instance, SSP operates Burger King, Caffè Ritazza, Delice De France, Harry Ramsden's, Millie's Cookies, Nam-Po, Sloe Bar, The Pasty Shop, Threshers and Upper Crust. In the SSP supply chain well-loaded articulated goods vehicle deliveries make deliveries to Euston station on which the goods for all these retail outlets is combined. Although this results in longer unloading times for its vehicles compared with deliveries for many other retailers at Euston station, it substantially reduces the total number of vehicle deliveries required, and hence the total unloading time that would otherwise be required. SSP also services eighteen retail catering units at Victoria station and eight at Charing Cross station using this same consolidation method. This approach also significantly reduces the total vehicle kilometres travelled in supplying goods to these retail outlets and the associated fuel consumption, carbon emissions and air pollutants (Browne et al., 2013).

Table 2.1: Key freight transport issues relating to central London railway stations and to Euston in particular

Key measure	General characteristics	Station-specific information (where available)
Number of retail tenants	The number of retail tenants in the five stations range from 24-100 tenants.	Euston: 50 retail tenants. St Pancras International: 63 retail tenants and 1 hotel. Charing Cross: 24 retail tenants. Kings Cross: 29 retail tenants. Victoria: approx. 100 retail tenants.
Freight road trip generation per retailer per week	Variable, dependent on size and nature of retail operation at station, extent of storage space, and survey coverage: average weekly no. of goods vehicle trips per retailer at each station varies from 4 to 20.	Euston: 13 vehicle movements. St Pancras International: 5 vehicle movements (plus 120 vehicle movements for hotel). Charing Cross: 6 vehicle movements. Kings Cross: vehicle movements. Victoria: 20 vehicle movements.
Total road freight trip generation per week	The total road freight trip generation per week at the five stations ranges from 150-2000 vehicle movements.	Euston: 650 vehicle movements. St Pancras International: 400 vehicle movements. Charing Cross: 150 vehicle movements. Victoria: 2000 vehicle movements.
Goods delivered	Predominantly food and drink, with other deliveries dependent on range of activity (e.g. presence of hotels, offices, shopping malls, specialist retailers)	Euston: two thirds of vehicle activity for food, drink and packaging; others include newspapers/magazines and healthcare/toiletries.
Timing of vehicle arrivals	Sizeable out-of-hours activity (between 0000 and 0700), with typically fewer deliveries at weekends.	Euston: peak period for vehicle arrivals 0500-1200, with peak hour arrival from 0600-0700. Charing Cross: peak period for vehicle arrivals are 0000-0300, 0400-0730 and 0930-1530. Kings Cross: peak period for vehicle arrivals 0300-0800 and 0000-0100, with peak hour arrival from 0300-0400. Victoria: vehicles arrive throughout day, with 25% vehicle arrivals between 1900-0700.
Location of deliveries/ collections	Mix of off- and on-street: recently redeveloped stations typically have better off-street facilities	Euston: 63% off-street, 37% on-street. Charing Cross: 85% off-street, 15% on-street. Victoria: 50% off-street, 50% on-street.
Type of vehicle used for deliveries	Majority of vehicles are LGVs and rigid HGVs, but articulated HGVs used for larger retailers.	Euston: LGV & car: 49%, rigid HGV to 17.5t: 28%, rigid HGV over 17.5: 9%, artic HGV: 14%. Charing Cross: LGV & car: 74%, rigid HGV to 17.5t: 15%, rigid HGV over 17.5t – 11%. Victoria: LGV: 50%, rigid HGV: 28%, artic HGV: 2%, m'bike: 10%, car: 5%, cycle: 4%, foot: 1%.
Vehicle dwell times	Average dwell time typically between 10 and 20 minutes per delivery	Euston: 19 minutes St Pancras International: 75% take 20 minutes or less Charing Cross: 11 minutes Victoria: deliveries – 20 minutes; collections and servicing – 35 minutes

There are obvious advantages to this approach of supplying retail outlets at stations in terms of reducing vehicle trip generation. It is possible that, with the cooperation of retailers, such an approach could be used to provide goods to other retail outlets at railway stations. However, it requires collaboration between retailers and logistics service providers (LSPs) that often perceive themselves as competitors. Depending on how it is implemented it can also involve substantial change in upstream goods handling and storage.

The second case is one in which receivers with several establishments located in relatively close proximity to each other having all deliveries made to one location and then performing onward road distribution to the other locations when required. This example is from Rail Gourmet (which is part of SSP), the provider of on-board food and catering services for train services at Euston, Kings Cross and St Pancras International. Rail Gourmet uses the Parcel Deck at Euston Station to receive consolidated deliveries of food supplies for each of these three stations. It then makes onward deliveries from Euston station to Kings Cross and St Pancras International during the day. This helps Rail Gourmet to overcome the constraint of limited storage space at St Pancras and Kings Cross (Browne et al., 2013). There may be scope for expansion of this type of arrangement at railway stations with sizeable storage facilities such as Euston. In principle, further consolidation of goods for more than one station should lead to better space utilisation, less duplication of facilities and a greater possibility of generating flow volumes that allow viable rail freight operations.

2.4.3 Locker banks and collections points

Introduction

In the UK online shopping accounted for 10.7 per cent of all retail spending in March 2013. This is equivalent to approximately £35 billion per year (ONS, 2014). It has been forecast that online retail spending in the UK will increase by 45 per cent between 2014 and 2019 to a total of £56 billion (Verdict, 2014a). Further details about online shopping and its current and expected growth are included in Appendix 3.

Rather than deliver goods to customers' homes or workplaces, fulfilment channels that offer deliveries to other locations are growing in importance. These include "click and collect" and "pick up and drop off point" (also known as PUDO). "Click and collect" is a fulfilment channel for online shopping which allows customers to order goods from a retailer's website and then collect them from a local branch or other standalone collection facility operated by the retailer. "Pick up and drop off point (PUDO)" is a place where goods can be left for customers for collection, or where customers can drop off goods to be returned. It can be a staffed or unstaffed locker bank, or a staffed counter in a building such as a shop or dedicated facility (i.e. a collection point). (DHL, 2014). The concept first emerged for field engineers requiring parts for their daily activities, but was later transferred to online shopping as a customer fulfilment channel. It therefore includes locker banks (such as those operated by DHL, Amazon, and InPost) as well as collection points (including the Post Office, CollectPlus, Kiala, and Doddle). Locker banks and standalone click and collect facilities can be located at railway stations, petrol stations, shopping centres, workplaces and residential estates. Collection points are located in either dedicated shops (in high streets or shopping centres), in railway stations (such as Doddle's outlets) or in existing retail outlets (for instance CollectPlus in the UK has counters in branches of Asda, Costcutter, Nisa, Spar and McColls - CollectPlus, 2014).

Delivering online orders to places other than customers' homes can help to eliminate failed home deliveries (i.e. when the delivery is made at a time when the consumer is not home to receive it). Failed deliveries can delay consumers receiving their goods and are costly for retailers / LSPs (or for consumers if these costs are passed on to them). Also, as a goods

vehicle delivers far more items to a single location items when locker banks and collection points are used than in the case of deliveries to consumers' homes, this helps to reduce the distance travelled per item delivered and the associated impacts. In deciding whether to make use of locker banks and collection points, consumers have to weigh up the charges involved with the convenience offered, and compare these with alternative delivery options (to home, work, with neighbour etc.). However there are some key differences in the attributes of locker banks and collection points (see Appendix 4).

It is also important to note that locker banks and collection points result in freight and passenger transport at the places they are located. Placing them at railway stations will have transport trip generation implications at these locations that are already often busy. This issue is discussed in further detail in section 6.1.

Growth in use

A major factor in the use of online shopping and click and collect and PUDO services is the increase in working hours of many people. Data in 2010 showed that the average working week in the EU27 was 38.2 hours with results close to or above 40 hours in many central and eastern Europe countries and in Greece and Cyprus (Verdict, 2011). However other alternative delivery arrangements continue to prove more popular to most online shoppers than collection point and locker bank services. A recent UK survey showed that when asked about their choice of alternative delivery channel (if not delivered to their home) 43 per cent said their neighbour's home, 15 per cent said a friends' or family member's home, 12 per cent said a post office, 11 per cent said a Royal Mail sorting office, 11 per cent said a work address, and 6 per cent said a convenience store (Royal Mail, 2014a). The click and collect fulfilment channel is forecast to grow more rapidly in the next five years (from £3.6 billion in 2014 to £6.5 billion in 2019) than other forms of home shopping as customers seek to avoid home delivery costs. The growing use of standalone collection points at locations other than retail stores is expected to feature importantly in this growth (Verdict, 2014a).

Groceries purchased online in the UK are likely to continue to be collected from stores and standalone collection facilities operated by retailers rather than from collection points or locker banks (Verdict, 2014b). Smaller retailers offering click and collect services can consider collaborating with other smaller retailers to extend their collection network. However a focus on high levels of customer service must be maintained to ensure customer loyalty (Verdict, 2011).

Customer charges for locker banks and collection points are also a deterrent in their use. A 2012 European survey indicated that free delivery is the most important and appealing factor for online grocery shoppers (Verdict, 2012). Survey work in 2010 showed that 22 per cent of respondents in the UK stated that they would be more likely to use home shopping for clothing and footwear purchases in delivery charges were lower, and 26 per cent would be more like to purchase health and beauty products online (Verdict, 2011). The lack of delivery charges are an important factor in the popularity of click and collect as a fulfilment channel (Verdict, 2011). Click and collect is also beneficial to retailers as it helps prevent the costs of failed home deliveries, and increases the density of goods to collection facilities.

Trials and collaborations

Several grocery retailers (including Tesco, Asda, Waitrose and Sainsbury) and locker bank providers (including Amazon and InPost) have been trialling online shopping collection services with TfL from 25 London Underground station car parks since November 2013. Since the click and collect grocery service from Underground stations was started in

November 2013, customers have placed 10,000 orders (Beard, 2014; TfL, 2014b and 2014c). TfL has announced that the trial has been successful and will be extended from 25 to 42 Underground station car parks. Ocado is planning to start click and collect services from four stations in September 2014 (TfL, 2014d). All of the London Underground station car parks offering these services are based in outer London, as such station car parks do not exist in central and inner London; the intention is that customers collect their goods on their way home in the late afternoon-evening. The PUDO fulfilment channel is forecast to treble over the next five years, but will still only account for £0.6 billion by 2019 (Verdict, 2014a). This growth is expected to be driven by the growth in Post Office and CollectPlus services, as well as Amazon and InPost locker banks. Despite having a network of 5,500 collection points (based in a range of retail outlets) CollectPlus is reported to be substantially behind the Post Office in terms of its collection point network. However, it is forecast that the CollectPlus network will overtake the Post Office in the next five years to become the leading collection point provider in the UK (Verdict, 2014b).

There are some existing and emerging logistics collaborations between companies offering online orders. For example, following a successful trial last year, customers purchasing goods from sellers on eBay can now choose to collect their goods from 650 Argos stores (Butler, 2014). Meanwhile Asda is the only major grocer so far to have joined CollectPlus, allowing customers to collect and return its goods via the extensive the Collect Plus network (Collect Plus, 2013). Westfield in London launched its CollectPlus lounge in January 2014. This service allows customers to shop online from 260 retailers at the centre and then to visit the lounge to collect their purchases rather than visit the individual retailers' shops (Westfield, 2014).

Collection points

It has been estimated that there are approximately 100,000 collection point locations across Europe (Proud, 2014). Germany has the largest number of collection points. France, the UK and the Benelux countries are also well-served while Southern and Eastern European countries have far fewer sites. Kiala began its collection point network in Belgium in 2001. This was subsequently extended to France, Luxembourg, the Netherlands and Spain, with a network is more than 7,000 collection points handling up to 145,000 parcels per day. More than 300 retailers make use of this Kiala service. Most collection points are stores and customers can track their goods online and receive text, e-mail, or phone when notification when their goods have arrived at the selected collection point. Kiala was purchased by UPS in 2012 (Berman, 2012).

CollectPlus is jointly owned by Yodel (a UK parcel carrier that handles approximately 135 million parcels per year) and PayPoint (an international provider of convenience store payments to major utility companies in the utility, housing, water, and telecoms sectors). It has a network of 5,500 collection points based in a range of retail outlets (CollectPlus, 2014). Relais Colis provides 4,200 collection points in France and handles approximately 35 million items per year. Many of its users are small online retailers (Relais Colis, 2014). The Post Office has a network of approximately 10,500 branches in the UK. It offers a parcel collection service from its branches for orders made from participating retailers – this service is called Local Collect. Customers can track their items online and receive notification when their items are ready for collection (Royal Mail, 2014b).

A joint venture between Network Rail and Lloyd Dorfman has resulted in the development of Doddle, a new collection point service that is due to commence in autumn 2014. The service will allow customers to collect goods ordered online from dedicated Doddle "shops" that are based at railway stations. These "shops" can be used to collect goods ordered from and delivered by any store-based retailer, online and other non-store retailers, and LSPs. A pilot

scheme has been trialled at Milton Keynes station. Doddle plans to open collection point "shops" in London Waterloo, Bromley South, Brighton, Chelmsford and London Cannon Street soon and to be operating from 300 locations in the next three years (BBC, 2014; Network Rail, 2014).

Locker banks

Locker banks are also forecast to expand rapidly in the next five years as the likes of Amazon and InPost continue to increase their facilities. However, it is reported there is currently a lack of penetration of locker banks in the UK, and that customers hold concerns about the use of locker banks and the service offered by their providers. In a 2013 survey, 85 per cent of respondents who had never used locker banks stated that they did not intend to in the future. These concerns include that locker banks are generally unstaffed, and therefore no help is available at the point of use. It is argued that getting customers to use locker banks for the first time is the major challenge facing providers – this could be achieved by providing staff to assist for a temporary, start-up period (Verdict, 2014b).

Locker bank providers in the UK include ByBox, InPost (which has 1000 locker banks in the UK), and Amazon (whose locker banks are dedicated for their own use at present). Other locker bank and box providers in other European countries include: Cleveron (an Estonian companies with networks in several countries including Finland; Keba (an Austrian company), which assisted DHL/Deutsche Post in establishing its Packstation network in Germany, and is now establishing a network in the Czech Republic (Fulfillment and elogistics, 2014).

Locker banks have several benefits as a means of receiving home shopping including their accessibility at any time of day or day of week, and their security. However, current limitations of locker banks include their limited size which prevents their use for larger products such as furniture, certain electrical products, clothing, DIY and gardening products, and their inability to handle chilled or frozen food. Locker banks are likely to continue to be most suited to shoebox-sized parcels. Many staffed collection points located in existing retail outlets also tend to have limited storage space which also affects the goods they can hold for collection, and their ability to handle larger returns (Verdict, 2014b). Locker banks have been taken up far more rapidly in Germany in the UK. DHL has installed Packstations in all German cities with populations of more than 100,000 inhabitants, and 2,400 of them are located in railway stations. In total Packstation has approximately 800,000 customers in Germany (SUGAR, 2011).

2.5 Innovation in rail freight service provision

A number of recent innovations have been identified from the literature that may offer scope for developing rail freight but which do not fit neatly into the previous sections. This section briefly summarises those which seem to offer potential particularly to urban rail freight activities, as follows:

- Emerging market for electric locomotives with 'last-mile' diesel capability, such as the Bombardier TRAXX DE (Bombardier, n.d.), Siemens Vectron DE (Siemens, n.d.) and Vossloh EURODual (Vossloh, n.d.). Similar multiple unit trains are also available. The diesel capability is clearly useful for accessing branch lines or terminals that are not electrified but, in the context of urban freight services that may operate at night, the diesel capabilities may offer the flexibility to allow service operation even if the overhead power supply is isolated for maintenance.

- Advances in temperature-controlled rail freight flows. For example, a new service was introduced in Italy in 2013 on behalf of Unilever carrying ice cream from the Napoli area to near Parma, carrying containers with an internal temperature range from +25C to -25C) (Today's Railways Europe, 2013a). Similarly, GreenRail provides temperature-controlled rail movement of floriculture products between Netherlands and Italy (BESTFACT, 2013).
- Introduction of low noise brake blocks for freight trains to reduce disturbance caused by freight train operations. DB Netze, responsible for the German railway network, has revised its track access charges so that wagons not fitted with quieter brake blocks pay more to use the network. There is a target to halve freight train noise emissions by 2020, presumably based on a 2012 baseline (Today's Railways Europe, 2012; 2013b); this will have particular benefits for urban areas with higher population densities around rail infrastructure.
- Integrating novel urban freight systems with rail freight activity, such as the use of underground pipelines or pneumatic systems. For example, De Halve Maan Brewery in Bruges (Belgium) plans to build a three kilometre underground beer pipeline to link its two sites in the historic city so as to remove lorry traffic from the city's road network (De Halve Maan, 2014). In New York (USA), consideration is being given to the retrofitting of linear transportation infrastructure such as rail and subway lines with pneumatic tubes to carry municipal solid waste (NYSERDA, 2013). The former example does not specifically consider the use of rail, but that from New York does consider the onward movement of waste by either barge or rail.

2.6 Summary of key issues from the literature

While there is a considerable volume of literature considering the use of rail for urban freight requirements, little explicit consideration of the use of passenger stations as hubs for the coordination of freight activity has been identified. Further, the increasing attention devoted to last mile solutions in urban areas has little focus on the scope for rail-borne activity to contribute to a more efficient and sustainable outcome. The following general conclusions can be drawn from the literature that has been reviewed:

- Much of the literature focuses either on last mile (road-based) solutions or on urban rail solutions. There has been some previous consideration of interrelationships between the two, but this has been quite limited.
- Many of the urban rail freight initiatives identified appear to have characteristics which may limit their transferability, although the scope for transferability is often not discussed.

There is therefore a need to assess the opportunities (and barriers) for the greater integration of rail infrastructure and services into urban supply chain activity.

3. ASSESSMENT FRAMEWORK

Although the feasibility study is essentially based on qualitative research methods, it was necessary to structure the analysis so as to ensure a consistent and rigorous approach. This was achieved through the development and application of a common assessment framework that was designed to address four key topics in relation to: (i) urban rail freight and (ii) using stations as freight hubs:

1. opportunities and barriers
2. supply chain impacts
3. traffic and environmental impacts
4. space requirements, financial implications and planning timescales

The project team developed the assessment framework from their previous assessment efforts in earlier studies that were largely qualitative in nature, notably the report for Transport for London (TfL) on *HS2 - Identifying opportunities for freight at Euston and Old Oak Common* (University of Westminster, 2013)[1] and the report for the Department for Transport on addressable rail freight markets as part of the freight modal choice study (University of Westminster, 2010).

Given that LaMiLo is an INTERREG IVB NWE project, the assessment framework needed to be capable of addressing both generic and London-specific situations. Once developed, the assessment framework was applied by the project team at both levels to provide generic, high-level findings (i.e. for large urban areas in general), and a specific case study assessment of London. In the London case study, central passenger stations were also analysed in terms of selected characteristics relating to the stations themselves, their rail network access and their interactions with the surrounding area in order to assess their freight suitability to perform the role of an urban rail freight hub. This was based on a set of criteria developed in the initial stages of the study including characteristics relating to the stations themselves, their rail network access and their interactions with the surrounding area (see Section 7.4.1 and Appendix 6 for further details). The assessment work also involved the development of a Central London Action Plan. The assessment framework developed for and applied in the study is shown in diagrammatic form in Figure 3.1.

The assessment framework involved the application of four research activities: (i) the results of the international literature review, (ii) additional material provided by international experts, (iii) the interviews with a range of expert stakeholders, and (iv) the specialist judgement and experience of the project team.

The assessment framework was structured around eight urban freight transport initiatives identified from the literature review and additional material provided by international experts as having the greatest relevance to stimulate improvements in the sustainability of freight transport operations at stations through the use of either: (i) rail freight and/or (ii) road freight operations serving railway stations. These eight selected initiatives were then used as the basis of discussion in the stakeholder interviews, and for considerations of transport and environmental impacts, and timescales, financial and planning implications of stations as freight hubs.

[1] This document is unpublished and is the property of Transport for London (TfL).

These freight transport initiatives were grouped into three categories as follows:

I. Dedicated rail freight services
A. Using dedicated rail freight terminals within urban areas
B. Using major passenger railway stations within urban areas

II. Carrying freight on passenger rail services
A. On heavy rail passenger trains
B. On self-contained urban rail and metro systems

III. Using major railway stations in the city as hubs for last mile freight activity
A. Locker banks
B. Collection points
C. Consolidation centres
D. Other means of road freight vehicle load consolidation

It should be noted that option I.A (i.e. using dedicated rail freight terminals within urban areas) does not involve using passenger railway stations. Instead this option involves rail freight travelling to/from rail freight terminals. Movements to and from the rail freight terminal would be road-based but could serve retail outlets at railways stations. The four initiatives in category III (options A to D) may operate independently of any rail-borne freight activity but at the very least would be utilising railway station infrastructure.

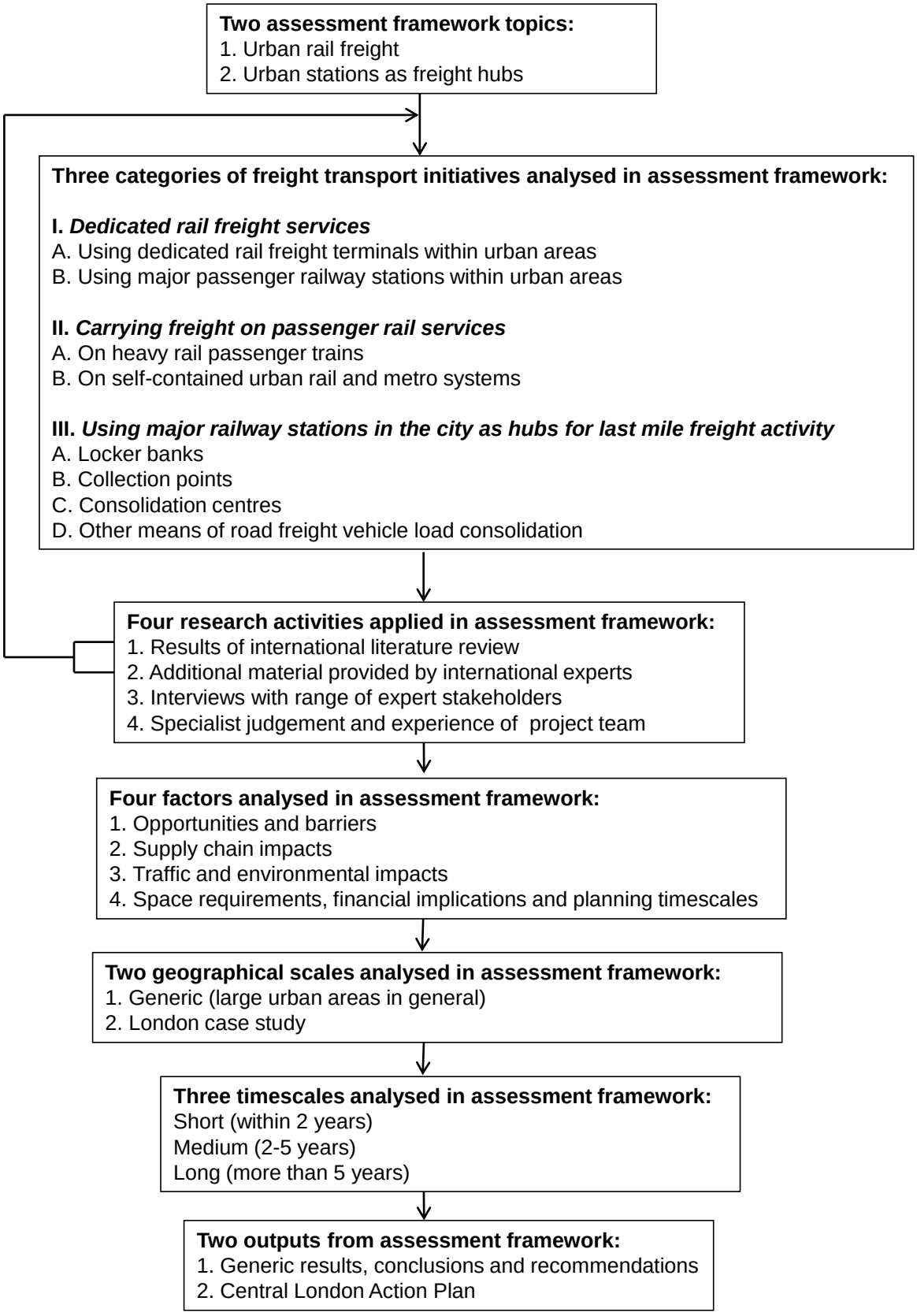
The assessment framework reflected three time periods over which the implementation of freight transport initiatives to bring about rail freight and/or stations as freight hubs were considered. These were the short-term (i.e. within 2 years), the medium-term (i.e. 2-5 years) and the long-term (i.e. more than 5 years).

The outcomes of the application of this assessment framework in relation to large urban areas (i.e. the generic assessment) are presented in Sections 4-6. This consists of the views of interviewees together with the expert judgement of the project team concerning the opportunities and barriers for rail freight (in Section 4) and urban railway stations as freight hubs (in Section 5), and the overall assessment of traffic and environmental impacts, and timescales, financial and planning implications (in Section 6). Section 7 contains the London case study and Action Plan.

While much of the assessment work is necessarily within the British context, given that this is a relatively small scale feasibility study, the framework itself is designed to be transferable and applied elsewhere.

It should also be noted that the original intention of the feasibility study was to focus on providing a suitable assessment framework for thinking about rail stations as freight hubs. The current work has gone some way beyond this aim, and has attempted to also apply the assessment framework developed. However the results of this assessment work need to be treated with some caution given the scale of the project both in terms of its timescale and budget. While hopefully providing useful initial insights into the topics and questions investigated the feasibility study is not able to provide definitive answers. Further research would be needed to investigate key issues further before greater certainty about some issues is possible.

Figure 3.1: Assessment framework for the study



4. THE ROLE OF RAIL FREIGHT IN LARGE URBAN AREAS

The assessment of the possible role of urban rail freight starts with the consideration of dedicated rail freight services using either dedicated rail freight terminals or major passenger railway stations (Section 4.1). This is followed by a discussion of issues relating to the use of passenger services to carry freight, either on heavy rail passenger trains or on self-contained urban rail and metro systems (Section 4.2).

4.1 Dedicated rail freight services in urban areas

Almost all respondents were supportive of, and were keen to see, growth in urban rail freight activity, though not all believed it to be likely to be achieved within the next five years. Below that headline finding, however, there were divergent views on the most appropriate type of rail freight services and the degree of penetration of urban areas that would be best suited to rail's characteristics. Added to this was a general lack of consistency and clarity over which group(s) of stakeholders should take the lead in developing new urban rail freight services, so this tends to lead to the perpetuation of the status quo. There was a feeling across the different stakeholder groups that the options for urban rail freight are currently not well understood and that, in particular, there is an insufficient evidence base at present to be able to develop strong business cases.

From the discussions with respondents, three broad options for increasing the provision of dedicated rail freight services in urban areas emerged:

1. Directly into (or out of) city centres using major passenger railway stations

2. To (or from) dedicated rail freight terminals in inner and suburban locations, most likely with direct rail-road transhipment and limited on-site storage

3. To (or from) rail freight terminals on or just beyond the periphery of the urban area, possibly as part of a strategic rail freight interchange/logistics park

While many points made by interviewees related specifically to London (see Sections 7.3 and 7.4), the general view was that, for each of the options, the movements to/from customers (i.e. the last mile) would be by road although linking the third option by shuttle service to one of the first two options may have some merit in a similar manner to the Monoprix operation in Paris (see case study 3 in Section 2.2.2). No clear consensus emerged as to whether it would be better to focus on developing new dedicated rail freight services using dedicated freight terminals or major passenger stations, reflecting the limited evidence base referred to above. The predominant view of the rail freight operating companies (FOCs) was that dedicated freight terminals would be better, although it can be difficult to gain planning permission and to build a business case. Further growth in bulk trainload flows (e.g. of aggregates materials) may offer the "safest" growth opportunity for rail, since it is a market that the FOCs understand and, certainly in London, there are terminals that seem able to handle additional volume. The FOCs pointed out that this was the type of operation in which they are experienced, so they were generally capable of assessing the viability of potential flows. This was contrasted with the risks associated with entering (or re-entering) new markets, such as high speed parcels trains into passenger stations, where, in a privatised and competitive rail freight market, it is more difficult to build a viable business case.

On the other hand, the majority view from those outside the rail industry was that central passenger stations offer better opportunities than freight terminals in commercial, traffic and

environmental terms for urban rail freight services carrying goods destined for the central urban area (due to their proximity to the final destinations to be served). These stakeholders tended to focus more on the associated road transport requirements than on the likely viability of serving city centres directly by dedicated freight trains.

There were mixed views about the timescale for growth and development of new markets in urban rail freight operations. The majority of respondents did not expect this to take place in the short- to medium-term (i.e. within 5 years), but some felt that achieving commercially viable rail freight growth in new markets was possible within two years. Despite concerns raised from a number of stakeholders from outside of the rail industry, the FOCs were mostly positive about investigating the scope for new types of service to broaden the role of rail freight in urban areas, particularly when some traditional bulk markets (e.g. coal) are predicted to decline at the national level.

Overall, there was a lack of convergence in the views from across the stakeholders interviewed as to which type(s) of rail freight services offered the greatest opportunity, particularly for the non-bulk traffics where rail currently has little or no market presence. For the majority of respondents, the way forward in achieving rail freight growth and innovation was the setting up of trials that could kick-start this process and provide insight into what is possible and feasible in operational and commercial terms. Commercial viability in particular was viewed as being elusive, with a feeling that if this was achievable then there would already be more evidence of greater uptake of rail freight in urban areas. That said, there were some mixed messages in this regard, since a perceived lack of flexibility and reliability for rail freight featured in discussions with a number of stakeholders from outside of the rail industry and in some cases these were viewed as being bigger obstacles than cost. Indeed, some from the logistics service provider and retailer stakeholder groups said that higher costs may not be an insurmountable obstacle given corporate social responsibility (CSR) benefits of using rail instead of road. Occasional trials excepted, the dominant view from respondents was that central urban passenger stations would not offer rail freight services in the short- to medium-term (i.e. within 5 years from now). This would only become possible in the longer-term if policy makers, the rail industry and freight customers came together to implement change, make suitable space available and develop freight handling facilities. Those from outside the industry tended to think that rail network capacity was a definite constraint on bringing freight into or close to city centres, though the rail industry stakeholders themselves did not consider this to be an obstacle.

A key challenge identified for rail if it is to be used on a widespread basis for urban freight is the need to be able to offer unit transport costs (including the last mile delivery costs) that are equivalent to direct delivery by road. Terminal handling and transfer costs are therefore critical and short distance rail flows are particularly disadvantaged. Several participants highlighted that road haulage costs in urban areas may actually be too cheap since external costs are not fully covered, so the cost gap between road and rail solutions could be narrowed by either making rail more efficient or road more expensive (or a combination of both). Another view, from a slightly different perspective but along the same lines, was that retailers need to change their logistics operations to serve urban areas, with more emphasis on fulfilment centres and last mile, but it is not clear that this means a role for railway stations in consolidation. This highlighted a common call for greater innovation in redesigning supply chains to focus more on door-to-door efficiency and sustainability than in the past, and not simply expecting a rail leg to replace a road leg when rail may not be well placed to do so. Perhaps unsurprisingly, there was no clear view on how, and by whom, such a redesign could actually be undertaken.

Another key challenge related to the ability to aggregate sufficient volume for viable dedicated trainload operation, particularly where individual customers do not have enough volume in their own right. Respondents generally saw scope for single customer trainload

flows to dedicated rail freight terminals outside of the city centre, particularly those on or just beyond the periphery of the urban area. Logistics service providers, with multiple customers within the urban area, are likely to be best placed to aggregate sufficient volumes of parcels or retail products. The growth in parcels-type freight movement as a consequence of the growth in on-line shopping was seen as being particularly favourable for rail, though with differing views as to whether this should be on dedicated freight trains or existing passenger services.

4.2 Carrying freight on passenger rail services

4.2.1 Heavy rail passenger trains

Several respondents identified opportunities to carry freight on passenger rail services, though with considerable challenges to overcome if this was to become established as more than a very niche type of operation. The obstacles identified for running dedicated freight trains into passenger stations generally were not viewed as being applicable to freight on passenger trains since there would not be a requirement for additional trains to operate into/out of the station and the quantities carried per train were assumed to be small enough to be able to be handled without causing interference to the operation of the station for passengers. The main barriers to carrying freight on passenger trains were seen as relating to the characteristics of the trains themselves and the structure of the rail industry which means that the passenger train operating companies (TOCs) are not incentivised to carry freight. A key benefit of carrying freight on passenger trains was seen as the high level of attention devoted to passenger train punctuality and reliability so that time sensitive freight in particular could possibly be carried by rail more reliably than by road. However, it was pointed out that the perception that freight trains are treated as being of less importance is no longer the case on the British rail network since there is a performance regime for them too. There were some concerns about the lack of control when problems are encountered on the rail network, so this may rule out highly time sensitive flows unless ways of working can be developed to minimise risks of failed deliveries.

In most cases, inter-city passenger trains were seen to offer the greatest opportunities, since this is where rail can more easily offer faster centre-to-centre journey times than can alternative transport modes. This reflects the characteristics of the case studies identified from the literature (see case studies 10 to 12 in Section 2.3.1). There were mixed views as to whether inter-city passenger rolling stock is capable of carrying freight consignments in a sufficiently secure manner and without causing problems for passengers. The inter-city train fleets are not homogeneous, with some types better suited than others to carrying freight in a separate and secure location such as a guards van. In general, older train types such as the High Speed Train (HST) and train sets including driving van trailers (DVTs) were viewed as the most suitable but most are expected to be phased out during the next decade and replaced by trains with higher passenger density. All of the case studies from the literature use older types of train which have secure space that was formerly dedicated to parcels, bicycles, etc. and the guard's accommodation. In addition to these case studies, one interviewee stated that at least one of the inter-city TOCs has a number of nominated HST services per day which carry internal documents and parcels between key locations on its network.

While newer British inter-city train types such as the Pendolino, Voyager/Meridian or soon-to-be-introduced Super Express Train (SET) do not have the same degree of segregated, lockable space they do offer some scope to carry small volume consignments without any major reconfiguration. Modern high-speed rolling stock requires a crumple zone behind the driving cab to meet crashworthiness standards and, while there may be competing demands for this space (such as for staff accommodation or food preparation), if there is a business

case then it may be that freight consignments could be securely carried in such a space. Irrespective of this, if TOCs could be convinced of the commercial benefits of carrying freight it is possible that they would find ways of doing so such as by locking a carriage (or section of carriage) out of use on quiet trains so as to segregate passengers from freight. The move towards more accessible trains, whereby the entire fleet must meet the accessibility standards for people with reduced mobility by the start of 2020 may make it easier to transfer consignments between platform and passenger train.

While individual arrangements for the conveyance of small volume freight consignments could be ad hoc and at the discretion of individual TOCs, on the evidence available it appears that there is an opportunity for a national inter-city network based on a number of regional hubs and the use of scheduled passenger trains. From an operational point of view, there was no consensus as to whether it would be preferable to nominate specific trains, where staff would know to expect to have to load or unload consignments, or have the possibility of using all services between hub stations to carry consignments. Flexibility to allow inter-city TOCs to decide may be appropriate, but with basic standard principles written into franchise agreements so as to bind all the relevant TOCs into a coherent national scheme. A standardised approach may relate to specified outputs (e.g. guaranteed delivery times) rather than the application of standard operating practices so that the TOCs would have flexibility to develop a solution to fit their franchises.

Shorter distance passenger trains were viewed as offering far less scope for freight flows. In many cases, they have far shorter turnaround times at major termini since they require less cleaning and preparation for their next journey with, for example, no requirement for catering provisions or seat reservations. In some cases, these trains may not even terminate within the city centre and dwell times at major central stations are short. While modern rolling stock may allow for rapid loading/unloading of consignments, many local passenger trains do not have such secure storage areas and their services often have limited on-train staffing, so there are more obstacles than for inter-city services. The short dwell times may be a barrier to TOCs being willing to carry consignments since any delays in loading/unloading may impact on train performance and there may be financial penalties. To encourage the uptake of freight on local passenger trains may require changes to TOCs' financial and operating practices.

4.2.2 Self-contained urban rail and metro systems

The interviews saw very limited opportunity to use these systems for freight in the short- to medium-term, although this may be a reflection of the British situation where, for example, few cities have light rail systems in place. While self-contained urban rail and metro systems give a high level of access to central areas of cities, there are considerable obstacles to overcome in developing viable freight initiatives and the interviewees saw little or no potential for this type of rail-based freight operation within the next five years. Regarding light rail, there was limited awareness of mainland European initiatives such as the Dresden CarGo Tram (see case study 13 in Section 2.3.2) and Zürich Cargo Tram and E-Tram (see case study 14 in Section 2.3.2) and those that knew of them thought that they were not applicable more generally within a five year timescale due to characteristics which limited transferability. One respondent, with direct operating experience of light rail, identified challenges of running freight trams at night due to contractual agreements relating to the maintenance of the infrastructure; the limitations were such that it had not been possible even to run additional passenger trams late at night after major events. Combining people and freight on scheduled passenger trams was seen as undesirable for similar reasons to the obstacles outlined for carrying freight on local passenger trains, particularly relating to lack of space and short stop dwell times.

4.3 Summary

While challenging to discern clear circumstances that would lead to the development of new urban rail freight services or the greater uptake of freight on passenger services, the following factors were seen as important:

- Clear leadership from a ‘guiding mind’ with the ability to bring together the necessary range of stakeholders and reduce the risks associated with developing innovative and potentially more complex solutions; there is an apparent lack of confidence among private sector stakeholders that there is sufficient commitment from policy makers to support urban rail freight
- A number of policy makers expressed a desire for a stronger evidence base to assist in the prioritisation of the various rail-based options, since they felt that many aspects were insufficiently well understood at present
- While there may be a business case for freight to be carried on passenger trains, this is likely to be on a piecemeal basis with highly niche operations unless a standardised approach is adopted and written into the franchise agreements for the inter-city TOCs

5. THE ROLE OF URBAN RAILWAY STATIONS AS FREIGHT HUBS

The assessment of the role of urban passenger railway stations as freight hubs begins with an identification of the three types of supply chain that could be affected by using railway stations as freight hubs and the implications and issues associated with modifying these supply chains in this way (Section 5.1). The relationship between possible initiatives that could stimulate the freight potential of railway hubs and the characteristics of key supply chains are considered in Section 5.2. This is followed by the presentation of the findings of the interviews together with the authors' expert judgement of the key considerations in the role of urban stations in rail freight, locker banks and collection points, and goods consolidation initiatives (Sections 5.2.1-5.2.3). The assessment considers the interactions between the railway stations themselves and the broader issues relating to rail freight use for supply chain activity serving central urban areas.

As already noted, the four freight initiatives listed in sub-category III make use of/serve railway stations without necessarily involving rail freight (see Figure 3.1 for further details). For options A-C (locker banks – option A, collection points – option B, and urban consolidation centres – option C) these initiatives could receive product flow from either rail or road freight services. However, at present, the use of road to provide incoming products for these three options is far more likely than rail. Options III.A and III.B (locker banks and collection points) refers to these infrastructures being located at railway stations. By contrast Option III.C could involve locating a consolidation centre either: i) at a railway station, or ii) in close proximity to, but not at, a railway station. In both cases the consolidation centre would need to serve both the station and the businesses in the surrounding area in order to generate sufficient product throughput to be commercially viable. Option III.D concerns the use of upstream consolidation in the supply chain to improve the load factors of road-based vehicles delivering/collecting goods at stations. Option III.D is therefore by definition road-based and does not concern the use of rail freight services.

5.1 Supply chain assessment

Assuming that the main aim of stimulating rail freight and the use of railway stations as freight hubs would be to achieve greater sustainability in freight operations, it is possible to think about two main categories of supply chain that could be involved (each of which has two sub-categories):

- the provision of goods for services offered at rail stations – this relates to the provision of goods: (i) for use on rail services (such as on-board catering and other goods consumed on trains), and (ii) for sale at the retail premises located at stations.

- goods flow beyond the immediate confines of rail stations – this relates to the use of stations as (i) intermediate locations in consumer supply chains at which passengers can be provided with goods they have ordered from elsewhere, and (ii) intermediate locations in commercial supply chains which can be used to handle and distribute goods to businesses based in close proximity to the station using sustainable systems and road transport equipment. In both of these initiatives the goods may or may not have been brought to the station by rail.

For the purposes of this assessment, points (i) and (ii) in the first bullet point can be grouped together, as in supply chain terms, they both have broadly similar features (in that they involve goods ordered by commercial organisations that are delivered to stations by road in similar vehicle types, and in which the station represents the last point in the supply chain).

Each of these three supply chains have differing attributes that result in various challenges in terms of the future use of: (i) rail freight and (ii) stations as hubs. For each of these three supply chains, Table 5.1 provides an indicative assessment of the parts of these supply chains that would be affected and the extent of this change, together with details of these possible changes if railway stations were used as freight hubs and/or for rail freight.

Table 5.1: Indicative effect on supply chains of using railways stations for freight

Type of supply chain	**Part of the supply chain that would be affected by use of rail freight/ stations as hubs**	**Extent of change to supply chain**	**Possible changes that this could involve**
Provision of goods to stations for on train catering and retail outlets	Inbound flow of goods *(Outbound flow of catering by rail and personal travel by shoppers unchanged)*	Inbound flow already takes place but its operation and mode could be modified	• Mode shift from road to rail for inbound freight • Upstream goods consolidation of road freight resulting in better loaded vehicle deliveries
Provision of goods to stations for collection by passengers who ordered them elsewhere	Inbound flow of goods to stations *(Outbound personal travel by shoppers unchanged except if shoppers make dedicated journeys to stations or reroute their journeys to collect goods)*	Inbound flow does not usually take place to this location so requires change in retail supply chains Although most consumers already make these trips collecting goods could lead to changes in them	• Mode shift from road to rail for inbound freight • Additional road freight trips to stations • Additional consumer trips to/from stations (to collect) • Changes in mode choice by consumer for trip to/from station
Provision of goods to/from stations for businesses in close proximity	Inbound and outbound flow of goods to/from stations (and handling/ transhipment location for these goods)	Inbound flow does not usually take place to this location so requires supply chain change Outbound flow from stations does not usually take place so would be a major change to business supply chains	• Mode shift from road to rail for inbound freight • Need for consolidation centre facility at station • Additional road freight trips to/from stations • Use of low emission road vehicles for final delivery

5.2 Relationship between freight transport initiatives and supply chain requirements

The three supply chains (considered in Section 5.1) that may be affected by efforts to stimulate the use of rail freight and/or stations as freight hubs have been assessed in relation to the eight freight transport initiatives (see Figure 3.1 for further details). The application of these eight initiatives to the three supply chains has been assessed using our expert judgement together with the views of the project interviewees. Table 5.2 shows the

indicative relationship between these eight urban freight initiatives and the three types of supply chain involved in goods flows to and from urban railway stations. Most of the emphasis in the subsequent discussion relates to issues specific to the use of railway stations for freight activity.

Table 5.2: Indicative relationship between types of goods flows to/from railway stations/terminals and freight transport initiatives

Freight transport initiative	Provision of goods to stations/ terminals for on-train catering and retail outlets	Provision of goods to stations/ terminals for collection by passengers who ordered them elsewhere	Provision of goods to/from stations/terminals for businesses in close proximity
I. Dedicated rail freight services			
A. Using dedicated rail freight terminals within urban areas	0/+	0/+	++
B. Using major passenger railway stations within urban areas	+	+	+
II. Carrying freight on passenger rail services			
A. On heavy rail passenger trains	0/+	+	0/+
B. On self-contained urban rail and metro systems	0/+	+	0/+
III. Using major railway stations in the city as hubs for last mile freight activity			
A. Locker banks	0/+	+/++	+
B. Collection points	0/+	+/++	+
C. Consolidation centres	+/++	+	+/++
D Other means of road freight vehicle consolidation	++	+	n/a

Key: ++ major potential; + some potential; 0 no potential; n/a not relevant.

5.2.1 Use of rail services for freight at passenger stations

Of the two options, carrying freight on passenger trains was viewed by the interviewees as being easier to incorporate into the activities at major stations than running dedicated freight trains. Regarding the latter, issues raised included:

- perceptions that freight trains would be seen as a distraction from the main purpose of handling passengers, particularly when increasing passenger numbers are putting pressure on the ability of key stations to cope with more passenger trains and more pedestrian activity within stations; current and forecast growth in rail passenger demand was cited by a number of respondents as a key barrier to the use of major urban passenger stations for rail freight
- health and safety considerations resulting in the need to avoid physical interactions and conflicts between passenger and goods flows within the station area
- as a consequence of the first two points, restrictions on the times at which freight trains are likely to be able to operate into the passenger stations which, particularly if only night time operation were to be allowed, creates conflict with engineering possessions and

makes it more difficult to offer guaranteed services on a nightly basis; lengthy platform occupancy times to unload/load dedicated freight trains may limit opportunities

- few major urban passenger stations have sufficient existing space provision for freight activities (e.g. spare platforms, goods handling areas, easy and well-designed road vehicle access) and they mostly have limited land available for development as a result of the growth in passenger volumes and the selling off of land by station operators for commercial return; where land does exist, in current business models it is used for activities generating greatest commercial returns which generally precludes its use for rail freight development
- in particular, poor rail-road transfer opportunities at passenger stations for trainload volumes of freight lead to lengthy and costly transhipments and make it difficult to develop an economic case; many stations do not even have level access from platform to street level
- possible damage by transhipment equipment to station infrastructure (e.g. roll cages damaging tactile platform strips) although this can be ameliorated by, for example, the use of spring-loaded equipment

If dedicated freight trains were to serve passenger stations, two of the three FOCs identified that suitable rolling stock existed in the form of traditional rail freight vans which could carry roll cages or pallets or, if a viable intermodal solution were to be found, standard flat wagons could be utilised. Standard sized intermodal units were seen as problematic for handling in passenger stations and for sufficiently large lorries to access platforms, so the preference was for traditional rail freight vans most likely loaded with roll cages.

Despite the FOCs identifying options for dedicated freight services into major passenger stations, there was more overall support among the interviewees for carrying freight consignments into these locations on passenger trains. No additional train movements would be needed and, with smaller volumes being carried on passenger trains than on dedicated freight trains, issues such as station layout, road-rail transfer facilities and health and safety were seen as being less important. However, wider obstacles to TOCs carrying freight on their trains (see Section 4.2) would need to be overcome. Parcels and courier type operations were most commonly mentioned as offering scope, with interviewees mostly believing that the goods would not be for the station itself but instead be for customers elsewhere in the city centre. Such activity would be consistent with the 5PL model (see case study 12 in Section 2.3.1) rather than, say, integrating with collection points and locker banks at the stations themselves. While the latter would seem to be logical, respondents from both the rail industry and the logistics service providers believed there to be too many challenges to overcome within a five year period to be able to successfully integrate freight on rail with freight activity at railway stations. Many of the comments and examples from the interviews related specifically to the London context so are assessed in Sections 7.3 and 7.4.

5.2.2 Stations as hubs for last mile freight activity: locker banks and collection points

Interviewees were generally equally positive about both locker banks and collection points at stations, and indicated that these facilities could be installed and commercially operational within 5 years. Some interviewees pointed to the fact that some locker banks and collection points are already being implemented at stations (and elsewhere) and thought that his could be a commonly-offered service within the short-term (i.e. within 2 years). It is important to note that there are some key differences in the attributes of locker banks and collection points (see Appendix 4).

Location issues

Locating locker banks and collection points at passenger stations has an important role to play in making retail supply chains more sustainable (through reducing home deliveries). These facilities also provide customers with alternative options as to how and where they receive their online orders and offer the opportunity for this to happen in a more than efficient manner than is achieved with deliveries to the home. This greater efficiency is due to two key factors. First, home deliveries are associated with high rates of delivery failure as the receiver is not present at home, and therefore the need for the goods to be re-delivered. This results in additional vehicle travel, extra costs for companies, and delays in receiving goods for customers. Second, delivering goods to locker banks and collection points allows for increases in the number of deliveries made per vehicle stop, and hence an overall reduction in distance travelled by commercial vehicles. If these facilities are located at passenger stations, those collecting goods are likely to be making these journeys by passenger rail as part of a journey they were already carrying out.

Central rail stations are under-utilised assets, generally handling increasing passenger numbers and often also serving a growing local population with retail and other services (as the population of central and inner urban areas increases). Many, though not all, central stations have available space for freight activity such as collection points and locker banks and they often have much higher footfall than just rail passengers. Compared with alternative locations (such as public car parks, petrol stations, shopping centres etc.), the location of locker banks and collection points at rail stations offers greater scope for the collection of goods to be incorporated into existing and public transport-based passenger journeys. The use of alternative locations is likely to generate more dedicated, and especially car-based, journeys.

In general, where possible, having collection points/locker banks at customers' home stations is preferable so that customers can collect these goods at the end of their return journey home do not need to carry the goods on trains. However, it is not necessarily feasible to serve small stations in outer urban areas or beyond the urban area with these facilities as they may not generate sufficient product flows to be commercially viable.

The consensus among interviewees was that in terms of locker banks and collection points, passenger stations in central urban areas are best suited to handling parcels rather than larger items. This is due to the limited space available at central stations for these facilities, as well as the difficulties for passengers in transporting larger, heavier items on train services, given the lack of luggage and other storage space on commuter trains and how full these services are in peak hours. By definition, locker banks have more constrained physical size limitations than collection points. But even at collection points, there is unlikely to be much desire among their operators (on space and cost grounds) or their customers for the handling of larger, bulky items.

Grocery collections are best suited to outer urban passenger stations where there is likely to be greater space availability in station car parks. At stations where the space is available, the collection of online grocery orders from stations could be facilitated by temperature-controlled locker banks, collection points or directly from delivery vans waiting in the car parks. The appropriate solution is likely to be determined by the scale of demand for such services, the space availability, and the customer service provided by the retailer.

Range of uses and solutions

As well as serving the general public who want to collect goods that they ordered online, locker banks and collection points can also be extremely useful for companies employing service engineers, lots of whom travel by train in central urban areas. Rather than having to

deviate in their journeys to company-run warehouses and stores to collect parts and tools needed for their day's tasks, these facilities provide the opportunity for engineers to instead collect this equipment from locations they will pass en-route to the customer's building where their next job is located.

Collection points can be used by customers for the return of goods as well as their collection. Locker banks also offer this opportunity, but their use for this purpose raises greater issues concerned with security at passenger stations. Locker bank and collection point space has the potential to not be well-utilised if customers do not collect their goods promptly. This is especially problematic with locker banks if goods deposited in the morning are not collected until the late afternoon/evening (or even later), leaving boxes unavailable for reuse. This can be addressed through the provision of information to customers and the use of price signals that encourage prompt collection.

Getting goods ordered online to customers is likely to continue to require a range of different solutions, including deliveries to home, to neighbours, to workplaces, to other safe locations, and to locker banks and collection points. At present, locker banks and collection points are only used for a very small proportion of all online orders, but this is expected to grow. However, a range of delivery solutions for online orders will be commercially supportable due to the current and forecast size of the market. Stations offer a suitable location for these facilities that can help to reduce the trip generation that can be associated with online orders, and especially the car trips associated with customers collecting their goods from other locations, and the van traffic associated with home deliveries. Also, stations could benefit from an emerging practice among some workplaces of banning deliveries of personal items due to the quantity of products involved and the pressure it places on loading bays and post rooms in addition to work-related products. Locker banks and collection points are likely to also be sited at many other types of location in addition to rail stations.

Comparison of locker banks and collection points

As collection points are staffed they have limited opening hours but these hours are likely to be sufficient for most rail users. By comparison locker banks are "open" at any time they are accessible, so this is only limited by station opening times if located inside station buildings. Collection points are more versatile than locker banks in terms of the type and size of goods they can handle. They also generate more employment than locker banks as they are staffed, however this also means that that they are more expensive to operate. Another consideration in comparing the two, is that some people prefer human interaction when collecting goods or are deterred from using locker banks by unfamiliarity with the technology. As collection points are staffed they also provide the opportunity to offer a wider range of services to companies and the public than locker banks. Some locker bank providers only currently use their lockers for their own products (such as Amazon) whereas others are for use by a wider range of retailers and LSPs.

Pricing issues

The pricing of locker bank and collection point services at stations is likely to be an important factor in their success. Many customers are keen to order online, and this is forecast to grow, but current evidence also indicates that many customers are price-sensitive in relation to delivery service charges, and some will attempt to avoid such charges altogether (through the use of click and collect services and similar). It may be possible for station providers and train operators to work with retailers and providers of locker banks/collection points to offer financial incentives to passengers to use these facilities at stations. This would have the benefits of stimulating product throughput at these locker banks/collection points to ensure their commercial viability, as well as helping to promote goods collection using existing public transport journeys.

Combining with rail freight

At present collection points and locker banks at stations are served by road freight rather than by rail freight services. It is a challenging proposition to try to link the development of collection points/locker banks at stations and the use of rail for freight flows to stations, even though this potential exists. This is due to the fact that although railway stations have a major role to play in fulfilling modern consumer demands (for travel, shopping, eating, and goods collection), currently the most efficient way to provide the goods that they require in order to offer these services is by road-based goods vehicle. However, in the longer term, if rail freight services at passenger stations can be developed that meet the service criteria required by retailers then it is possible that these collection services could be served by rail freight.

5.2.3 Stations as hubs for last mile freight activity: load consolidation

Interviewees were asked to discuss two options to improve the load consolidation on road freight vehicles delivering goods to stations. These two options were:

- Using hub stations to consolidate goods flows for last mile delivery in the surrounding area
- Greater consolidation of road-based delivery of goods to retail outlets at hub stations and for on-train catering

The first option involves using stations as locations in which to consolidate goods flows for the station and for delivery to nearby businesses. This would involve the operation of an urban consolidation centre (UCC) at which goods are unloaded from incoming vehicles and then consolidated onto fully-loaded vehicles for final delivery in the vicinity. These last-mile vehicles could be alternatively-fuelled to remove carbon and local air pollutant emissions.

The second option involves shippers and LSPs grouping goods destined for delivery to stations (goods for retailers and food supplies for on-train catering) together upstream in the supply chain in order to reduce the number of goods vehicle deliveries needed to provide these products to stations. This would lead to reduced vehicle trip generation at stations (and its associated traffic, noise and safety impacts), together with reduced vehicle kilometres in total (and its associated carbon emissions, local air pollution, traffic, safety and other impacts).

Overall, the respondents were positive about the possible benefits of both of these options, and the likelihood of achieving them. They did not however, generally, foresee either of these initiatives being achieved in a commercially viable form in the short-term (i.e. within 2 years) and instead thought that the medium-term (2-5 years) was a more realistic timeframe for their development and implementation. The interviewees generally had far more to say about the first option than the second. The first option, the use of a UCC, will therefore be discussed first.

Users and operators of UCCs

UCCs in central urban areas would be benefit to some retailers and LSPs, but not all. They suit freight operations in which vehicles have to make numerous, small deliveries in central areas. Retailers and LSPs with these types of operation are finding it increasingly difficult and expensive to serve central urban areas, and expect this to worsen further over time. This is due to two key factors. First, increasing traffic levels in central urban areas are making multi-drop operations increasingly unreliable and time-consuming. Second, the loss

of logistics land in central urban areas (i.e. warehouses and depots) means that rather than delivering central urban outlets from depots in central and inner areas, instead vehicles are despatched from outer or outside urban areas. This loss of logistics land is a product of increasing land values in central urban areas, and logistics land uses having low rates of profitability compared with alternative uses. As a result, logistics facilities have become increasingly suburbanised and de-urbanised. This has the effect of increasing stem distances travelled by goods vehicles from the logistics facility to the first point of delivery in central urban areas. This further increases transport costs, and delivery reliability. As a result of both of these factors the cost and difficulty of delivering goods in central urban areas is increasing and is expected to continue to worsen in future. For those operators performing multi-drop rounds, especially those with numerous, small deliveries, the opportunity to deliver all these goods to a UCC for final delivery by a centrally-based operator could be very attractive. This UCC model is less attractive to retailers and LSPs delivering full vehicle loads in central urban areas, due to the time savings of such a scheme being far less. Also these full-load single-drop operations are less prone to severe journey-time unreliability. Therefore for these operators, the costs and benefits of using a UCC are less obvious.

Interviewees felt that such UCCs would be best operated by independent LSPs who only work for other operators, and are therefore not direct competitors of the users. This is an important consideration, as some LSPs and retailers would never consider passing their goods to a direct competitor for last mile delivery. Other barriers to the establishment of a common-user UCC raised by interviewees include issues concerning liability and the handling requirements (for fragile goods and those with specific storage requirements). Such a UCC is unlikely to be suitable for the handling of food products with temperature-controlled requirements, but these other concerns have been addressed at UCCs that are already operational.

A key barrier to the use of such a UCC is the price charged for such a service. In order to achieve commercial viability, such a UCC requires high levels of product throughout so that prices charged for these services can be attractive and encourage its use. A business model is required in which the costs and benefits of such a UCC need to be shared fairly between the users for it to be acceptable and successful. There is often also a need for some public subsidy/financial support to help initially establish the UCC and help it cover its operating costs in its initial period of operation until product throughput levels reach the necessary financial break-even point. It is possible that station operators could insist on the use of a UCC as part of the contract they offer to company with retail outlets at the station. This model has been used successfully at Heathrow airport, where the demand for retail space is such that retailers are prepared to meet this condition and any costs associated with it.

UCC space requirements and location issues

Many interviewees felt that central rail stations do not have sufficient available space for the inclusion of a UCC. As with land in all central urban areas, station operators are keen to maximise their returns on their space and, as previously explained, logistics facilities including UCCs are far less likely to achieve this than other uses such as retailing and office development. The difficulties in building an economic case to put logistics facilities in central stations may be insurmountable, and could probably only come about as a result of decisions by policy makers based on other factors such as traffic and environmental benefits. Instead, government (and station operators) could use the finance generated from station regeneration to build fit-for-purpose UCCs in other inner and central locations in relatively close proximity to stations.

An alternative to locating the UCC at central stations is the possibility of locating it not at the station but in close proximity to it. This would have several advantages – it would still provide the opportunity to consolidate the flow of vehicles providing retail and train catering needs and those of the businesses in the wider area but without leading to all this incoming vehicle trip generation at the stations themselves (thereby negating the traffic and environmental benefits of UCCs at the station itself). By finding an alternative, non-station location, for the UCC this incoming traffic activity can be diverted to a more suitable location. The station, and other businesses in the area, could then all be served by fully-laden, clean vehicles operated from the UCC. The key disadvantage of not locating the UCC at the station is that the opportunity for using the UCC to also handle incoming (and outgoing) rail freight is then lost. If a central station is to receive regular, substantial rail freight flows, then it may be more viable to consider locating the UCC at the station. However, if rail freight flows are infrequent or small, then the benefits and commercial viability of a UCC to handle this rail flow are diminished.

Interviewees generally felt that urban and local government have an important role to play in helping to facilitate UCCs that serve central stations and other businesses in the locality. This role would include helping to safeguard and provide suitable sites in close proximity to stations for such a UCC, as well as assisting with the initial establishment and start-up costs.

Upstream consolidation of goods destined for stations

In terms of the second option, of consolidating goods flows for stations upstream at the point the vehicles are despatched from, some goods flows to catering outlets at stations are already consolidated onto single vehicles. However this occurs as a result of a franchise agreement between the outlet owners and their franchisee, which operates several of the catering outlets in central stations. This provides a natural opportunity for consolidating goods for several retailers on one vehicle. To achieve this same consolidation approach for other, unconnected retailers with station outlets would require far greater collaboration between retailers and LSPs than happens at present. But, given the existing costs and difficulties involved in delivering to central urban stations, and that such city centre deliveries are likely to become ever-harder and ever-more expensive there is good reason for these companies to consider working together to devise better, more consolidated delivery operations.

Obviously retailers and LSPs would not collaborate specifically for the purpose of delivering goods to retail outlets to one or more rail central stations. Instead this collaboration would have to extend across a far greater extent of their urban deliveries in order for it to be viable. As well as involving moving the goods of more than own retailer on the same vehicle to improve vehicle loads and thereby reduce trips and transport costs, the nature of this collaboration would extend upstream to shared rather than dedicated distribution facilities.

Upstream consolidation operations can obviously add to upstream transport costs, especially if shared distribution are not implemented and different suppliers have to deliver goods to an intermediate point for final delivery. However, if practised as a shared distribution network, this can result in reductions to in total supply chain costs, while at the same time improving service levels and reducing traffic and environmental impacts of delivery systems.

In order to develop such a collaborative approach to distribution management and freight transport there is a need for companies to commit to close working relationships with others, who may traditionally have been viewed as competitors. There is also a need to develop a strong business model that can clearly demonstrate the comparison of costs and benefits and how these are to be shared between those collaborating in the supply chain.

6. OVERALL GENERIC ASSESSMENT RESULTS

This section contains the generic assessment of the eight urban freight transport initiatives considered in the feasibility study in terms of their likely: traffic and related environmental impacts (Section 6.1), and space requirements, financial implications and planning timescales (Section 6.2).

6.1 Traffic and environmental impacts of the freight transport initiatives

The eight urban freight transport initiatives studied in this project were selected on the basis of having the greatest relevance to stimulate improvements in the sustainability of freight transport operations at stations through the use of either: (i) rail freight and/or (ii) road freight operations serving railway stations. The use of these initiatives would therefore be expected to result in reductions in freight traffic and environmental impacts within the entire urban area and beyond. However, the traffic and environmental impacts of these eight initiatives would not necessarily be so beneficial at the stations and the surrounding streets where they were implemented.

Therefore, assessment work was carried out at a generic level into the likely direction and scale of change of local traffic and environmental impacts at railway stations and the streets surrounding them that these eight freight transport initiatives could bring about if implemented. The indicative results of this assessment are provided in Table 6.1.

It is important to note that the impacts shown in Table 6.1 are dependent on the scale and manner in which the initiatives were implemented. In addition, the direction and scale of change indicated in Table 6.1 refers to changes in traffic and environmental impacts at the railway station/terminal and the roads immediately around it.

Dedicated rail freight services to freight terminals would have no bearing on traffic and environmental impacts at passenger stations (as any additional rail and road activity would be concentrated at the freight terminal). Dedicated rail freight services to stations freight terminals would be expected to lead to impacts at these stations including a worsening in on-street space requirements (from associated goods vehicle activity), and in noise and pollutant emissions (from rail and road operations). However these dedicated rail operations would be unlikely to affect peak goods vehicle traffic volumes on the roads around the station as such dedicated freight activities would have to take place outside peak hours so as not to affect passenger rail services. Carrying freight on passenger trains to stations would be expected to result in either no change or some worsening in the traffic and environmental impacts considered, depending on the scale of this freight flow and its ultimate destination (as these factors will determine whether additional road freight journeys are generated at the stations).

Locker banks and collection points are generally expected to lead to some increase in goods vehicle peak traffic volumes, on-street space requirements of goods vehicles, associated freight noise, and fossil fuel use as these facilities will generate freight flows and associated vehicle trips that never previously took place to stations. However, it should also be noted that although goods vehicle peak traffic volumes at stations may increase due to the presence of locker banks and collection points located there, there would be a related reduction in peak goods vehicle traffic volumes elsewhere (predominantly in residential areas) as these goods would no longer need to be delivered to consumers' homes. When thinking about the overall effect of locker banks and collection points on peak goods vehicle traffic volumes it is also important to note that both of these initiatives would be expected to reduce these total traffic volumes due to two key reasons: i) the use of locker banks and

collection points do not suffer from the failed deliveries and redeliveries necessary when delivering to consumers' home (due to them not being present to receive the goods), and ii) each vehicle trip will result in the delivery of far more items than in the case of deliveries to consumers' homes, thereby reducing the distance travelled per item delivered.

Table 6.1: Indicative generic local traffic and environmental impacts of the freight transport initiatives at railway stations

Freight transport initiative	Peak goods vehicle traffic volumes	On-street space requirements of delivery/ collection	Noise pollution	Fossil fuel consumption and air quality
I. Dedicated rail freight services				
A. Using dedicated rail freight terminals within urban areas	n/a	n/a	n/a	n/a
B. Using major passenger railway stations within urban areas	0	- / - -	- / - -	- / - -
II. Carrying freight on passenger rail services				
A. On heavy rail passenger trains	0 / -	0 / -	0 / -	0 / -
B. On self-contained urban rail and metro systems	0 / -	0 / -	0 / -	0 / -
III. Using major railway stations in the city as hubs for last mile freight activity				
A. Locker banks	-	-	-	-
B. Collection points	-	-	-	-
C.1 Consolidation centre (located at station)	- / - -	- / - -	- / - -	- / - -
C.2 Consolidation centre (serving station, located elsewhere)	+	+	+	+
D. Other means of road freight vehicle consolidation	+	+	+	+

Key:

++	+ / + +	+	0 / +	0	0 / -	-	- / - -	- -
Major Improvement				No change				Major worsening

The majority of users of locker banks and collection points located at stations would be expected to be users of rail services at these stations – with their goods collection being part of a journey they were already making (for work, leisure etc.) However, it is possible that locker banks and collection points could lead to a small increase in car and other road-based passenger trips to stations among consumers using these services who are not using the rail services.

In the case of the introduction of a consolidation centre its location is likely to have an important bearing on the change in peak goods vehicle traffic volumes and the other impacts

listed in Table 6.1. In the case of the consolidation centre being located at the station peak goods vehicle traffic volumes would be expected to increase (as unconsolidated loads would be delivered here for onward delivery in the station and elsewhere in the surrounding area). If, however, the consolidation centre was located elsewhere, and consolidated loads were delivered to retailers and train operators at the station then peak vehicle traffic volumes and other impacts would be expected to reduce at the station.

Upstream load consolidation of goods destined for retail outlets and train catering would be expected to have the same beneficial effects of traffic and environmental impacts at stations as the use of consolidation centres located close to, but not at, the station. This is due to the goods vehicle trips reduction at stations that would result from such load consolidation.

6.2 Space requirements, financial implications and planning timescales

This section summarises the space requirements, financial implications and planning timescales for each of the eight freight transport initiatives considered. From the discussion, it is clear that packages of solutions are likely to lead to greater improvements in freight sustainability than individual initiatives. Table 6.2 indicates the key characteristics of each of the eight initiatives addressed in this study.

Table 6.2: Indicative location, space requirements, financial implications and planning timescales of the freight transport initiatives

Freight transport initiative	Physical space requirements	Financial implications	Planning timescale
I. Dedicated rail freight services			
A. Using dedicated rail freight terminals within urban areas	Major	Major	Medium - Long-term
B. Using major passenger railway stations within urban areas	Moderate-Major	Minor-Major	Short - Long-term
II. Carrying freight on passenger rail services			
A. On heavy rail passenger trains	Minor	Minor-Moderate	Short - Long-term
B. On self-contained urban rail and metro systems	Minor	Minor-Major	Short - Long-term
III. Using major railway stations in the city as hubs for last mile freight activity			
A. Locker banks	Minor	Minor	Short-term
B. Collection points	Minor-Moderate	Minor-Moderate	Short-term
C. Consolidation centres	Minor-Major	Minor-Major	Medium - Long-term
D Other means of road freight vehicle consolidation	Possible change in upstream storage location	Minor-Major	Short - Long-term

N.B. Short-term: Within 2 years; Medium-term: 2-5 years; Long-term: More than 5 years

6.2.1 Physical space required for initiatives

The freight transport initiatives proposed in this note vary in terms of the quantity of physical space that they require, and whether these space requirements are on public or private land. For instance rail freight facilities and consolidation centres typically use private land, while, for instance, locker banks and collection points are located on both public and private land. Typically, private landlords are not keen on using valuable space for freight transport-related activities as these generate little income compared with other activities such as retailing or

office space. Therefore it is likely that intervention by public authorities would be required to encourage the design and implementation of such initiatives that allocate private space to freight transport activities.

Many current railway stations incorporate relatively little space provision for goods vehicle deliveries and storage activities that would help to improve the efficiency of freight transport by reducing the need for such frequent deliveries and making each delivery faster. Locker banks have smaller space requirement than collection points (as collection points are staffed, typically accept a wider range of products, and are designed to handle greater throughputs of product – see Appendix 4). Collection points therefore typically occupy part of or an entire retail outlet. Some freight transport initiatives, such as load consolidation by means other than the use of consolidation centres, do not have physical space requirements at stations.

6.2.2 Stage in planning/development process that action is required

The implementation of the freight transport measures shown in Table 6.2 requires the successful design, planning and installation of the necessary infrastructure and enforcement mechanisms. The time period involved in implementing these freight transport initiatives vary from those that can be considered as short-term (i.e. taking up to 2 years), those that are medium-term (i.e. taking 2-5 years), and those that are long-term (i.e. taking more than 5 years).

The freight transport initiatives in this note that are likely to require the longest period of implementation at railway stations are those that have physical space and major new infrastructure requirements, and/or will require major operational changes in supply chains in order to succeed. Such initiatives will need to be included at the outset of the planning and design of new or refurbished stations if they are to be achieved. The time taken to implement the rail freight transport services and consolidation centre initiatives considered will depend on the scale of the proposed activity and hence the physical scale and operational reorganisation necessary.

By contrast, some of the freight transport initiatives in this note can be achieved in the short-term. These include initiatives that have little or no major infrastructure or space requirements on private land, and which require only minor supply chain modifications and operational disruptions for freight transport operations. Such initiatives include the introduction of locker banks and collection points at passenger stations and the greater use of dedicated freight trains at freight terminals.

6.2.3 Financial implications of freight transport measures

All the freight transport measures considered in Table 6.2 require some degree of infrastructure investment. This will vary from relatively substantial investments (for instance in the case of a new, purpose-built urban consolidation centre) to relatively minor in the case of installing locker banks, handling small number of parcels on passenger trains, or setting up a small-scale micro consolidation centre.

In addition to infrastructure investment, some freight transport initiatives can result in increases in operating costs. Sometimes this involves an increase in total operating costs across the entire supply chain, while in other cases the operating costs may increase for certain supply chain parties. For instance, in the case of consolidation centres, receivers are typically charged for its use, rather than LSPs delivering goods to the centre. However, LSPs also derive benefits from the use of the centre in terms of time and distance savings,

resulting in lower operating costs and the opportunity to use these time savings to increase their revenue. In addition, some freight initiatives, including increasing storage and off-street loading space at stations, may reduce the revenue generation per unit of area for the landlord and tenants.

In order to ensure that freight transport initiatives are able to achieve commercial viability in the longer term it is necessary to consider the possible effect on operating costs for individual parties and for the supply chain as a whole, and also to consider how parties that receive operational benefits from a freight initiative can be made to contribute towards the costs of such an initiative.

7. CENTRAL LONDON RAIL FREIGHT CASE STUDY

7.1 Introduction

Informed by the generic assessment presented in Sections 3-6, this section is focused on the specific London context for the possible use of urban railway hubs for freight. It begins by providing an overview of the current situation regarding the use of rail freight in London (Section 7.2). Section 7.3 sets out an assessment of the role of central London railway hubs, identifying the opportunities to use stations for different types of freight and considering the broader issues relating to serving London's freight requirements by rail. Finally, a Central London Action Plan in relation to the central London railway hubs is set out in Section 7.4.

The success of London is dependent on the efficient movement of goods and services as well as people (Mayor of London, 2011). The growth of London in the medium- to long-term, as set out in the London Plan, will lead to an increase in freight movement to construct, supply and service London's economy in a sustainable way. The population of London was 8.2 million in 2011, and is estimated to have increased by another 100,000 people between 2011 and 2012 (ONS, 2013a). London's population is currently forecast to reach 9.8 million people by 2031 (GLA, 2013). In addition, the Mayor's London Plan forecasts that approximately 750,000 more jobs will have to be accommodated in London by 2031 (Mayor of London, 2011). This will result in additional passenger and freight transport demand.

The Mayor of London's Transport Strategy pledges to, "seek to deliver enhanced rail freight capacity through supporting new terminals to facilitate efficient movement of goods; and encourage transfer of freight from road to rail wherever possible" (Mayor of London, 2010, para 241). The London Freight Plan identifies that increasing rail freight mode share has an important role to play in improving the sustainability and reducing the environmental impact of freight in London. It notes that the lack of rail freight terminal capacity and infrastructure is constraining the use of rail freight, both for long-distance movements and some intra-London traffic (TfL, 2007c, para C.32).

7.2 Existing rail freight activity in London

By way of context, this sub-section updates the status of London's rail freight activity since the report for Transport for London (TfL) on HS2 (University of Westminster, 2013). Network Rail (2010) highlighted the importance of rail freight to London's economy, particularly with the delivery of aggregates and cement for construction projects in central London and similar flows to the railheads in the vicinity of the Olympic Park in Stratford. According to TfL (2007a), 40 per cent of London's requirement for construction materials is serviced by rail. Figure 7.1 shows that construction flows dominate rail freight in London in tonnage terms. Waste traffic has accounted for around half of the remaining tonnage in most years since 2008, though 2012 saw a decrease in these flows. Only 10 per cent of rail freight activity (in tonnes lifted) in 2012 related to other types of traffic. Within the "other" category, there are some flows of less bulky and higher value products, primarily focused on the terminals in the Barking and Dagenham area of east London. From the rail freight database developed by the University of Westminster (and based on a range of data sources) and observation surveys, these flows include cars and car components (within the UK and to/from Spain via the Channel Tunnel), intermodal traffic to/from Poland, consumer goods for Tesco and, and seasonal produce from Spain. Mail services for the Royal Mail operate to/from the Princess Royal Distribution Centre (PRDC) near Wembley (north west London).

Figure 7.1: Goods lifted by rail on journeys to, from and within London by commodity, 2008-2012

Source: Network Rail data processed by MDS Transmodal

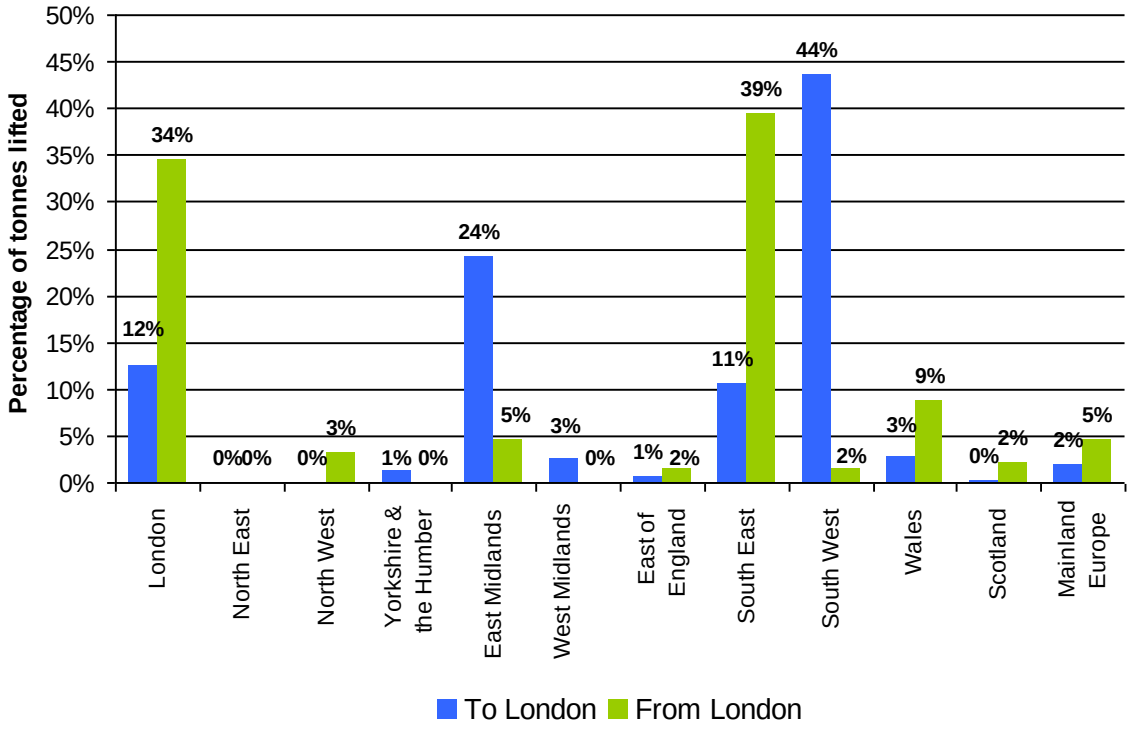
Figure 7.2: Goods lifted by rail on journeys to, from and within London, 2008-2012

Source: Network Rail data processed by MDS Transmodal

As Figure 7.2 demonstrates, 10 per cent of the rail freight tonnage in 2012 had both its origin and destination within London, around 20 per cent travels outwards from London, but the vast majority (70 per cent) is carried on inward journeys. Figure 7.3 shows the importance of regions of the UK in terms of rail freight flows to and from London, with a small number being particularly important. The South West and East Midlands dominate inward freight rail to

London flows with their aggregates supplies, while the South East is a key recipient of London's flows from London including waste. Some of the terminals are within inner London, such as at St. Pancras Churchyard Sidings (for aggregates and cement) and Stewarts Lane (Battersea) for aggregates. Further data about rail freight lifted on journeys to, from and within London is provided in Appendix 5.

Figure 7.3: Goods lifted by rail on journeys to, from and within London by origin/destination, 2012



Source: Network Rail data processed by MDS Transmodal

In addition, rail plays a major role in removing construction waste from major development projects. In particular, as part of the Crossrail construction project, more than one million tonnes of spoil were removed by rail from a railhead at Westbourne Park, near to the western portal of the main tunnel, to Northfleet (Kent) for transfer to ship for onward movement to Essex (Crossrail, 2013). The flow commenced in 2012 and operated until early-2014, albeit only sporadically in the latter months. Another flow of spoil commenced from Bow (east London) in 2013, but there is conflicting information as to whether this was related to Crossrail construction works or the redevelopment of the Olympic Park after the 2012 Olympic Games.

While the "other" rail freight flows are not significant in tonnage terms, they demonstrate rail's capabilities within an urban environment in catering for higher value products within manufacturing and retailing supply chains. These flows use dedicated rail freight terminals in outer London, the central London termini not having seen any regular rail freight services since the transfer away of Royal Mail trains to the dedicated PRDC in 1996. However, two trials have taken place within the last two years bringing goods into Euston station. The first took place in October 2012, operated by Colas Rail for Stobart Group and carrying perishable goods for six Sainsbury's stores (Railway Gazette, 2014). The second trial, during the night of 4/5 June 2014 and also operated by Colas Rail, conveyed goods for Staples and Bristan; last mile deliveries were made to stores and suppliers in London using a fleet of electric and zero emission road vehicles (TNT, 2014). It is not yet known whether

these trials will lead to regular rail freight flows serving Euston or other central London termini. The examples identified in the literature of passenger trains being used to carry small consignments (see case studies 10 to 12 in Section 2.3.1) are not included in these rail freight statistics.

It is clear that rail freight already plays a considerable role in London for certain commodities and in certain supply chains, but this role is often overlooked. However, rail freight activity in central London is very limited, and almost non-existent for flows of retail goods and parcels.

7.3 Broad assessment of rail freight potential in the London area

From the interviews with stakeholders, there was no consensus as to the most appropriate way (or ways) in which to pursue a greater role for rail in meeting London's freight transport needs. The broad scope for increased rail freight operations in London is summarised Table 7.1, updating the assessment from the earlier DfT addressable markets study (University of Westminster, 2010) and specifically considering the scope for growth in i) London and the South East and ii) central London based on the interviews with stakeholders. This considers the commodities moved by rail, the current state of these markets nationally and the opportunities for these rail freight markets to increase their role in London and the South East and in central London. Where appropriate (i.e. within the "other general freight" and Channel Tunnel categories), consideration has also been given to the carriage of freight on passenger trains.

Table 7.1: Indicative rail freight market assessment

	National assessment of:		**Potential for growth in rail share:**	
Market	**degree of market maturity**	**current rail position**	**in London and South East**	**in central London**
Coal	Mature and stable	Dominant	None	None
Aggregates	Mature and stable	Strong for longer distance flows	Moderate	Limited
Metals	Mature and stable/declining	Strong for certain sub-markets	Limited	None
Petroleum	Mature and stable	Strong for high volume flows where no pipeline exists	Limited	None
Automotive	Mature and stable	Low	Moderate	None
Waste	Mature and stable/declining	Low	Moderate	Limited
Intermodal	Dynamic and growing	Significant share of deep sea; low share of other unitised	Very considerable	Limited
Channel Tunnel	Dynamic and growing	Very limited	Very considerable	Moderate
Other general freight (non-intermodal):	Variable	Variable, but generally limited	Depends on aggregation potential	Depends on aggregation potential
Parcels	*Mature and growing*	*Very limited*	*Considerable*	*Moderate*
Retail: Non-food	*Mature and stable*	*Low*	*Moderate*	*Moderate*
Retail: Food	*Mature and stable*	*Low*	*Moderate*	*Moderate*
Train catering	*Mature and declining*	*Non-existent*	*Limited*	*Limited*

The rail freight operating companies (FOCs) and some other participants identified opportunities for new bulk rail freight flows, notably in the aggregates sector given the large quantities of construction materials required in London and the existence of terminals capable of handling such flows. For large volume flows of retail goods and parcels, where dedicated freight trains are a possibility, there was a difference of opinion as to where the most appropriate railhead in the London area would be. While central London stations such as Euston, Paddington and Waterloo were mentioned as possibilities by some participants, others saw greater opportunities to serve dedicated rail terminals in outer London railway locations such as Willesden, Cricklewood and, possibly, the redeveloped Old Oak Common area. A case was also made by several interviewees for the development of strategic rail freight interchanges/logistics parks in outer London (e.g. Barking) or the area beyond the Greater London boundary (e.g. at Colnbrook and Radlett) in the vicinity of the M25 and key arterial routes, where inward intermodal flows from ports or other parts of the UK would be made by rail for onward road distribution within London and the South East. Like bulk aggregates flows, this was seen as a more natural target market for rail than smaller volume, highly urban flows, but any efficiency and sustainability benefits of inward intermodal flows to these locations would accrue mostly over the inter-urban corridors rather than in London itself. No participants identified rail-based solutions to move goods in to London from the strategic rail freight interchanges/logistics parks as being feasible within the next five years. In large part, and not unexpectedly, the location decision was related to the volume and nature of flow foreseen by participants. At the opposite end of the scale, most of the scope for increased rail freight activity in central London itself relates to the carriage of small volumes of freight on passenger trains.

The land use planning process was viewed by most of those respondents from the rail industry as being critical in overcoming difficulties in encouraging more urban rail freight, particularly using dedicated terminals. Most of the existing terminals in inner London are dedicated to handling aggregates and many are controlled by individual users with difficulties in gaining planning permission for new terminals. Several interviewees felt that road facilities and connections to existing rail freight terminals in outer London are generally poor and that these terminals are not well set up for last mile road deliveries to service customers in central London in an efficient manner. However, gaining planning permission for new, more appropriate, terminals was seen as an obstacle; funding such facilities, particularly for open access rather than sole user use, was also considered to be a barrier. An interesting way to overcome these problems, proposed by a respondent who felt that it was not possible to build an economic case to put logistics facilities into central London stations, was that government and/or Network Rail should use added value released from the regeneration of passenger hub stations to build fit-for-purpose rail freight terminals in more appropriate areas outside of central London. In any event, the challenge for developing rail freight activity in London relies on the identification of ways to bring down costs, notably for the rail-road transfer and the last mile delivery, and there may be a need for public funding to pump prime market changers that would then become commercially viable on an operational basis as well as providing wider environmental and social benefits.

Little or no scope for alternative rail-based freight activity was seen to be feasible in London in the next five years. While self-contained urban metro systems (such as the London Underground) give a high level of access to central areas of cities, there are considerable obstacles to overcome in developing viable freight initiatives. In the context of London, the sub-surface underground lines (e.g. Circle line) was mentioned by two participants, particularly given the forthcoming overnight provision of passenger services on some underground lines which signals that track maintenance requirements may not be an insurmountable obstacle. However, neither participant saw the underground system as being feasible for freight within a five year timescale because of the lack of an effective way of moving freight from track level to street level at appropriate locations in central London.

The former Post Office Railway (also known as Mail Rail) was identified as offering opportunities by a small number of participants, but ruled out by others. Mount Pleasant and Rathbone Place stations were identified as possible start and end points for moving goods by rail into the West End shopping and business area, but the additional handling and associated costs would possibly prevent viable operations. On balance, the view was that reopening the Post Office Railway for other types of flow would not be feasible in the short- to medium-term if at all.

7.4 Assessment of central London railway stations as freight hubs

7.4.1 Overview

In relation to the London-specific element of the assessment, 18 stations were listed in the project brief. Of these, 17 are included in the "London stations" group for the purposes of defining central London for rail fares purposes, the exception being Old Street. For completeness, Elephant and Castle, Farringdon and Kensington Olympia have been added to the list of stations considered since they too are part of the "London stations" group and are situated within the boroughs forming the CRP. A total of 21 stations have therefore been evaluated based on published information and the interviews. While the interviews generally did not seek views on the possible role of individual stations, a number of interviewees had views on the opportunities (or otherwise) offered by specific stations so account has been taken of this in the assessment. Given the scale of the project it was not possible to carry out primary research into these topics at the 21 stations considered. Instead it was necessary to make use of published information to provide insight into three topics, representing issues relevant to the rail network access, the station characteristics and the local area characteristics. For each, a number of sub-topics were considered based on available information, as follows:

- Rail network access:
  - Access from key radial routes
  - Loading gauge
  - Route availability
  - Additional characteristics

- Station characteristics:
  - National rail station facility manager
  - Passenger footfall (National and Underground passenger entries & exits)
  - Whether step-free access to national rail platforms exists
  - Type(s) of passenger services operated

- Local area characteristics (are surrounding station):
  - Proportion of non-domestic land/buildings
  - Residential population
  - Motorised vehicle availability to households (car/van availability)
  - Mean household income

It should be borne in mind that this assessment presents an initial sift of the central London stations is based on published information. It is intended to demonstrate in broad terms the issues associated with using each station for freight purposes and to indicate where the greatest opportunities for different types of activity may lie. The details should be taken as indicative. Further detailed work would be required in order to fully understand the freight hub potential at different stations. The full results of this central London freight hub

assessment work is provided in Appendix 6. A summary of these indicative opportunities is provided in Table 7.2. Key assumptions in conducting this assessment were:

- For dedicated rail freight services, level access from platform to street would be required since volumes would be too great for the efficient use of lifts
- For freight on passenger trains, station dwell times for non-terminating passenger London and South East (LSE) passenger services would be too short for loading/unloading unaccompanied freight without risking passenger train performance
- For collection points and locker banks, in general terms it is possible to fit a solution to the perceived need, with collection points being better suited to stations with high footfall (from passengers and, also, from local residents or workers) and locker banks possibly being a viable option for smaller stations with lower footfall and/or less space
- For consolidation of goods for stations, the opportunity is positively correlated with the level of retailing activity but no assessment has been made of available space for consolidation requirements
- For urban consolidation centres based at stations, the availability of some storage space within the station footprint and off-street facilities for goods vehicles is required

In a thorough assessment, these assumptions could be varied or tested and others could be incorporated as necessary. What is important is the development of a hierarchy which allows the most feasible options to be identified and pursued.

Table 7.2: Indicative opportunities for freight activity at central London railway hubs

Station	Opportunities for: dedicated rail freight trains	freight on passenger trains	collection points/locker banks	consolidation of goods for stations	urban consolidation centres*
Blackfriars					
Cannon Street					
Charing Cross					
City Thameslink					
Elephant & Castle					
Euston					
Farringdon					
Fenchurch Street					
Kensington Olympia					
King's Cross					
Liverpool Street					
London Bridge					
Marylebone					
Moorgate					
Old Street					
Paddington					
St. Pancras Intl.					
Vauxhall					
Victoria					
Waterloo					
Waterloo (East)				with Waterloo	

Key:	Likely opportunities	Potential opportunities	No clear opportunities

* - opportunity for urban consolidation centre based at the station for last mile road deliveries to surrounding area (rather than based elsewhere and serving the station)

7.4.2 Dedicated freight trains

This discussion builds on the earlier generic discussion of issues relating to the use of dedicated freight trains to serve urban freight requirements (see Sections 4.1 and 5.2.1). Opportunities to serve central London stations by dedicated freight trains seem to be very limited, with more barriers than opportunities being identified. In particular, overnight rail access and efficient rail-road transfer were deemed to be problematic at many of the locations considered. Euston station was by far the most frequently mentioned as being suited to handling dedicated freight trains, and the only one where specific opportunities were identified, for the following main reasons:

- It is situated at the end of the West Coast Main Line (WCML), so has direct access to this key freight artery which serves locations likely to offer opportunities for sufficient volume over sufficient distance (e.g. from rail terminals at Daventry or Hams Hall or stations such as Rugby or Northampton)
- From Rugby southwards, the WCML is a four-track formation with considerable overnight freight traffic running over almost the entire length to Euston and a number of passenger services and empty passenger trains running in and out of Euston itself during the night period, so 24 hour access is generally maintained
- The platforms at both of the station's extremities offer direct road access, enabling easier rail-road transfer than at other stations where there is generally physical separation of platforms and roadways
- The parcels deck above the station offers potential for dedicated space for freight transport activities without conflicting with passenger flows, thus avoiding many of the health and safety and consignment security issues that affect other stations
- Despite some restrictions (e.g. only vehicles up to 7.5 tonnes gross vehicle weight can access the station platforms), the central London station location means that a technically feasible solution is possible

Despite these positive attributes and the two recent trials of dedicated freight trains at Euston (see Section 7.2), none of the respondents thought it feasible to introduce regular rail freight services at the station because of the uncertainties associated with the rebuilding of the station to cater for High Speed 2 (HS2) services. At the very least, the reconstruction period itself is expected to preclude the possibility for any dedicated freight trains since both track and station capacity will be limited and there is no guarantee that all of the attributes that currently make Euston a feasible option will be retained in the rebuilt station.

Of the stations shown in Table 7.2 as offering potential opportunities for dedicated freight trains, further investigation is required to determine whether they would indeed be viable since there are aspects which make them less than ideal. Paddington and Waterloo (former Eurostar platforms) may offer satisfactory road access but present some issues relating to rail network access from key out-of-London logistics locations. Consideration would also need to be given to issues such as the possible disturbance to local residents or hotel guests of night time operations associated with freight trains and associated road movements.

7.4.3 Freight on passenger trains

Several issues relating to freight on passenger trains were discussed in Sections 4.2.1 and 5.2.1. In the specific London context, the four stations handling terminating inter-city train services (including Eurostar trains via the Channel Tunnel) would appear to offer the greatest potential: these are Euston, King's Cross, Paddington and St. Pancras International. The combination of long-distance flows on high-speed trains (thus offering competitive city centre to city centre journey times), rolling stock that generally offers some possible secure

storage space and reasonably long train turnaround times at the stations. As discussed in Section 4.2.1, it may be possible to develop additional niche operations on an individual basis such as those already in existence using East Midlands Trains' HST services and the Caledonian Sleeper train from Inverness. To make more of an impact, however, it would be worth investigating the scope for some kind of national inter-city network based on connecting a number of regional hubs with London. Such a national network would require the involvement of a number of franchised operations currently including East Coast Trains, East Midlands Trains, First Great Western, Virgin Trains and, possibly, the Scotrail sleeper franchise. This may require government intervention in amending franchise agreements if voluntary participation is not forthcoming. There may be scope to use other central London stations as transfer points for freight carried on passenger trains, but the potential is less obvious in the immediate future and the obstacles are greater.

A number of interesting ideas were proposed by stakeholders to combine freight on passenger trains with wider initiatives such as the promotion of small- and medium-sized enterprises (SMEs) by giving them access to the London market through the use of rail or the promotion of tourism through the development of combined passenger and freight trains to provide new or more frequent train services to regional locations that cannot justify increased service provision based on passenger numbers alone. Daytime use of passenger trains into major stations could assist retailers with replenishment of small convenience stores within the station or to supply locker banks and collection points. These ideas require further development to establish their viability, particularly where several stakeholders would need to become involved.

7.4.4 Locker banks and collection points

The generic points made about locker banks and collection points in Section 5.2.2 are all also relevant to the London-specific situation. In addition, the following points that emerged from the interviews and assessment work also need to be taken into account in the case of London.

Network Rail is supportive of the collection points recently opened by Doddle at several mainline stations, since it helps to increase footfall in stations and generates rental income from previously unused space. Having collection points and locker banks at central London stations helps providers of these services to increase their physical presence and brand awareness. In this way it can generate awareness of the service among potential customers passing through these central stations.

Locating collection points/locker banks at customers' home stations is preferable so that customers do not need to carry the goods on trains. However, it is not likely to be commercially viable to serve small stations in outer London and beyond London. For a collection point/locker bank provider, aiming to serve commuters to London who live outside, a compromise is to locate collection points/locker banks at key regional stations outside London with high volume passenger flows and encourage passengers from small stations to use central London collection points (e.g. Waterloo). Doddle is following this strategy by opening collection points in Basingstoke and Woking.

Grocery collections are best suited to outer London passenger stations where there is greater space availability in station car parks. On the London Underground network, such car park facilities only exist in outer London (in zones 3/4 and further out), with no such sites in central or inner London.

In offering collection facilities at stations, there is the possibility that customers may decide to access these facilities by car in dedicated journeys not involving the use of rail services

(especially in the case of facilities at outer London stations). It is therefore necessary to consider ways in which such customer behaviour can be discouraged so as to prevent additional car trip generation at stations that is unconnected with rail travel).

In outer London locations where London Underground still owns shopping parades adjoining stations, it is possible to consider their suitability as collection points and for locker banks. This may prove to be an especially attractive option in situations in which the demand for such retail space has diminished.

There is a sizeable central London population that would potentially benefit from locker bank and collection point services for their entire range of online orders. For instance the City of Westminster has a resident population of approximately 250,000. Attracting non-rail users to London stations may even encourage them to start using rail, thereby leading to wider sustainability benefits. However, it is unlikely that the space exists in London passenger stations for collection points that are sufficiently large to handle the full range of products regardless of size and storage requirements. It is likely that collection points in locations other than stations would be required to accommodate such product diversity.

In central London, mainline stations have far more space availability than London Underground stations, and it will therefore be easier to accommodate locker banks and collection points in the former than the latter. However, with the future closure of ticket offices in London Underground stations this will provide new space for the provision of such facilities. However, whether this space will be used for such facilities will depend on commercial decisions yet to be taken by London Underground. It is also important to recognise that not all London Underground stations in central London provide level access to their ticket halls and retail areas. Many customers are not therefore likely to find such locations as suitable for the collection of heavy items.

7.4.5 Load consolidation

The generic points made about initiatives to improve goods consolidation in Section 5.2.3 are all also relevant to the London-specific situation. In addition, the following points that emerged from the interviews and assessment work also need to be taken into account in the case of London.

In addition to the space required for the storage and handling activities associated with a UCC, the vast majority of central London stations do not have the necessary design and layout features that facilitate the easy access and departure of goods vehicles. This explains why much of the current servicing of retail outlets at central London stations currently takes place on-street. In addition, many London stations have residential property in close proximity to them, so the operating of a UCC at the station could be liable to result in noise disturbance and complaints. There are therefore some significant barriers to installing UCCs at central London stations.

Some respondents felt that despite having lost a lot of space at stations in recent decades, Network Rail still owns many small spaces in and around central London stations, some of which could be regenerated for UCCs which are simply used for the transfer of goods from incoming to last-mile delivery vehicles (often referred to as micro-consolidation centres) rather than having any goods storage facilities. Such micro-consolidation centres have far smaller space requirements and simply require sufficient space to park last-mile delivery vehicles overnight and handle incoming vehicles, and electric vehicle charging points for the last-mile delivery vehicles.

Another alternative would be to locate UCCs at London freight terminals outside the centre of city where land is cheaper and space is more readily available. This option would then involve carrying out last-mile delivery of these goods to retail outlets and other businesses by road, albeit over longer distances than if the UCC was located at a central London station. This option would still potentially allow the opportunity to use clean, electric vehicles for these last mile deliveries, providing that the freight terminal was not too remote from the central London.

7.5 Central London Action Plan

A Central London Action Plan in relation to the central London railway hubs has been developed from the various strands of research carried out in this feasibility study (i.e. literature review, the interviews with a range of expert stakeholders, and the specialist judgement and experience of the research team). The Central London Action Plan is shown in Table 7.3. This Plan is based on the eight freight transport initiatives considered in the interviews and assessment work (see Section 3 and Figure 3.1) and the following factors were taken into account for each of these initiatives in developing this Plan:

- Financial implications
- Planning timescale
- Complexity of actions needed
- Key responsibility for action
- Current state of commercial feasibility
- The extent of further research needed
- Likelihood of occurrence in central London (regardless of timescale)

7.5.1 Short-term actions (i.e. within 2 years)

The locker banks and collection point initiatives at central London stations considered in this study have the potential to be operating commercially in the short term (i.e. within 2 years). However, in order to ensure that these facilities are located and provided in ways that will maximise their benefits to customers, as well as in terms of traffic and environmental impacts, further research is required at central London stations to better inform issues including: suitable stations and the most appropriate types and siting of facilities within these locations, the customer service offer, likely customer behaviour and how best to mitigate against undesirable behaviours, and the logistical supply of goods to and from these facilities.

Efforts to improve upstream consolidation in the supply chain to reduce vehicle deliveries and collections at central London stations would need to be developed and taken forward primarily by private sector stakeholders including shippers, LSPs, and industry associations. Public sector stakeholders and station owners may be able to help encourage such behaviour change by offering financial or operational inducements. The timescale for implementation will vary depending on the circumstances but in some cases may be feasible within the short-term.

A number of the rail-based initiatives may be feasible on a small scale within the short-term, given that there are existing examples (both of dedicated rail freight trials and the carriage of freight on passenger trains) which demonstrate the technical capabilities. However, organisational and financial challenges are likely to limit the uptake in the short-term. Recommended actions in the short-term to achieve implementation at a later date include:

- Further research to ascertain the advantages and disadvantages of these initiatives in economic, traffic, social and environmental terms, together with insight into the specific solutions that offer the greatest net benefits. This includes consideration of the land and facility requirements of rail freight in central London, and the feasibility of providing these at commercially viable rates for this purpose.
- Urban and national government (i.e. TfL and the UK Department for Transport) need to consider how specific urban rail freight and station as freight hub initiatives can be supported in terms of strategy formulation and development. This is likely to also require input and support from station owners in terms of their prioritisation of freight services and facilities.
- The establishment of a forum that brings together the various private and public sector stakeholders to discuss and work jointly to address the opportunities and barriers presented by the specific urban freight initiatives discussed in this report. The stakeholders best placed to initiate this forum are TfL and the UK Department for Transport. Stakeholders that should be involved include (depending on the initiative being discussed): the various levels of national, city-wide, and local government in London, station owners/operators (i.e. TfL and Network Rail), shippers and receivers, LSPs, rail freight operators, passenger train operators, industry associations, researchers, and any other relevant organisations.
- Private sector stakeholders need to think innovatively about new urban rail and road freight solutions and how these can be made operationally and commercially successful to the mutual benefit of all parties concerned. However, public sector actions are likely to be required to help develop and implement these solutions to ensure that they have a viable long-term future.
- Rail freight trials would play an important role in the investigation of the organisational and commercial feasibility of rail freight services in central London, as well as demonstrating these opportunities to potential users.

A similar series of steps to those proposed above for rail freight in central London is required for the UCC initiatives considered in this study. Further research may indicate that there is no scope to locate a UCC at a mainline station in central London due to lack of affordable space and hence commercial viability. It is therefore necessary to also consider the availability of other sites in central London that are located in sufficiently close proximity to mainline central London stations to be able to serve them and other businesses in the surrounding area. The option of locating a UCC at a site away from a central London station may prevent the joint provision of rail freight and consolidation centre services, but would have the advantage of shifting the road trip generation involved away from the station.

7.5.2 Medium- to long-term actions (i.e. more than 2 years)

For rail-based initiatives and UCCs, as reflected in Table 7.3, long-term commercial viability on a considerable scale is likely to require more than two years to achieve given the set of short-term actions identified in Section 7.5.1 that need to be addressed prior to widespread implementation. This view was held by the majority of those interviewed and reflects the complexities of responsibilities and actions for these initiatives given that the issues are more nuanced and further investigation of the various possibilities is needed.

Table 7.3: Central London Action Plan

Freight transport initiative	Financial implications	Planning timescale	Complexity of actions needed	Key responsibility for action	Current state of commercial feasibility	Further research needs	Likelihood in central London
I. Dedicated rail freight services							
A. Using dedicated rail freight terminals within urban areas	Major	Medium - Long-term	Low - medium	National govt. TfL/boroughs Network Rail FOCs	Partly developed	Medium	Low
B. Using major passenger railway stations within urban areas	Minor - Major	Short - Long-term	High	National govt. Network Rail FOCs	Not developed	High	Low – medium
II. Carrying freight on passenger rail services							
A. On heavy rail passenger trains	Minor – Moderate	Short - Long-term	Medium – high	National govt. Network Rail TOCs LSPs	Partly developed	Medium	Medium
B. On self-contained urban rail and metro systems	Minor-Major	Short - Long-term	Medium – high	TfL LSPs	Not developed	High	Low
III. Using major railway stations in the city as hubs for last mile freight activity							
A. Locker banks	Minor	Short-term	Low	Network Rail/TfL LSPs	Well developed	Low	High
B. Collection points	Minor-Moderate	Short-term	Low	Network Rail/TfL LSPs	Well developed	Low	High
C.1 Consolidation centre (located at station)	Minor-Major	Medium - Long-term	Medium – High	TfL/boroughs Network Rail LSPs	Partly developed	Medium	Low
C.2 Consolidation centre (serving station, located elsewhere)	Minor-Major	Medium - Long-term	Medium – High	TfL/boroughs LSPs	Partly developed	Medium	Medium - high
D. Other means of road freight vehicle consolidation	Minor-Major	Short - Long-term	Medium	LSPs Shippers/receivers	Partly developed	Low	High

N.B. Short-term: Within 2 years; Medium-term: 2-5 years; Long-term: More than 5 years

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Several key conclusions have emerged from the feasibility study. These are summarised below. However, it is important to note that the original intention of the feasibility study was to provide an assessment framework for thinking about rail stations as freight hubs. The current report has gone some way beyond this aim, and has attempted to also apply the assessment framework developed. However the results of this assessment work need to be treated with some caution given the scale of the project both in terms of its timescale and budget. While hopefully providing useful initial insights into the topics and questions investigated the feasibility study is not able to provide definitive answers. Further research would be needed to investigate key issues before greater certainty about some issues is possible. Therefore recommendations for further work are also included in section 8.2.

8.1.1 The role of rail freight in large urban areas

The topic of central urban rail stations as freight hubs has received little previous research attention. The feasibility study has indicated that consideration of this topic does have potential merit and applicability. The applicability is only likely to increase in future as central urban areas continue to increase in terms of building and population density and levels of economic activity, as this will resulting in ever-greater concerns about traffic and its environmental impacts. The rail freight opportunities offered by central urban stations have also received very little attention. Instead, any research into urban rail freight has tended to concentrate on traditional markets such as construction and waste materials. This study has identified that there are opportunities for central urban rail freight involving new product markets and services. However to realise these opportunities will require the overcoming of several significant barriers. The same is true of central stations as rail hubs and the role that they can play in consolidating the flow of products to them and the areas surrounding them.

Serving central urban areas with the range of goods that are required in accordance with the services attributes needed by those demanding these goods in future will require a range of different urban freight transport solutions. In terms of rail freight this is likely to mean that there is a possible role to be played by central stations and more outlying freight terminals, and by dedicated freight trains and freight on passenger trains and rail services. However, in terms of rail freight, these solutions are not likely to be arrived at quickly and to become commercially viable in the short-term (i.e. within 2 years) given the current, starting position.

One of the key barriers to the provision of rail freight in urban areas, as well as to improving the consolidation of goods destined for stations and businesses is the availability of suitable land for these services to take place. The loss of logistics land in central urban areas has been a common feature of western European cities in recent decades due to rising demand for land and the relatively low returns offered by logistics activities. However, unless such suitable land is safeguarded and made available at suitable prices, then both rail and road freight facilities will continue to be suburbanised and de-urbanised. This will result in road vehicles providing last-mile logistics services being dispatched to central urban areas from ever-more remote locations near the edge of, or outside, the urban area. This will contribute to urban traffic levels and its associated impacts and will further jeopardise the reliability of last-mile freight services in cities.

The carrying out of trials is likely to play an important role in the investigation of the technological and commercial feasibility of urban rail freight services, as well as

demonstrating the opportunities provided by these services to potential users. In the short- to medium-term trials can be used to act as a catalyst, giving a kick-start to this process of change in urban rail freight operations. Only by developing a sound business case based on commercial considerations for new urban rail freight services and consolidation operations will it be possible to make such transformation a reality.

8.1.2 The role of urban railway stations as freight hubs

Locker banks and collection points have the scope to be established at central stations in the short-term (i.e. within 2 years). They have an important role to play in changing the supply chain for online orders and helping replace home deliveries and deliveries to workplace with a more sustainable alternative. They could also be used to provide service engineers travelling around central urban areas by rail a convenient place from which to collect parts and equipment. Depending on the creativity of central and urban governments, station owners and train operators, locker banks and collection points may also help to stimulate greater use of passenger rail transport. However, central urban stations are unlikely to be suitable places from which to collect large items and grocery orders given the cost of storage space at these sites, and the lack of commuter train facilities for passenger storage. Items with sizeable space requirements and other more complex storage needs are likely to be better suited to collection from passengers' home stations in outer urban areas and beyond.

Although locker banks and collection points at stations offer an exciting opportunity to reorganise the supply chains for online orders in a way that could reduce their traffic and environmental impact, it is important to ensure that these facilities do not inadvertently attract dedicated car trips unconnected with passenger rail travel. It is also important to note that at present and in the immediate future, these collection services are likely to remain a relatively minor supply chain solution for online orders, with the majority of items continuing to be delivered to homes and workplaces, or collected from shops as part of click and collect transactions.

Improved load consolidation on goods vehicles serving stations either through upstream collaboration between shippers, receivers and LSPs, or through the use of UCCs would be beneficial in reducing vehicle trip generation at stations (as well as in the surrounding areas). There have been many trials and experiments involving UCCs in European cities in recent years in non-station contexts but few have managed to achieve long-term commercial viability. In order to achieve vehicle load improvements through either initiative it will be necessary for supply chain stakeholder to work closely together to find operational practices that meet the logistics service criteria required, and pricing systems that reflect the operational costs and benefits that result from such practices. Only through such innovations and agreements between supply chain partners will it prove possible to devise and implement systems that can achieve commercial viability.

When thinking about UCCs it is important to bear in mind that these can range in scope from large centres offering a wide range of additional logistics services through to very small micro-consolidation centres that are only used to transfer goods onto last mile delivery vehicles. The greater the physical scale and complexity of the UCC, the more difficult it is likely to be to achieve the goods throughput necessary for commercial viability. A UCC serving a central station would be likely to also have to serve businesses in the surrounding area in order to generate the necessary quantities of product throughput. In terms of the potential location of a UCC that serves central stations, the assessment suggests that it may be easier and better to locate in close proximity to, but not at, the stations due to their lack of affordable land, and so that stations benefit from the goods vehicle trip reduction associated

with UCC use. However, by locating the UCC away from the station would prevent its ability to directly handle rail freight.

8.1.3 Responsibilities for action by stakeholder groups

Building on the assessment in earlier sections, Table 8.1 summarises the views of the stakeholder experts who participated in the study. It is evident that almost all of them are of the opinion that rail freight has a bigger role to play in urban areas generally and more specifically in London. While difficult to make generalisations given the diversity of detailed opinions, around three quarters of respondents identified obvious potential for dedicated rail freight services and for the use of major stations in urban areas for last mile freight activity. Half of all participants felt that there is potential to carry freight on passenger rail services.

Table 8.1: Summary matrix of participants' views on role for rail-related urban freight and responsibility for taking action

Participant	Bigger role for rail-related urban freight in general?	Bigger role for rail-related freight specifically in London?	Main potential			Responsibility for taking action
			I	II	III	
LSP 1	Yes	Yes	✓	✓	✓	Not known
LSP 2	Yes	Yes	✓		✓	Public (national); private
LSP 3	Yes	Yes	✓		✓	Public (national/local); private
LSP 4	Yes	Yes		✓	✓	Public (national/local); private
Rail freight provider 1	Yes	Yes	✓		✓	Public (national)
Rail freight provider 2	Yes	Yes	✓		✓	Public (national/local); private
Rail freight provider 3	Yes	Yes	✓			Not known
Rail freight provider 4	Yes	Yes	✓			Not known
Rail freight provider 5	Yes	Yes	✓	✓		Not known
Public authority 1	Yes	Yes	✓		✓	Public (national/local); private
Public authority 2	Yes	Yes	✓	✓	✓	Public (national/local); private
Public authority 3	Yes	Yes	✓	✓	✓	Public (national/local); private
Public authority 4	Yes	Yes	✓	✓	✓	Public (national/local); private
Public authority 5	Yes	Yes	✓	✓	✓	Public (national/local); private
Public authority 6	Yes	Yes				Not known
Public authority 7	Yes	Uncertain	✓			Public (national/local)
Public authority 8	Yes	Yes		✓	✓	Public (national)
Shipper/receiver 1	Uncertain	Uncertain			✓	Not known
Shipper/receiver 2	Yes	Yes		✓	✓	Public (national/local); private
Industry association 1	Yes	Yes			✓	Not known
Industry association 2	Yes	Yes	✓		✓	Public (national); private
Industry association 3	Yes	Yes	✓	✓	✓	Public (national); private
Rail infra provider 1	Yes	Yes	✓	✓	✓	Public (national/local); private
Consultant 1	Yes	Yes	✓	✓	✓	Public (national/local); private
		Total	18	12	19	

Key: I – Dedicated rail freight services; II – Carrying freight on passenger rail services; III – Using major stations in the city as hubs for last mile freight activity

There is less of a convergence of views as to who is responsible for taking action to increase the role of rail-related freight activity, either on trains or at stations. In order to develop this potential there is a need for national and local (urban) government and station operators to take the lead in terms of strategy development. A key aspect of developing such strategy

will be to bring the various private and public sector stakeholders together to discuss the opportunities and barriers. For this to happen, national and urban government would need to facilitate this dialogue and discussion between relevant stakeholders. An important role for private sector stakeholders is to think in innovative and imaginative ways about new urban freight transport solutions including the use of rail freight and how these solutions can be made operationally and commercially successful to the mutual benefit of all parties concerned.

The use of major railway stations as hubs for last mile freight activity tends to have fewer strategic requirements and solutions are primarily LSP-led. The major role for public policy makers (and station operators where appropriate) is to identify, safeguard and provide space for the infrastructure required to support these solutions. In the case of consolidation centres, this may also broader consideration of suitable sites within the locality in addition to stations themselves. The case of road freight vehicle consolidation by other means requires little, if any, public sector involvement.

8.2 Recommendations for further work

Use of rail for urban freight activity

Reflecting the limited current level of understanding (and the lack of unanimity among the stakeholder participants in this feasibility study), it would be beneficial to conduct detailed research into the optimal location for transfer from rail to road for last mile deliveries so as to achieve the greatest overall benefits for supply chain efficiency and sustainability. In particular, it is not clear whether the benefits of bringing large volumes of freight by rail into city centre stations outweigh the additional complexities when compared to using dedicated freight terminals in more suburban locations. Such research would ideally bring together the operational, commercial and broader sustainability perspectives.

Possibly linked to this point, the scope for integrating the consideration of what are currently seen as almost mutually exclusive rail options for dedicated freight services and freight on passenger trains should be explored. The current structure of rail activity in the UK and many other countries is that passenger and freight service provision is treated separately. However, there may be options for rail to play a bigger role by combining dedicated freight service provision where volumes are sufficiently large and/or end-to-end journey times are not critical with the use of passenger trains where volumes are lower and/or fast and direct access to city centres is highly important.

While largely dismissed by stakeholders at this stage due to the combination of a lack of market maturity for locker banks/collection points, the very limited carriage of small consignments by rail and the challenges of combining the evolution of both of these types of initiatives, there would be merit in conducting an assessment of the extent of possible synergies associated with developing these markets in parallel. This may link to some of the issues raised below in relation to locker banks/collection points themselves.

Locker banks and collection points

- Topics concerned with understanding the needs of potential users of locker banks and collections points including:
  - the customer service criteria they want
  - whether there are clear preferences between locker banks or collection points
  - whether they want these facilities at stations or elsewhere

  - whether they want collection facilities at central London or home stations
  - what they are prepared to pay for such services
  - the scope for locker bank/collection point as stations to be used by service engineers

- The traffic and environmental impacts of the use of locker banks and collection points:
  - study of existing locker bank/collection point facilities at stations and their impacts on travel behaviour
  - comparison of the impacts of locker bank/collection point facilities at stations with other locations
  - comparison of the impacts of locker bank/collection point facilities at stations with deliveries to the home and workplace

- Analysis of the goods throughput needed to make locker bank/collection point at stations viable and comparisons with passenger numbers / station footfall.

Load consolidation and urban consolidation centres

- Establish stakeholder engagement/forum/focus groups to discuss the scope and opportunities for UCCs serving rail stations and surrounding areas
- Market research into the potential demand for UCCs from users at stations and the surrounding areas
- Research into the commercial, traffic and environmental viability of UCC business models (consider various types of UCC and micro-consolidation schemes)
- Research space requirements and space availability for various types of UCC and micro-consolidation centres in central urban areas

8.3 Practical recommendations

Six specific recommendations for action are made on the basis of the preceding analysis:

- National (or, where appropriate, urban) government should develop clearer strategic policy guidance to safeguard and/or allocate space for logistics activities in urban areas, setting the framework within which rail-related freight is promoted and local decisions are made; audits of suitable land for safeguarding should be carried out by local government
- A more coordinated approach to station redevelopment should be implemented by national government to ensure that Network Rail takes account of opportunities to improve freight transport activity in and around major railway stations
- More widespread conveyance of small freight consignments on passenger trains needs to be incentivised, most likely through a top-down approach whereby national government establishes regulatory and operational requirements through the franchising process for passenger train operators
- Future trials for rail-related freight initiatives in urban areas should focus on providing evidence to fill gaps in understanding of operational aspects (i.e. proof-of-concept) and, more particularly, on developing stronger business cases for initiatives that are known to work operationally; the results of trials should be clearly disseminated to key decision makers to raise the profile of these initiatives
- The potential for collection points and locker banks at railway stations should be considered in the wider context to establish since stations are often, but not always, among the most appropriate location for these facilities; local circumstances should be taken into account within a broad assessment framework
- Establish a stakeholder group with a remit to determine responsibilities for action

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APPENDIX 1: Email sent to international rail and/or urban freight experts

Dear Colleague

We are conducting a feasibility study to understand the potential role that urban railway hubs could play in regard to last mile logistics solutions, using Central London railway hubs as a case study, now and in the future. While much of the study is London-focused, we are carrying out a literature review to try to identify relevant examples from around the world. Given your expertise in this area, and the fairly limited investigation of this topic to date, we would appreciate it if you would let us know of any examples relating to the following:

- Urban freight initiatives involving the use of rail transport (heavy rail or light rail)
- Urban freight initiatives involving the use of railway stations
- Innovative rail solutions (not necessarily urban) which may offer potential within an urban environment
- Innovative non-rail urban solutions which may offer potential to involve the use of rail
- Any national or city laws/regulations that may impact on urban freight activity

Ideally, we are looking for material such as reports and press releases, but if there is no written information that you know of then any basic details of initiatives would be very helpful (together with contacts of people who may be able to provide more information, if possible). While we have targeted experts in specific countries, we are keen to hear of any initiatives you know of and not necessarily just ones from your own country.

Thank you in advance for your cooperation.

Regards

Michael Browne, Allan Woodburn and Julian Allen
Freight and Logistics Group, University of Westminster, London

APPENDIX 2: Pre-interview questionnaire

UNIVERSITY OF WESTMINSTER

Urban Railway Hub Freight Expansion Feasibility Study

Pre-interview questionnaire

Name of respondent: _____

Job title: _____

Name of organisation: _____

We would be very grateful if you would please complete this short questionnaire and email it to us prior to the interview taking place. The questionnaire is designed to gather a range of high-level information which will allow us to focus the discussion in the subsequent interview. When considering your responses, please focus on the UK context.

Part A: Role for rail freight in urban areas

Q1. What do you think are the main opportunities for rail to play a greater role in urban freight activity in the UK at the present time?

1. _____

2. _____

3. _____

Q2. What do you think are the main barriers restricting rail from playing a greater role in urban freight activity in the UK at the present time?

1. _____

2. _____

3. _____

Q3. Please score the following options regarding their potential for rail to increase its role in meeting urban freight requirements in the UK in the next five years.

Option	Great potential				No potential
Dedicated rail freight services:					
using dedicated rail freight terminals within urban areas	1	2	3	4	5
using major passenger railway stations within urban areas	1	2	3	4	5
Carrying freight on passenger rail services:					
on heavy rail passenger trains	1	2	3	4	5
on self-contained urban light rail and metro systems	1	2	3	4	5
Using major railway stations in the city as hubs for 'last mile' road-based freight activity (but no actual freight moving by rail)	1	2	3	4	5

Part B: Use of major passenger railway stations as part of 'last mile' initiatives

Q4. Please indicate the potential for major passenger railway stations in city centres to play a role in the following possible 'last mile' urban freight initiatives in the UK in the next five years.

Initiative	Great potential				No potential
Dedicated rail freight services of retail goods and/or parcels for onward road delivery within the central urban area	1	2	3	4	5
Dedicated rail freight services carrying waste away from the central urban area	1	2	3	4	5
Dedicated rail freight services carrying retail goods and/or parcels which are destined for the station itself (i.e. no onward road freight)	1	2	3	4	5
Using timetabled passenger trains to carry small volume items (e.g. parcels) for onward road delivery within the central urban area	1	2	3	4	5
Provision of locker banks to allow customer collection of goods	1	2	3	4	5
Provision of collection point "shops", offering additional facilities as well as customer collections (e.g. return of goods)	1	2	3	4	5
Using hub stations to consolidate goods flows for last mile delivery in the surrounding area	1	2	3	4	5
Greater consolidation of road-based delivery of goods to retail outlets at hub stations and for on-train catering	1	2	3	4	5
Other (please specify):	1	2	3	4	5

Part C: Respondent-specific focus on specialism/expertise

Q5. In your opinion, based on your specific role and experience within the freight transport industry, what are the top five (max.) actions that would lead to greater use of rail in urban areas in the UK in the next five years? These actions could relate to physical infrastructure, supply chain organisation, rail network/station operations, freight transport regulation, freight transport costs, etc.

1. _____

2. _____

3. _____

4. _____

5. _____

Thank you for taking the time to fill in this questionnaire. We look forward to discussing your responses with you.

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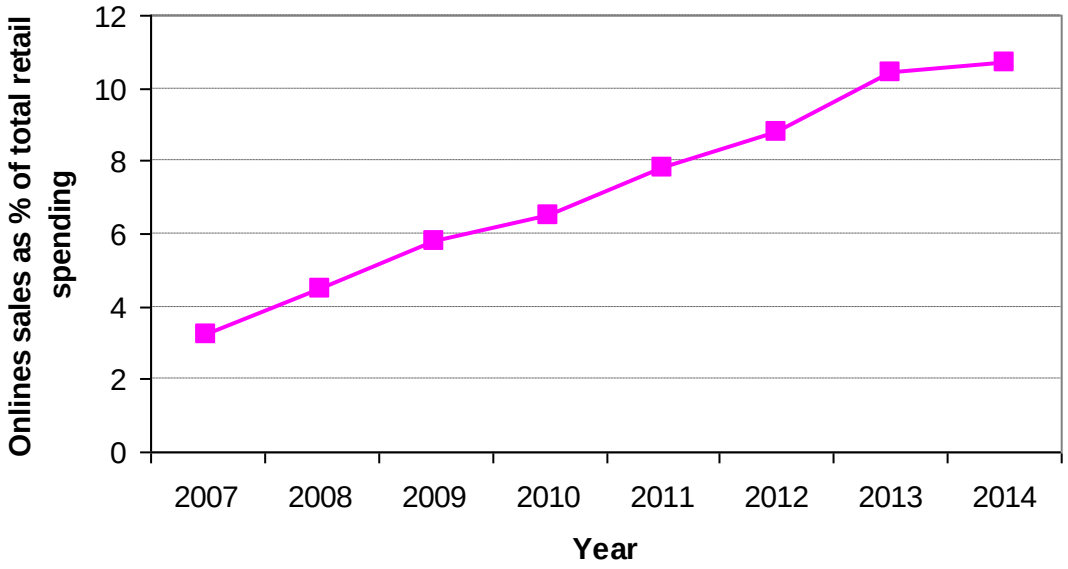
APPENDIX 3: Online shopping in the UK

In the UK online shopping accounted for 10.7 per cent of all retail spending in March 2013. This is equivalent to approximately £35 billion per year (ONS, 2014). Year on year growth in online food retailing to March 2014 was estimated to be 13.6 per cent, non-food online retailing to be 4.9 per cent, and non-store online retailing to be 6.7 per cent (ONS, 2014). The growth in the proportion of total retail sales accounted for by online shopping has been rapid in recent years (see Figure A3.1). Substantial growth in online retail spending is continuing with an increase of 7 per cent in the average weekly spend between March 2013 and March 2014. Most important in terms of online retail spending in the UK is the non-store retailing sector, with online spending accounting for 68 per cent of total spending in this sector in March 2014. In the food sector 3.7 per cent of total spending was online in March 2014, and was 8.5 per cent in non-food store sector (ONS, 2014).

Figure A3.1: Online sales as a percentage of total retail spending in the UK, 2007-2014



Note: data is for end of March in each year.
Source: produced from data provided in ONS (2012), ONS (2013b) and ONS (2014)

Online shopping remains largely domestic. Consumers are more likely to purchase online from national sellers/providers (39 per cent) than from sellers located in other EU countries (10 per cent) (European Commission, 2012). But this will probably change in the future. It is likely that the purchase goods by the internet will increase further. The following factors play a role:

- New demand: ageing of the population
  - Older people discover the convenience of internet ordering
  - Young people used to internet and remote ordering by the internet
- Traditional shopping (bricks and mortar) is hit by the economic crisis and the competition of online shopping: number of shops reduce
- Certain goods, such as groceries are just starting to be sold online: still a small share but will increase, considering the above mentioned factors
- The use of smart phones to purchase goods online

It has been forecast that online retail spending in the UK will increase by 45 per cent between 2014 and 2019 to a total of £56 billion (Verdict, 2014a). It is estimated that there

were 36.4 million online shoppers in the UK in 2014, with the number forecast to increase to 41.1 million by 2019 (Verdict, 2014a). A recent UK survey showed that when asked about their main reasons for shopping online, 95 per cent of respondents mentioned convenience and flexibility, 92 per cent mentioned the range of products available, 82 per cent mentioned price, 43 per cent mentioned speed, and 41 per cent mentioned online reviews (Royal Mail, 2014a). A major deterrent to those not using online shopping services is a concern about fraud and the security of online card payments. A European survey in eight countries of why people did not online showed that the most common deterrent was that people liked to browse the goods in store. However the second greatest deterrent was these security concerns, with between 30 per cent of respondents (in the Netherlands) and 59 per cent of respondents (in France) citing them (Verdict, 2011).

Returned products that were purchased online were estimated to have a total value of £3.1 billion in the UK in 2014. At present approximately 35 per cent of UK returns are taken to the Post Office, 10 per cent to another collection point, 35 per cent are collected by courier from home or work and 20 per cent are taken to store. Returns are forecast to grow by 50 per cent over the next five years as online sales increase and retailers make it easier to return products (Verdict, 2014a). Factors causing customers to return products can include: customers deciding the products are inappropriate once they see them or try them on; impulse purchases that customers later decide were not necessary; and customers ordering more goods than they intend to buy to obtain free delivery that is offered more than a certain total amount of money is spent.

APPENDIX 4: Attributes of locker banks and collection points

Table A4.1: Comparison of attributes of locker banks and collection points

Attribute	Locker bank	Collection point
Space requirements	Limited	Greater – usually part of or entire retail outlet
Operating costs	Low	Higher – due to space and staffing requirements
Opening hours	Typically 24/7	Typically convenience store hours (i.e. early morning until 8-11pm)
Labour requirements	None	Staffed
Dedicated to a single retailer	Sometimes (e.g. Amazon lockers)	No
Facility for goods return	Sometimes offered – sometimes not due to security concerns	Yes
Facility for sending goods	Never	Often
Customer concerns about how to use	More likely	Uncommon
Goods throughput	Low – due to small size/number of lockers	Higher
Specific operating problems	Lockers unavailable for reuse until customer collects	-

APPENDIX 5: Rail freight lifted to, from and within London

Table A5.1: Goods lifted by rail on journeys to, from and within London by commodity, 2008-2012 (million tonnes and percentages)

Commodity	2008	2009	2010	2011	2012
Construction	5.83 (80%)	5.39 (80%)	4.88 (77%)	5.99 (82%)	5.66 (85%)
Waste	0.88 (12%)	0.85 (13%)	1.00 (16%)	0.64 (9%)	0.35 (5%)
Other	0.59 (8%)	0.47 (7%)	0.47 (7%)	0.72 (10%)	0.68 (10%)
TOTAL	**7.29 (100%)**	**6.71 (100%)**	**6.36 (100%)**	**7.35 (100%)**	**6.68 (100%)**

Source: Network Rail data processed by MDS Transmodal

Table A5.2: Goods lifted by rail on journeys to, from and within London by origin and destination of journey, 2008-2012 (million tonnes)

a) On journeys originating in London
By destination:

	2008	2009	2010	2011	2012
London	0.85	0.93	0.58	0.79	0.67
North East	0.00	0.00	0.00	0.00	0.00
North West	0.06	0.06	0.07	0.07	0.06
Yorkshire & the Humber	0.00	0.00	0.00	0.00	0.00
East Midlands	0.03	0.03	0.04	0.08	0.09
West Midlands	0.00	0.00	0.00	0.00	0.00
East of England	0.01	0.04	0.03	0.02	0.03
South East	1.09	0.93	1.21	1.02	0.77
South West	0.00	0.00	0.00	0.00	0.03
Wales	0.04	0.03	0.03	0.09	0.17
Scotland	0.03	0.10	0.07	0.03	0.04
Mainland Europe	0.14	0.11	0.08	0.09	0.09
TOTAL	**2.23**	**2.23**	**2.09**	**2.19**	**1.95**

b) On journeys with London destinations
By origin:

	2008	2009	2010	2011	2012
London	0.85	0.93	0.58	0.79	0.67
North East	0.00	0.00	0.00	0.00	0.00
North West	0.00	0.00	0.03	0.06	0.00
Yorkshire & the Humber	0.07	0.06	0.07	0.08	0.07
East Midlands	1.20	1.00	0.80	1.24	1.30
West Midlands	0.14	0.14	0.13	0.15	0.14
East of England	0.11	0.10	0.14	0.08	0.03
South East	0.58	0.43	0.48	0.53	0.57
South West	2.62	2.40	2.32	2.77	2.36
Wales	0.21	0.26	0.22	0.15	0.15
Scotland	0.00	0.01	0.01	0.01	0.01
Mainland Europe	0.13	0.09	0.08	0.09	0.10
TOTAL	**5.91**	**5.42**	**4.85**	**5.95**	**5.41**

Source: Network Rail data processed by MDS Transmodal

APPENDIX 6: Further assessment of central London stations

Table A6.1: Rail network access characteristics

Station	Access from key radial routes[a]	Loading gauge	Route availability	Additional characteristics
Blackfriars	ECML, GWML, MML, WCML	W6 (from London Bridge only); < W6 (other)	8 (from south); 4 (from north)	
Cannon Street	ECML, GWML, MML, WCML	W6	8	
Charing Cross	ECML, GWML, MML, WCML	W6	4	Restricted access for locomotives
City Thameslink	ECML, GWML, MML, WCML	< W6	4	Highly restricted access for locomotives
Elephant & Castle	ECML, GWML, MML, WCML	< W6	8	
Euston	GWML, WCML	W6	8	
Farringdon	ECML, GWML, MML, WCML	< W6	4	Highly restricted access for locomotives
Fenchurch Street	ECML, GWML, MML, WCML	W6	3	
Kensington Olympia	ECML, GWML, WCML	W9	8	
King's Cross	ECML	W6	9	
Liverpool Street	ECML, GWML, MML, WCML	W6	8	
London Bridge	ECML, GWML, MML, WCML	W6	8	
Marylebone	-	W6	7 (via Ruislip); 8 (via Amersham)	Access via Amersham route requires special operational arrangements
Moorgate	ECML	< W6	9	No access for diesel traction; highly restricted access for electric traction
Old Street	ECML	< W6	9	No access for diesel traction; highly restricted access for electric traction
Paddington	ECML, GWML, MML	W6	8	
St. Pancras Intl.	GWML, HS1, MML	W6	8 (MML); HS1 not specified	
Vauxhall	ECML, GWML, MML, WCML	W6	8	
Victoria	ECML, GWML, MML, WCML	W6	8	
Waterloo	ECML, GWML, MML, WCML	W6	8	
Waterloo (East)	ECML, GWML, MML, WCML	W6	4	

Source: Network Rail (2014b)

Notes: [a] – with no reversals required; HS1 – High Speed 1; ECML – East Coast Main Line; GWML – Great Western Main Line; MML – Midland Main Line; WCML – West Coast Main Line; for information about loading gauge and route availability see Network Rail (2014c)

Table A6.2: Station characteristics

Station	National rail station facility manager	National rail entries & exits (million, 2012/13)	Underground entries & exits (million, 2013)	Step free access to national rail platforms	Type(s) of passenger services	Additional characteristics
Blackfriars	Thameslink	13.02	12.09	Yes (via lifts)	LSE	
Cannon Street	Network Rail	20.02	4.64	Yes (via lift)	LSE	
Charing Cross	Network Rail	38.61	18.63	Yes	LSE	
City Thameslink	Thameslink	5.54	-	Yes (via lifts)	LSE	No terminal platforms
Elephant & Castle	Thameslink	2.70	-	No	LSE	No terminal platforms
Euston	Network Rail	38.30	38.03	Yes	LSE, long dist.	Road vehicle access to some platforms
Farringdon	Thameslink	5.04	21.76	Yes (via lifts)	LSE	No terminal platforms
Fenchurch Street	Network Rail	16.84	-	Yes (via lifts)	LSE	
Kensington Olympia	London Overground	5.29	1.88	Yes	LSE	No terminal platforms
King's Cross	Network Rail	28.45	84.87[a]	Yes	LSE, long dist.	
Liverpool Street	Network Rail	58.45	67.89	Yes	LSE, long dist.	
London Bridge	Network Rail	53.35	69.88	Yes	LSE	
Marylebone	Chiltern Railways	14.69	13.40	Yes	LSE	
Moorgate	Great Northern	8.00	21.38	No	LSE	
Old Street	London Underground	1.40	21.86	No	LSE	No terminal platforms
Paddington	Network Rail	34.14	49.71	Yes	LSE, long dist.	Possible road vehicle access to some platforms
St. Pancras International	Network Rail	24.30	84.87[a]	Yes (via lifts)	International, LSE, long dist.	
Vauxhall	South West Trains	19.07	25.15	Yes (via lifts)	LSE	No terminal platforms
Victoria	Network Rail	77.35	84.58	Yes	LSE	
Waterloo	Network Rail	95.94	89.40	Yes	LSE	
Waterloo (East)	Southeastern	6.79	-	Yes (via lift)	LSE	No terminal platforms

Source: National Rail Enquiries (2014), ORR (2013, 2014), TfL (2014e)

Notes: [a] – King's Cross St. Pancras underground station; LSE – London & South East

Table A6.3: Local area characteristics

Station	% of land area for non-domestic buildings (by ward, 2005)	Residential population (persons per ha in surrounding MSOA(s), 2012)	No car/van availability (% of households in surrounding MSOA(s), 2011)	Mean household income (£ per annum in surrounding MSOA(s), 2011/12 est.)
Blackfriars	24 – 38	26 – 88	68 - 69	55,571 – 59,728
Cannon Street	38	26	69	59,728
Charing Cross	27	32	70	85,245
City Thameslink	38	26	69	59,728
Elephant & Castle	12 – 24	112 – 197	69 - 71	37,390 – 42,867
Euston	16 – 35	128 – 167	73 - 78	30,767 – 45,271
Farringdon	24 – 37	133 – 171	72 - 74	40,721 – 54,945
Fenchurch Street	38	26	69	59,728
Kensington Olympia	4 – 18	91 – 153	48 - 63	50,075 – 67,202
King's Cross	22	88 – 210	73 - 83	28,942 – 36,800
Liverpool Street	38	26	69	59,728
London Bridge	16 – 24	88 – 159	60 - 69	39,033 – 73,941
Marylebone	17 – 26	54 – 240	64 - 72	33,072 – 86,424
Moorgate	38	26	69	59,728
Old Street	31	130	74 - 76	42,306 - 43,765
Paddington	19	130 – 184	62 - 69	62,390 – 76,266
St. Pancras Intl.	22	88 - 210	73 - 83	28,942 – 36,800
Vauxhall	13 – 16	57 - 146	65 - 68	41,434 – 44,918
Victoria	6 – 27	26 - 131	41 - 65	54,429 – 141,363
Waterloo	23	74	68	51,982
Waterloo (East)	23	74	68	51,982

Source: GLA (2014a); GLA (2014b)

Notes: MSOA – Middle Super Output Area