

# **ANALYSING THE RESULTS OF UK URBAN FREIGHT STUDIES**

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## **ABSTRACT**

The paper is based on work carried out as part of the Green Logistics project<sup>1</sup>. The paper provides a review of urban freight studies that have taken place in the UK over approximately a thirty year period from the early 1970s to the present (this is the first attempt at such a review in the UK as far as the authors are aware). Coverage of both goods collection and delivery vehicle activity and service vehicle activity is included. This review covers the survey techniques used, as well as the survey results obtained. Comparisons are made between the results of studies from the 1970s and those carried out in the last decade in order to gain insight to changes in urban freight transport operations.

The data provided the studies reviewed is extremely important as it provides insight into urban freight operations that is unavailable from any other data source, including national freight surveys conducted by government. However, until now, the results of these studies have not been widely disseminated or compared.

## **INTRODUCTION**

The paper begins with an overview of the techniques that have been used in urban freight surveys. The following section contains a review of 30 UK urban freight studies carried out between 1996 and 2008. The studies were intended to provide insight into urban freight activities in our towns and cities and focused mainly on quantitative data collection and analysis. In the next section the results of 7 UK urban freight studies carried out in the 1970s (between 1970 and 1975) are presented and the results are briefly compared with the recent studies that were previously presented. This provides insight into the extent of similarity and difference in urban freight operations over this 25-35 year period.

Gaining a detailed understanding of urban freight transport activities is an important element in determining the current sustainability of such activity (in economic, social and environmental terms) and how best to go about enhancing its sustainability. It is hoped that reviewing the results of these UK studies, and comparing recent study results with those from the 1970s is of help in developing this insight.

## **URBAN FREIGHT SURVEY TECHNIQUES**

A recent review of urban freight surveys identified approximately 60 such studies in the UK and approximately 100 elsewhere since the 1960s. Data collection in these surveys been made use of several different survey techniques as listed below (Allen and Browne, 2008):

- Establishment survey
- Commodity flow survey
- Freight operator survey
- Driver survey
- Roadside interview survey
- Vehicle observation survey
- Parking survey
- Vehicle trip diaries
- GPS survey
- Suppliers survey
- Service provider survey

In addition, vehicle traffic counts are commonly used in conjunction with the above techniques as a means of understanding the proportion of all road traffic accounted for by commercial vehicles by time of day and day of week.

It is planned that guidelines on urban freight survey techniques will be produced as part of the Green Logistics project in 2009/2010 (see footnote 1 for further details of the project).

## **ANALYSIS OF RECENT URBAN FREIGHT STUDY RESULTS IN THE UK**

An analysis of the results of 30 urban freight studies conducted in the UK over approximately the last decade (1996-2008) was carried out in order to examine various features of urban road freight activities in the UK. These represent all the recent UK studies that the authors were able to identify and obtain. In most cases only a report or paper detailing the results of the study was available rather than the raw data collected in surveys.

It should be noted that the same topic has often been investigated in differing ways in the various studies. Also, even when the same survey technique is used to study a particular aspect of urban freight activity, the way in which the question is phrased is often different. All of these complications make comparisons between the study results difficult. In addition, many of the studies have relatively small sample sizes.

Despite the difficulties extracting results from these surveys and comparing results where more than one survey has focussed on a specific issue has enhanced the existing knowledge of urban freight transport activities. These UK studies that were analysed are summarised in Appendix 1.

### **Number of vehicle deliveries and collections at establishments**

Many of the recent UK surveys reviewed have collected data about the number of goods vehicle trips to establishments in urban areas to provide deliveries. In most cases this data was collected by establishment survey, but in a few cases it was collected by vehicle observation survey – the technique used is noted in Table A.1. Vehicle observation surveys are likely to underestimate vehicle trips to establishments for two key reasons: i) the time over which the survey is conducted (the surveys are typically less than 24 hours per day so night deliveries are not counted, and do not always take place over an entire week), and ii) deliveries made via side and rear roads are often not observed by surveyors. By contrast, establishment surveys rely on the ability of the respondent in the receiving establishment to provide information about the average number of vehicle deliveries over a given time period, and the quality of this response will depend on the knowledge of the respondent as no direct observations are made in this approach. No consistent relationship was established about the difference in delivery numbers obtained by establishment survey compared with observation surveys.

Table 1 provides details of the number of goods vehicles deliveries to establishments in the UK surveys reviewed. The average number of vehicle deliveries per establishment in a typical week ranges from 1.8 (in the Croydon study) to 24.5 (in the Torbay study). Table 1 also reflects the range in the number of deliveries per establishment within these studies (for those which data is available). Table 1 also shows the average number of sources from which deliveries are despatched to establishments. This also varies from 1.3 sources per establishment in the Bromley study to 14.1 in the Norwich and London study.

Table 1: Goods vehicle delivery trips to urban establishments in recent UK studies

<b>Study</b>	<b>Year of study</b>	<b>Number of respondents</b>	<b>Ave delivery trips per establishment per typical week</b>	<b>Range of no. of deliveries in typical week</b>	<b>Ave. no of sources for deliveries per establishment</b>	<b>Survey technique used</b>
Leeds	1996	444	9.6	5-100		Establishment survey
Southampton	1996	172	9.7	1-100		Establishment survey
Winchester	1996	115	8.3	2-100		Establishment survey
Norwich and London*	1999	34	19.6	1-159	14.1	Establishment survey
Covent Garden	2001	104	5.7	0.25-75		Establishment survey
Norwich	2001	21	21.6	2-150		Establishment survey
Winchester	2001	137	10.6	0.5-90	8.7	Establishment survey
Park Royal	2002	101	121.0	<10 to >500		Establishment survey
Bexleyheath	2003	21	16.2			Establishment survey
Broadmead, Bristol	2003	119	6.1	1-60		Establishment survey
Torbay	2003	34	24.5			Establishment survey
Ealing	2004	130	7.6			Observation survey
Colchester	2005	228	8.4			Establishment survey
Chichester, W.Sussex	2005	14	6.4	1-23	3.1	Establishment survey
Crawley, W.Sussex	2005	9	5.7	1-30	2.4	Establishment survey
Horsham, W.Sussex	2005	14	8.9	1-31	2.9	Establishment survey
Worthing, W.Sussex	2005	14	7.3	1-30	2.6	Establishment survey
Wallington	2005	85	13.0			Establishment survey
Catford	2006	45	12.0	1-60		Establishment survey
Croydon & Sutton	2006	183	4.9	1-100		Establishment survey
Bromley	2007	98	5.4	1-100	1.3	Establishment survey
Clapham Junction	2007		9.5			Establishment survey
Croydon	2007		1.8			Establishment survey
Kingston	2007		2.0			Establishment survey
Lewisham	2007	7	5.3	3-14	2.7	Establishment survey
Merton	2007		2.1			Establishment survey
Reading (Friar Street)*	2002-3	30	23.0			Establishment survey
Reading (Market Place)*	2002-3	31	16.0			Establishment survey
Reading (Market Place)*	2002-3		11.0			Observation survey

Note: \* - results include goods vehicle collections of core goods as well (i.e. not waste collection trips)

A wide range of factors will affect the number of goods vehicle deliveries made to an establishment. These include: the type of business, the size of the business (in terms of physical space, number of employees and turnover of goods), the range of goods required by the establishment, and the type of supply chain/goods supply system in which the establishment operates (i.e. whether goods destined for the establishment are consolidated upstream or not). This latter point is reflected in Table 1, with those studies showing higher average number of sources from which goods are dispatched to establishments also tending to show greater vehicle deliveries per establishment per week. The Norwich/London study showed how the number of vehicle deliveries varied by type of goods supply system (centralised, decentralised or hybrid). Binsbergen and Visser (1999) have noted that Dutch research has shown that local differences occur in the average number of deliveries and collections at establishments at an urban level. They note this is related to the size, economic composition, and number and type of businesses within the urban area.

It is important to recognise that the studies reviewed often involve a wide range of business types, sizes and ownerships of establishment (i.e. some studies focus on areas with small, independent shops while other focus on large establishments that are part of national chains), and have relatively small sample sizes, so comparing averages can be misleading. The average number of deliveries per establishment may be substantially inflated by a small number of establishments receiving a large numbers of deliveries. The median is probably a better indicator of what is 'typical', although it is perhaps foolhardy to generalise about numbers of deliveries as they are highly variable depending on the specific business. However without access to the raw data collected in these surveys a more detailed analysis is not possible.

It should also be noted that in some studies respondents were asked to provide an estimate of all goods vehicle deliveries in a typical week, while in other cases respondents were asked to estimate vehicle deliveries of "core goods" (i.e. those goods that are fundamental to the establishment, with ancillary goods vehicle movements being dealt with separately).

All recent UK studies reviewed have only expressed freight delivery and collection activity at urban establishments in terms of the number of vehicle trips, there have been no attempts to quantify tonnages, volumes, or monetary values of goods delivered and collected. In a very limited number of recent UK studies data about the number of items by packaging type (e.g. boxes, pallets, racks etc.) has been gathered for a limited sample. Dutch urban freight studies have attempted to quantify volumes of goods delivered and collected but Binsbergen and Visser (1999) have noted that this proved difficult and data was deemed unreliable.

## **Time and day of deliveries**

The various studies reviewed suggest slightly different peak times of day for deliveries and collections to retailers: however, the consensus view is that the morning (0600-1200 hours) is the busiest period. Many establishments appear to receive deliveries and collections throughout the working day. In the majority of surveys no more than 5% of deliveries and collection take place during the night/early hours of the morning when the establishment is closed. However, in the case of the Park Royal industrial estate study, 14% of deliveries and collections take place at night.

Some of the surveys have only investigated delivery times at urban establishments while other have considered both delivery and collection times. Three of the studies (Park Royal, Catford and Wallington) that considered deliveries and collections have grouped the results for both together. However, two surveys have provided separate results for delivery and collection times (Norwich and Colchester). The results of these two studies indicate that while the majority of deliveries tend to take place in the morning, collections are more spread throughout the working day.

Results concerning the days on which collections and deliveries were made were available from fifteen of the recent UK surveys. These survey results indicate that the vast majority of collections and deliveries are made on weekdays (Monday to Friday) with comparatively little activity at the weekend. Across the fifteen surveys deliveries and collections made on weekdays accounted for 87% - 96% of all collections and deliveries in high street surveys, and 76% - 86% of all collections and deliveries in surveys at wholesale markets.

Friday is the busiest day for vehicle deliveries and collections at establishments in approximately half of the studies. Monday is quietest weekday for vehicle deliveries and collections in more of the studies than any other weekday, followed by Tuesday. Sunday is the least busy day in the week for deliveries and collections at establishments in all the studies. Saturday is quieter than weekdays in all but three of the studies, and these are all London wholesale produce markets. However, in general, the differences in the number of deliveries (and collections) at establishments between Monday to Friday are relatively small in many of the studies.

As one might expect the run up to Christmas tends to be the busiest time of year for retail and other vehicle deliveries to establishments. The studies in Bexleyheath, Colchester and West Sussex towns (Chichester, Crawley, Horsham and Worthing) all confirm this. Respondents in establishments were given the opportunity to indicate their busiest month(s) for deliveries, with more than one response allowed. In each of these three studies, November received approximately twice as many responses, and December three times as many responses, as the average month.

### **Vehicle types used to make deliveries**

A cross-survey comparison of vehicle types used for delivering goods to establishments in the studies reviewed was carried out. Wide variations were found between studies in terms of the proportion of articulated goods vehicles, rigid goods vehicles, and light goods vehicles (up to and including 3.5 tonnes gross weight). The variations in vehicle types used at establishments in different studies reflect the different urban locations studied, and the type of establishments surveyed. The use of articulated vehicles ranged from 0 - 48% of all delivery trips in the various studies, while light goods vehicles ranged in importance from 2 - 75%. In those studies that considered the use of non-goods vehicles for deliveries, cars accounted for between 1-23% of all deliveries.

The vast majority of the studies that analysed vehicle type used establishment surveys to collect this data. However four studies used vehicle observation surveys. The establishment survey relies on the respondents in the establishment to have a good recognition of the mix of vehicles used to make deliveries to their site. Whether respondents have such knowledge is open to question.

### **Vehicle dwell times**

Vehicle dwell times are of interest because they indicate the amount of time that goods vehicles occupy road space while carrying out loading and unloading activities. Shorter dwell times help to increase the number of deliveries and collections that a vehicle can make in a day and also help to reduce the traffic delays that vehicles stopping to load and unload can cause for other road users.

Twenty-three of the studies reviewed collected data about average dwell times. Sometimes this has been gathered through vehicle observation surveys and in other cases by questioning an employee of the establishment. The use of establishment surveys to investigate dwell times is likely to provide less accurate results than a vehicle observation survey. This is because the respondent in the establishment: i) does not tend to know how long the entire process really takes from vehicle to establishment and back again instead they only witness the time the driver spends at their establishment, ii) does not know whether the person delivering/collecting goods from their establishment returns immediately to their vehicle and drives away or whether they make further collections/deliveries before moving the vehicle – i.e. once a vehicle is parked it may make more than one collection/delivery before being moved, and iii) will typically provide an average time taken for loading/unloading for all deliveries and collections rather than being able to provide information about whether dwell times vary for different sizes/weights of goods vehicle (and even if they do the accuracy of the data provided may be questionable).

The average dwell time in the various studies reviewed ranges from 7-34 minutes. Whether this difference is the result of specific conditions or the result of the survey approaches used is not clear. Previous research has identified that vehicle dwell time when loading/unloading will depend on a wide range of factors including: the distance from the goods vehicle to the premises, the location at which the vehicle parks (off-street v on-street), the size of delivery, the weight of the goods/type of product, the means of conveying the goods from the vehicle to premises, the number of people performing the delivery, the extent of help provided by staff at the receiving establishment assist with loading/unloading, and the amounting of checking and paperwork required as part of the delivery (Allen et al., 2000).

### **The loading/unloading process**

The majority of the studies reviewed have examined where goods vehicles park while loading and unloading in urban areas. On-street stopping locations are potentially liable to cause more traffic delays to other road users compared with off-street locations. However off-street locations can also cause traffic problems if they are difficult to manoeuvre the vehicle in and out of. The availability of off-street loading/unloading locations in urban areas varies depending on the type of location served.

The proportion of on-street deliveries ranged from 10% in the case of Bromley (in which most establishments were located in a shopping centre with dedicated, off-street delivery facilities) to 95% in the case of Norwich. In twelve of the seventeen surveys more than 50% of deliveries took place with the vehicle on-street.

Even when off-street loading facilities exist, this does not necessarily mean that they are always used. For example, in the Park Royal study, 14% of respondents said that their establishment did not have off-street facilities for goods vehicles, but 22% of respondents received deliveries from vehicle parked on-street.

The type of packaging that goods are delivered in and the method of moving goods from the vehicle to the establishment have a bearing on the time taken for the delivery and also on the disruption and potential for accidents with pedestrians when making deliveries from on-street and having to transfer the goods across the pavement. This is also an important consideration when thinking about any reorganisation of urban freight deliveries which would require additional handling of goods and possibly storage (such as the use of consolidation systems in the supply chain).

Few of the studies reviewed have investigated the type of packaging in which goods are delivered. However, two of the surveys reviewed (Sutton/Croydon and Bromley) did explore this topic in detail and found that 60% and 61% of deliveries respectively involved only loose



boxes. Deliveries involving pallets, roll cages and hanging rails only accounted for 12% and 21% of all deliveries respectively in these two surveys. The remaining deliveries involved the use of more than one type of goods packaging.

Eight of the studies reviewed have also considered the method by which goods are transported from vehicle to establishment, either by use of an establishment survey or by driver survey. The results indicate that transport by hand from the vehicle to point of delivery is by far the most common method in all studies (representing 47% to 99% of all deliveries in the various surveys). This indicates the relatively small size of most deliveries to urban establishments. However, the results indicate that trolleys, cages, and hand, pallet and forklift trucks are also widely used.

### **Type of vehicle operator**

Several of the urban freight studies reviewed have examined the type of vehicle operator responsible for making deliveries at the urban establishments surveyed.

The Bromley freight study in 2007 identified that of the 470 deliveries for whom the vehicle operator was known to the receiving establishment, 66% were operated by the receiver (or a third party logistics company on their behalf) and 34% were operated by the supplier of the goods (or a third party logistics company on their behalf). This study including mostly large multiple retailers, so the proportion of deliveries made by vehicles either operated by the retailer or contracted by it to a logistics company is likely to be far higher than would be the case for smaller and independent retailers.

In the Winchester freight study of 2004 managers at urban establishments receiving goods deliveries were asked who made these deliveries – respondents were allowed to identify more than one party making deliveries to them. The most common response from these managers was that they received deliveries from express parcels and courier companies (representing 44% of responses made), followed by the receiving establishments' own company vehicles (30% of responses), suppliers' vehicles (18%), third party logistics companies (6%), and 3% of respondents were unsure.

In the Reading study in 2002-3, 63% of respondents in Market Place stated that deliveries to their establishments by suppliers' vehicles, 11% by third party logistics providers' vehicles and 8% by their own vehicles. Meanwhile on Friar Street, 40% of respondents stated that deliveries to their establishments were made by third party logistics providers' vehicles, 37% by their own company's vehicles, and 23% by suppliers' vehicles. These differences between responses from establishments in the two streets are likely to be related to types of businesses – Friar

Street respondents were mostly multiple retailers and pubs/bars, while Market Place respondents comprised mostly independent establishments and offices.

### Service trips to urban establishments

Relatively few of the urban freight surveys have investigated service and other freight trips made to establishments. However, the few that have provide insights into the type and number of service and other freight trips as well as the vehicle types used.

The Bexleyheath (2003), Winchester (2001) and West Sussex (2005) surveys all produced a breakdown of service and other freight visits by the type of service provided (see Figure 1). The results indicated that overall mail deliveries were the most common service visit type, followed by window cleaning and general cleaning, waste collection and catering (however the number of each of these trips varied widely between the surveys indicating both differences in the locations and types of establishments surveyed, as well as differences in survey methodologies and definitions).

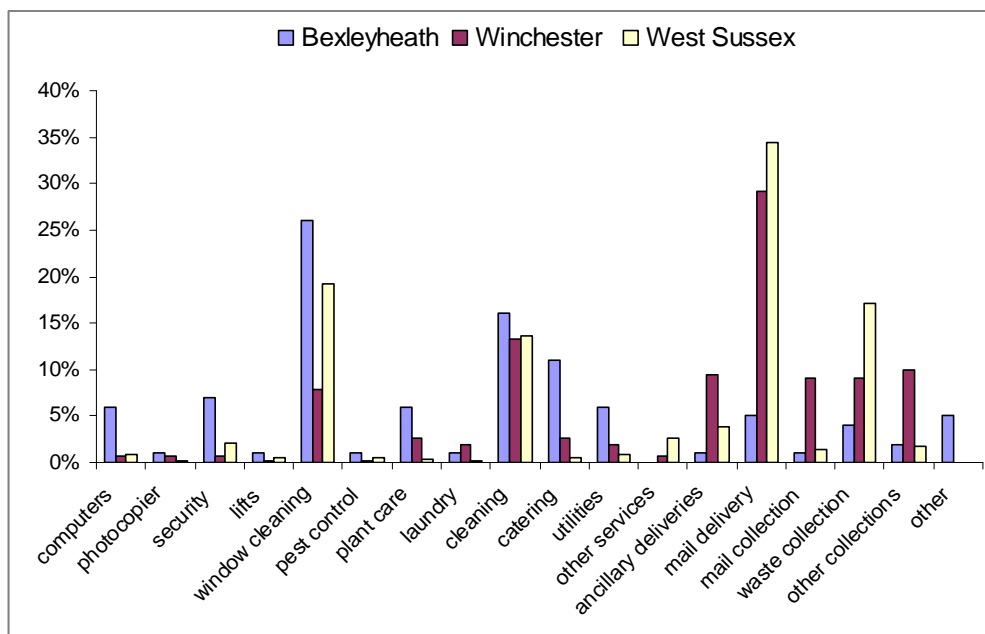


Figure 1: Frequency plot of service visits by type, Bexleyheath 2003, Winchester. 2001 and West Sussex towns, 2005

In the recent UK urban freight studies reviewed, the total number of service trips made to urban establishments was examined in ten survey locations. The number of service trips per establishment varies widely between survey locations (from 2.7 trips per establishment per week in Norwich, to 14.5 in Bar End, Winchester).

The results indicate that service trips to urban establishments are an important trip generator. Service trips as a proportion of all commercial trips (service trips plus goods delivery trips) range from 11% in the Norwich study to 63% in the Worthing study. However, it is important to bear in mind that not all service trips take place in motorised vehicles, some are provided on bicycle or on foot.

One of the studies (Norwich/London in 1999) has also demonstrated that ancillary freight collection and delivery trips (i.e. those not associated with deliveries and collections of the core goods required by the establishment) can generate as many, and in some cases more, vehicle trips than “core” goods trips at establishments. These trips are therefore an important topic of study in any urban freight research concerned with trip generation and the impacts of freight activity levels.

The types of vehicles used to provide services were studied in four of the survey locations. The results indicate that vans were used for approximately half of all service trips, cars for approximately 15-20% of trips, goods vehicles over 3.5 tonnes for 10-15% of trips, and non-motorised modes (i.e. bicycle and walking) for 15-20% of trips.

The West Sussex indicated that mail deliveries and collections took the least time (all being in the 1 to 15 minute category). Specialist waste collections were also very short, highlighting that many retailers will use specialist containers and skips compatible with their waste contractor’s collection vehicle, making them easy to collect and deliver. The average cleaning visit took the longest time, at 65 minutes, with lift maintenance taking 56 minutes on average. The total weekly service visit time for the 47 surveyed businesses was estimated to be 142 hours of service activity. Given that 83% of these service visits were undertaken by motorised transport, this implies that each business would generate 2.5 hours of service vehicle stationary time per week which could be directly outside the premises or in local car parks.

The Winchester study measured the average dwell time by the type of service visit. The results indicate that lift servicing had the greatest average dwell time (approximately 80 minutes), followed by cleaning services (approximately 75 minutes). The West Sussex towns study produced similar average dwell time findings. In this studied the findings implied that each establishment generated 2.5 hours of service vehicle stationary time per week which could be directly outside the premises or in local car parks.

## **COMPARISONS WITH EARLIER UK URBAN FREIGHT STUDIES**

A comparison between the results of the recent UK urban freight studies presented in the previous section and earlier UK urban freight studies in the 1970s was carried out to see whether the results provided insights into how urban freight transport operations have changed

over this 25-35 year period. The decision to compare recent UK urban freight studies with studies from the 1970s studies was made for two main reasons: i) the 1970s was a particularly rich period for urban freight studies in the UK, with a research programme backed by the Department for Transport and carried out by the Transport Research Laboratory, as well as studies funded by the Greater London Council. The 1970s therefore provides more studies for comparison than the 1980s, during which time far fewer UK studies took place; and ii) by going back to studies that took place 25-35 years ago it is possible to consider changes in the way in which urban freight operations are carried out and the extent to which these are reflected in the study results.

In addition, these 1970s studies were examined to see if they contained any data collection that has not been used in more recent studies. This involved an analysis of the results of seven urban freight carried out in the UK between 1970 and 1975. All but one of these studies (Greenwich-Lewisham) were primarily concerned with retail establishments. These studies that were analysed are summarised in Appendix 1.

Most of the urban freight studies from the 1970s that were reviewed collected data about the number of goods vehicle trips to establishments in urban areas to provide deliveries. This information was captured by vehicle observations surveys and establishment surveys. In the studies focusing on retail, the average number of vehicle deliveries per establishment in a typical week ranges from 8.9 in Putney to 15.8 in Newbury. These results are similar to many of the recent studies reviewed. The two industrial locations studied in the 1970s found average number of vehicle deliveries per establishment in a typical week of 24.5 and 27.5.

Four of the 1970s studies considered the total number of goods vehicle trips to establishments per weekday by establishment type and floor area. The results for all establishments in these four studies for which the data is available (0.5-1.0 vehicle trips per 100 sq. m.) are comparable to the results from the more recent Ealing (2004) and Wallington (2005) studies (0.9 and 1.5 vehicle trips per 100 sq. m respectively).

On average, establishments in the Hammersmith and Wembley studies of the 1970s received goods from vehicles operated by 12-13 different companies. This is higher than in the majority of recent studies for which comparable data is available. The results of these two studies indicate that manufacturers and wholesalers were the main source of goods despatched to establishments in Hammersmith, while in Wembley, companies' own warehouse were the main source of goods. These results reflect the lack of third party distribution and logistics, with "other" (which includes transport contractors) representing a minor proportion of the distribution systems used. This is very different from the distribution systems currently used on the high street with third party logistics operators playing a far greater role in deliveries to

establishments on behalf of manufacturers and also multiple retailers, and a lesser importance of wholesalers (as the number of independent retailers has diminished).

The Hammersmith and Wembley studies of the 1970s asked drivers about the origins of their trips. The trip origins vary depending on product type. However, on average for all products, approximately three-quarters of trips to Hammersmith and Wembley originate in London boroughs, with approximately 10% of trips originating more than 50 miles away.

In the recent studies of the last 10 years a lower proportion of trips originated from as near to the establishments visited (in the Bromley study 47% of delivery vehicles had been despatched from either London or Kent depots, with 25% of vehicles travelling from depots at least 50 miles away; and in the Bexleyheath study 35% of delivery vehicles had been despatched from either London or Kent depots with at least 50% of vehicles coming from more than 50 miles away). The Torbay freight study found that only 29% of delivery trips originated from within Devon.

This comparison suggests that over the period from 1970 to the 2000s the distance over which the majority of vehicles are travelling to make deliveries to urban establishments has increased substantially. At a national level, many companies have centralised their distribution operations over this period, resulting in substantial increases in average trip length, which would appear to tie in with the results presented here.

It would appear that, as in the recent studies, the morning (06.00-12.00 hours) was the busiest period for deliveries to establishments in the 1970s. Deliveries arriving before 10.00 accounted for between 21% and 30% of all deliveries in the five studies and morning deliveries account for 53%-67% of all deliveries in the five studies. Deliveries from 14.00 onwards make up a relatively small proportion of the total in each study. None of these 1970s studies examined the amount of delivery work that took place outside the observation period (i.e. during the night).

Comparing these 1970s study results with the recent studies that involved observation surveys, the studies in Catford (2006) and Wallington (2005) showed that 57% and 58% respectively of all deliveries took place during the morning. In the other recent studies (which used establishment surveys) the proportion of deliveries made during the morning ranged from 27-71%, with most studies showing results between 40-60% of deliveries exclusively in the morning.

The 1970s studies show that the vast majority of collections and deliveries are made on weekdays (Monday to Friday) with comparatively little activity on Saturdays. There were no Sunday deliveries at this period. There was no weekday that was obviously busier than others in terms of deliveries and collections. Fewer trips were made on Wednesdays and Thursdays

than on other weekdays, typically due to half-closing days, which is no longer common practice in the UK (for example see Thursday in Hammersmith).

As would be expected, during the 1970s, as now, the greatest monthly peak in deliveries typically occurred near to Christmas. However, whereas the results from recent studies shows that the Christmas peak in deliveries takes place in November and December, data from the earlier studies in Hammersmith and Wembley suggests that the peak was confined to December (with retailers marketing efforts starting later than now). The most surprising aspect of the results is the proportion of respondents who report no discernable peaks in any months, which suggests that 36% of respondents in Hammersmith and 58% in Wembley did not experience a peak in deliveries even during December.

The results indicate that a smaller proportion of both light goods vehicles and relatively heavy goods vehicles (3 axle rigid vehicles and articulated vehicles) were used for deliveries and collections to urban establishments in the 1970s compared with now. Instead greater use appears to have been made of 2 axle rigid vehicles. This is in line with trends in the vehicle fleet at a national level, from rigid vehicles to both lighter and heavier vehicles.

The 1970s studies showed average loading/unloading times of 9.5 to 13.6 minutes. These average loading/unloading times are generally lower than those in the more recent urban freight studies reviewed. However, this may be due to the greater vehicle size (and potentially average delivery size) that is often now used.

The 1970s studies indicate that deliveries by hand were by far the most common method for moving goods from the vehicle to the establishment, accounting for between 68% and 86% of deliveries in the five studies that provided such data. There is no evidence of the wide range of handling equipment used today, as reflected in review of the recent studies, such as roll cages, wheeled rails, hand and pallet trucks. The introduction of these devices has helped to reduce loading/unloading times and to reduce the risk of injury to the driver.

The Hammersmith and Wembley studies in the 1970s distinguished service visits (defined as gas, electricity, telephone and laundry services) to establishments from goods vehicle deliveries and collections. These studies showed that service trips accounted for 3% of all commercial vehicle trips to establishments in Hammersmith and 6% in Wembley. This was equivalent to 0.4 trips per establishment per week in Hammersmith, and 0.8 trips per establishment per week in Wembley. This is far lower than the number of service trips reported in the recent UK freight studies reviewed, which ranged from 2.7 – 14.5 service trips per establishment per week. The number of service trips is expected to have increased significantly at establishments since the 1970s as a result of outsourcing of a wide variety of service tasks

together with the major growth in the use of equipment that requires regular maintenance and repair.

## **CONCLUSION**

The results of recent urban freight studies analysed in this paper provide much insight into the nature of recent urban freight operations in the UK. The results also indicate that urban freight studies in the UK (and elsewhere) are producing varying freight transport activity results in terms of topics such as the average number of deliveries and collections made at establishments, the types of vehicles used, dwell times etc.

It is unlikely that the geography of the urban areas studied is totally responsible for determining the pattern of urban freight activities (although it is likely to play a role). Instead, variations in patterns of urban freight activities are more likely to be related to factors such as types of establishments in an urban area, the scale of the premises, their supply chain organisation and goods supply systems, and the range of products they require.

The comparison of current operations with those taking place in the UK 25-35 year ago has provided evidence of the changes that have taken in the nature of urban freight operations in terms of the increased use of third party logistics operators, the reduction in the number of locations from which goods are despatched to the establishment, the increase in the distance over which goods are supplied to establishments, the spreading of deliveries over more days of the week, the increasing use of light goods vehicles (as well as articulated vehicles and rigid vehicles with more than 2 axles), the greater seasonal peaks in delivery traffic, the changes in handing systems used between vehicles and the point of delivery, the increase in vehicle average dwell times (probably linked to larger delivery quantities), and the increase in service trips to establishments (linked to the rise in equipment requiring maintenance and the outsourcing of activities). Some aspects of urban freight operations appear to have remained relatively unchanged over the period including the average number of vehicle deliveries per establishment in a typical week, and total number of goods vehicle trips to establishments per unit of floor area. In addition, as in the 1970s, the majority of deliveries take place during the morning.

Carrying out the comparison of urban freight surveys has identified the need to ensure that in future there is greater consistency in the classifications and units of analysis used when collecting urban freight data. This would help to ensure greater comparability between the results of different studies. It would also allow the opportunity to pool together the results of relatively small studies to obtain a far larger urban freight transport activity dataset.

In addition, in many of the UK urban freight studies reviewed the raw data collected is not available to researchers. Therefore although the ability to carry out detailed additional analysis and comparisons would be desirable, it is not possible. Efforts should be made to ensure that in future such data is retained and made available to researchers.

## NOTES

1. The Green Logistics project is funded by the UK Engineering and Physical Sciences Research Council and the UK Department for Transport, and runs from 2006-2010. The urban freight transport module in the project is led by the University of Westminster with practitioner input from Transport for London. The website of the project is: <http://www.greenlogistics.org>. The full report on which this paper is based is available on the project website.

## REFERENCES

- Allen, J. and Browne, M., 2008, Review of Survey Techniques in Urban Freight Studies, Green Logistics Project Report, University of Westminster.
- Allen, J., Tanner, G., Browne, M., Anderson, S., Christodoulou, G. and Jones, P., 2003, Modelling policy measures and company initiatives for sustainable urban distribution – Final Technical Report, project carried out as part of the EPSRC/DfT Future Integrated Transport Programme, University of Westminster.
- Allen, J., Anderson, S., Browne, M., and Jones, P., 2000, A Framework for Considering Policies to Encourage Sustainable Urban Freight Traffic and Goods/Service Flows: Summary Report, University of Westminster.
- Bartlett, R. and Christie, A., 1978, The Hull Freight Study, Traffic Engineering and Control, November 1978, pp.498-502.
- Bartlett, R. and Newton, W., 1982, Goods vehicle trip generation and attraction by industrial and commercial premises, TRRL Laboratory Report 1059.
- Browne, M. and Allen, J. 2006, Urban freight data collection - synthesis report, Deliverable 3.1 Best Practice in data collection, modelling approaches and application fields for urban commercial transport models I, BESTUFS project.
- Browne, M., Allen, J. and Anderson, S., 2005, Freight Transport Project in Southwark and Lewisham: Final Report, University of Westminster.
- Cherrett, T.J. and Hickford, A.J., 2005, Freight and the economy. The effects of freight movements associated with retailers common to Chichester, Horsham, Worthing and Crawley. Final report in response to the brief set out by West Sussex County Council as part of their second Local Transport Plan.
- Cherrett, T. and Smyth, K., 2003, Freight Vehicle Movements in Winchester: Issues affecting supplier, courier and service providers, Final Report, University of Southampton.
- Cherrett, T., McLay, G. and McDonald, M., 2002, Effects of Freight Movements in Winchester, Final Report, University of Southampton.
- Christie, A., Bartlett, R., Cundill, M. and Prudhoe, J., 1973, Urban freight distribution: studies of operations in shopping streets at Newbury and Camberley, TRRL Report LR603.
- Christie, A., Prudhoe, J. and Cundill, M., 1973, Urban freight distribution: a study of operations in High Street Putney, TRRL Report LR556.
- Devon County Council, 2004, Torbay Freight Quality Partnership: Business and Driver Survey, private communication.



- Edwards, S., 1997, Distribution in City Centres: Investigating the Logistics Impacts of City Centre Retail Strategies, paper presented at Universities Transport Studies Group Annual Conference, Bournemouth, 1997.
- Hasell, B. and Christie, A., 1978, The Greenwich-Lewisham Freight Study, TRRL Supplementary Report 407
- Hitchcock, A., Christie, A. and Cundill, M., 1974, Urban Freight: Preliminary results from the Swindon freight survey, TRRL Supplementary report 126UC, Transport and Road Research Laboratory.
- Intermodality, 2004 IMT J0015 Business Survey Report
- Jennings, A., Sharp, C. and Whibley, D., 1972, Delivering the Goods: A study of the Watford service-only precinct, Research Report No.2, Freight Transport Association, Croydon.
- McKinnon, A., 2002, Freight transport and logistics in west central Scotland, Report to West of Scotland Transport Partnership.
- McKinnon, A., 1999, Vehicle utilization and energy efficiency in the food supply chain. Full Report of the Key Performance Indicator Survey.
- Metra Consulting Group, 1973a, Supplying Shopping Areas: The Operation and Cost of a Transshipment Depot Serving a Pedestrian Shopping Area, Volumes 1-2, London.
- Metra Consulting Group, 1973b, Supplying Shopping Areas: The Operation and Cost of a Transshipment Depot Serving a Pedestrian Shopping Area, Volumes 3-4, London.
- MVA and Preston Solutions, 2007, London Wholesale Markets Freight Study: Final Report.
- MVA, 2002, Park Royal Freight Survey, MVA.
- MVA, 2004, West London FQP - Ealing Town Centre Detailed Freight Survey, MVA.
- MVA, 2005, Freight Quality Partnership Studies at Wallington Town Centre, MVA.
- Peter Brett Associates, 2006, Catford Freight Delivery Study
- Peter Brett Associates, 2003, Reading Town Centre Freight Access Plan: Market Place Freight Accessibility Study
- Salgado, R., 2005, Is there room for improvement in the management of loading/unloading bays in the Seven Dials Area, MSc dissertation, University of Westminster.
- Steer Davies Gleave, 2005, Freight in Colchester Town Centre: Outputs of Town Centre Business Survey.
- Synovate, 2006, Business Van Usage in Croydon & Westminster: Quantitative Research Report, Synovate.
- TTR, 2004, VIVALDI Freight Consolidation Centre - Survey Responses, Report, TTR.
- TTR, 2007, Out-of-hours Deliveries in Central London, TTR
- TTR, 2007, Site survey analysis: Deptford High Street - London Borough of Lewisham, TTR.
- TTR, 2007, Site survey analysis: London Road - London Borough of Merton, TTR.
- TTR, 2007, Site survey analysis: High Street - London Borough of Croydon, TTR.
- TTR, 2007, Site survey analysis: Market Square - London Borough of Kingston, TTR.
- TTR, 2007, Site survey analysis: Northcote Road - London Borough of Wandsworth, TTR.
- TTR, 2007, South London Retail Distribution: Bromley Survey Report, TTR.
- TTR, 2007, South London Retail Distribution: Croydon and Sutton Survey Report, TTR.
- Tyler, A., 2001, Sustainable Goods Distribution: The Possibilities for Clear Zones, MSc dissertation, University of Westminster.
- Westminster City Council, 2008, Church Street Freight Study, Brief 7583, Feasibility Report
- Wilbur Smith and Associates and P-E Consulting, 1977, Hull freight study: collection of data and construction of computer model, TRRL Supplementary report 315, Transport and Road Research Laboratory.
- WSP and Katalysis, 2002, Report B4: Review of Data Sources, Review of Freight Modelling Project, Department for Transport

## APPENDIX 1

Table A.1: Summary details of the recent UK urban freight studies analysed

Study	Location	Date	Survey type	Sample size and response rate	Types of businesses	Reference
Winchester, Southampton, Leeds	Retail locations in all 3 cities: historic town, industrial town, metropolitan city	1996	Establishment survey	197 establishments (from 731 asked = 27%)	Nine types of retailer	Edwards, 1997.
Norwich and London	Various parts of Norwich and retail high street in Marylebone, London	1999	Establishment survey; operator survey; service provider survey	58 establishments, 7 operators, 5 service providers, 8 suppliers and wholesalers plus discussion groups	Mostly retail, but also food and drink, professional services and industrial	Allen et al., 2000
Birmingham, Basingstoke, Norwich	Distribution companies delivering to one or more of these urban areas from various depot locations	2001	Freight operator survey; vehicle trip diaries; parking survey; traffic counts	7 distribution companies	Drinks (beer, wine, soft) x 2; Dedicated storage/distribution for non-food retailer x 2; General storage/distribution, including drinks x 2; Parcels carrier	Allen et al., 2003
Winchester	Winchester city centre, Winnall and Bar End (both more industrial parts of Winchester).	2001	Establishment survey	133 establishments (from 403 asked = 33% response rate)	Various retail outlets, service industries, restaurants, pubs and hotels.	Cherrett et al., 2002
Norwich	Bedford Street - retail street comprising mainly small, independent retailers	2001	Establishment survey; driver survey; parking survey; traffic counts	21 establishments, 35 drivers	Retailers many independent inc.furniture, computer repairs, public houses, travel agents and jewellers.	Allen et al., 2003
Covent Garden	Seven Dials area of Covent Garden, London - mainly small, independent retailers	2001	Establishment survey	112 establishments (from 153 asked = 73% response rate)	Retail, bars, restaurants, cafes, hairdressers, theatre, hotel, offices	Tyler, 2001
Park Royal	Park Royal, West London, a major industrial area.	2002	Establishment survey; parking survey; traffic counts	64 establishments (from 400 asked = 16% response rate)	Industrial and commercial establishments including BBC TV, McVities, Royal Mail, Jewson, Exel and DHL	MVA, 2002
Reading	Market Place and Friar Street - town centre retailing and business areas	2002-2003	Establishment survey; vehicle observation survey; traffic counts	Market Place: 31 establishments (from 51 asked = 61% response rate); Friar Street: 30 establishments	Market Place - shops, banks and offices; Friar Street - shops selling heavier items and pubs/bars	Peter Brett Associates, 2003
Bexleyheath	The Broadway in Bexleyheath, southeast London	2003	Establishment survey	21 establishments (from 251 asked = 8% response rate)	Various retail stores, one bank, one restaurant, two pubs	Intermodality, 2004 (not published)
Bristol	Broadmead retailing area of the city	2003	Establishment survey	118 establishments (from 137 asked = 87% response rate)	Clothes, food and other retailers including shopping centre	TTR, 2004

Study	Location	Date	Survey type	Sample size and response rate	Types of businesses	Reference
Torbay	Torquay, Paignton and Brixham	2003	Establishment survey	34 establishments (from 163 asked = 21% response rate)	Wide variety, including small retail businesses, manufacturers, hotels and the regional hospital.	Devon County Council private communication
Winchester	Winchester city centre, Winnall and Bar End (both more industrial parts of Winchester).	2003	Establishment survey; suppliers survey; couriers survey; service providers survey	74 establishments; 13 service providers; 19 suppliers; 6 couriers (from 403 establishments; 49 service providers; 98 suppliers; 9 couriers asked = response rates 18% establishments; 29% service providers; 19% suppliers)	Retailers, warehouses, manufacturers, services, restaurants, pubs and hotels	Cherrett and Smyth, 2003
Ealing	Ealing town centre, West London.	2004	Vehicle observation survey	1048 deliveries to 130 establishments observed over six days (7am-7pm)	Survey sites included retail, food and drink, business and professional services.	MVA, 2004
Colchester	Colchester town centre	2005	Establishment survey	244 establishments (from 800 asked = 30.5% response rate)	All business types in town centre	Steer Davies Gleave, 2005
West Sussex	Chichester, Horsham, Worthing and Crawley	2005	Establishment survey	51 establishments (from 97 asked = 53% response rate)	Various retail outlets, service industries, restaurants, pubs and hotels.	Cherrett and Hickford, 2005
Covent Garden	Seven Dials area of Covent Garden, London - mainly small, independent retailers	2005	Vehicle observation survey	2 streets surveyed	Retail, bars, restaurants, cafes, hairdressers, theatre, hotel, offices	Salgado, 2005
Wallington	Small town in south London	2005	Establishment survey; vehicle observation survey; driver survey	100 establishments; 270 vehicles observed, 80 drivers surveyed (from 130 establishments and 270 drivers asked = 77% of establishments, 30% of drivers)	All types of business in town centre	MVA, 2005.
Southwark and Lewisham	Businesses based in the two boroughs that operated light goods vehicles	2005	Freight operator survey	82 operators (from 718 companies asked = 13%)	Wide range of businesses that operated light goods vehicles	Browne, et al., 2005
Croydon and Sutton	Main shopping areas of Croydon and Sutton, south London	2006	Establishment survey	183 establishments (121 in Croydon + 62 in Sutton) (from 469 asked = 39% response rate)	Various retailers – clothing represented 25%; banks not included	TTR, 2007
Catford	High street in southeast London	2006	Establishment survey; vehicle observation survey	45 establishments (from 200 asked = 23% response rate)	Mostly retailers (inc 10 food stores) plus restaurants, bars and clubs	Peter Brett Associates, 2006
Westminster and Croydon	Businesses based in the two boroughs	2006	Freight operator survey	130 operators (from 3195 companies asked = 4%)	Wide range of businesses that operated light goods vehicles	Synovate, 2006

<b>Study</b>	<b>Location</b>	<b>Date</b>	<b>Survey type</b>	<b>Sample size and response rate</b>	<b>Types of businesses</b>	<b>Reference</b>
London wholesale produce markets	Western International Market; New Covent Garden Market; New Spitalfields Market; Billingsgate Market; and Smithfield's Market	2006-2007	Establishment survey; driver survey; traffic counts	298 establishments and 2053 drivers (from 4062 establishments and 523 drivers asked = 51% establishments and 57% drivers)	The five major wholesale produce markets in London	MVA, 2007.
Bromley	Main shopping areas of Bromley, south London	2007	Establishment survey	98 establishments (from 140 asked = 70% response rate)	Various retailers - clothing represented 37%; banks included	TTR, 2007
Wandsworth	Northcote Road, Wandsworth, London	2007	Establishment survey; driver survey; vehicle observation survey	26 deliveries observed; establishments surveyed not stated	Almost exclusively independent speciality shops	TTR, 2007
Croydon	High Street, Croydon, London	2007	Establishment survey; driver survey; vehicle observation survey	10 establishments (all retailers)	Street made up mostly of retailers and restaurants	TTR, 2007
Kingston	Market Square, Kingston, London	2007	Establishment survey; driver survey; vehicle observation survey	12 establishments (all retailers); 20 deliveries observed	Square that has a daily street market	TTR, 2007
Lewisham	Deptford High Street, Lewisham, London	2007	Establishment survey; vehicle observation survey	7 establishments (all retailers); 24 deliveries observed	Street made up mostly of independent retailers and restaurants	TTR, 2007
Merton	London Road, Merton, London	2007	Establishment survey; driver survey; vehicle observation survey	15 establishments (all retailers); 3 drivers	Retailers and restaurants	TTR, 2007
Lisson Grove	Church Street in Lisson Grove, Westminster	2008	Establishment survey; traffic counts	104 establishments (from 155 asked = 67% response rate)	Shops and market stalls	Westminster City Council, 2008

Table A.2: Summary details of UK urban freight studies from the 1970s analysed

Study	Location	Date	Survey type	Sample size and response rate	Types of businesses	Reference
Hammersmith	Main shopping street and street market	1970	Establishment survey; vehicle observation survey; driver survey; traffic counts	174 establishments and 2041 vehicle observations	Shops including food, newsagents, clothing & shoe, household goods, general stores, service stores and other retailers	Metra Consulting Group, 1973a
Wembley	Main shopping street and pedestrianised central square	1970	Establishment survey; vehicle observation survey; driver survey; traffic counts	103 establishments and 1487 vehicle observations	Shops including food, newsagents, clothing & shoe, household goods, general stores, service stores and other retailers	Metra Consulting Group, 1973b
Watford	"Service-only" shopping precinct	1971	Establishment survey; vehicle observation survey; driver survey; traffic counts	40 establishments, 80 drivers (from 45 asked = 88% response rate)	Shops including food, clothing, shoe, furniture and other retailers	Jennings et al., 1972
Camberley	High Street - main shopping street	1973	Establishment survey; vehicle observation survey	84 establishments	Shops (food, clothing, household, other non-food), pubs, cafes, restaurants, banks	Christie et al., 1973a
Newbury	Northbrook Street - main shopping street	1973	Establishment survey; vehicle observation survey	80 establishments	Shops (food, clothing, household, other non-food), pubs, cafes, restaurants, banks	Christie et al., 1973a
Putney	High Street, Putney, south west London - main shopping street	1973	Establishment survey; vehicle observation survey	79 establishments	Shops (food, clothing, household, other non-food), pubs, cafes, restaurants, banks & factory	Christie et al., 1973b
Greenwich and Lewisham	Greenwich and Lewisham (about one half of each borough in south east London)	1974-5	Establishment survey; vehicle observation survey; traffic counts	455 establishments; 301 vehicle trip logs, 686 interviews with visiting drivers	Shopping areas, mixed shopping and commercial areas, major building sites, and industrial areas	Hasell and Christie, 1978