London Construction Consolidation Centre

Final Report - April 2008 rev October 2008

Transport for London

In partnership with

Bovis Lend Lease

Constructing Excellence

Stanhope

Wilson James

University of Westminster

Transport Studies Department

Executive Summary

A demonstration (pilot) project involving a London Construction Consolidation Centre (LCCC) to serve construction sites in London was established in 2005. The LCCC was located in South Bermondsey in south London.

The LCCC was established for the supply of construction materials to major construction sites on a just-in-time basis of material from suppliers to site. The LCCC was intended to reduce the number of deliveries going directly to the construction sites and thereby reducing traffic congestion and vehicle emissions.

The mission statement of the LCCC was *"to deliver in the safest and most efficient manner possible the right materials to the right site at the required time in active partnership with trade contractors and project managers"*

The key aim of the LCCC project was to understand and demonstrate the potential benefits and impact reductions that such a scheme could provide.

By the end of the two-year LCCC demonstration (pilot) project the following findings were identified:

- For those materials delivered via the LCCC, it is estimated that there was a 60-70 per cent reduction in the number of vehicles delivering to the four sites being served;
- When taking account of all deliveries from suppliers, there was a reduction of approximately 40 per cent in total vehicle deliveries in the case of Unilever House (which was the best managed site in that it had the lowest proportion of deliveries direct);
- The vast majority of deliveries from the LCCC to construction sites were made in rigid goods vehicles. Therefore, consolidating goods at the LCCC eliminated the use of articulated goods vehicles for site delivery, and significantly reduced the use of vans;
- Two hours average reduction in supplier journey times by going direct to the LCCC rather than driving into and out of the City of London (including loading / unloading time);
- Deliveries from the LCCC to sites achieved 97 per cent delivery reliability (i.e. 97 per cent materials of the correct type and quantity were delivered within 15 minutes of the scheduled time). The standard achieved without use of a consolidation centre is 39%;
- Increased productivity of the labour force on the construction sites by up to 25 minutes per person day as a result of the delivery reliability from the LCCC;
- Work scheduling problems on the construction sites as a result of the LCCC including an increase in the order lead time of up to six days; and some incorrect components being sent from the LCCC to the sites and some items being misplaced at the LCCC;
- Liability issues on the construction sites as a result of the LCCC including: trade contractors having liability for materials held at the LCCC over which they did not have control; and sign-off process for goods deliveries from the LCCC to the site not being as good as they could be;
- Estimated 70-80 per cent reduction of CO_2 emissions as a result of the reduction in vehicle movements compared with if all deliveries had been made direct to the

construction sites (however, this only refers to the relatively short journey from the consolidation centre to the construction sites);

- Approximately 3000 goods vehicles did not enter the London Congestion Charging Zone over the two-year pilot as a result of the LCCC;
- The reduction in vehicle journeys as a result of the LCCC is also likely to have helped to reduce noise pollution and potential casualties from traffic accidents;
- It proved difficult to measure reductions in material waste as a result of using the LCCC. However, the improved reliability of delivery from the LCCC, together with the secure storage offered at the LCCC did help to reduce the quantity of construction materials damaged, lost, stolen and over-ordered compared with typical construction projects. A significant quantity of material was left in the consolidation centre after the project, with an estimated value in the region of £250K, further supporting the argument that reduced material is required using a consolidation centre.
- LCCC vehicles brought recyclable packaging and unused materials back to the LCCC for recycling, re-use, or disposal thereby improving vehicle utilisation and reducing waste transport journeys. The LCCC also operated a recover, repair and recycle service for pallets;
- Employment of 16 people at the LCCC, together with provision of training courses and the opportunity for staff to gain NVQs;
- A lower than expected take up by other construction projects to make use of this facility.

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1. Background

A two-year demonstration (pilot) project involving a London Construction Consolidation Centre (LCCC) to serve a number of construction sites in the City of London operated from 2005 to 2007. The LCCC was a 5,000 sq. m. facility located in South Bermondsey, approximately three miles south of the City of London. It had a capacity of more than 200,000 pallets per annum, assuming a dwell time of seven days in the LCCC. The mission statement of the LCCC was, "*to deliver in the safest and most efficient manner possible the right materials to the right site at the required time in active partnership with trade contractors and project managers*". Figures 1 and 2 show the outside and inside of the LCCC.

Figure 1: The LCCC in South Bermondsey

Figure 2: Inside the LCCC

Four project partners and a managing partner were involved in the LCCC demonstration (pilot) project as shown below.

- **Transport for London:**
  - Data collection
  - Promotion of consolidation centres
- **Wilson James Ltd:**
  - Physical management and operation of consolidation centre
  - Construction logistics expertise
  - Ownership of trucks
  - Provision of staff to run the operation
- **Stanhope Plc:**
  - Site development
- **Bovis:**
  - Major contractor
  - Project management of all other contractors
- **Constructing Excellence:**
  - acted on behalf of TfL to manage the involvement and input of the stakeholders in the project.

2. Objectives

The LCCC was established for the supply of construction materials to major construction sites in London. The premise for the project was to understand the

potential for consolidation within construction, especially as consolidation as a technique has been used extensively in other sectors (e.g. retail). It was intended for rapid flow (on a just-in-time basis) of material from suppliers to site (maximum storage time of 10 days) rather than for long term storage. The LCCC was intended to reduce the number of deliveries going directly to the construction sites and thereby reducing traffic congestion and vehicle emissions.

The key aim of the LCCC project was to understand and demonstrate the potential benefits and impact reductions that such a scheme could provide. It also provided a comprehensive, independently verified set of data concerning the distribution of construction materials in an urban area. Thereby leading to an understanding of the commercial business case and viability of the construction consolidation centre.

The LCCC also provided the opportunity for partners at the leading edge of the construction industry to collaborate in using a consolidation centre in conjunction with efficient logistics management techniques.

3. Operational aspects

The LCCC worked in the following way: contractors working on the construction sites placed orders for their material requirements with their suppliers in the normal way, but instructed that the delivery was made to the LCCC, not the construction site.

Contractors received notification from the LCCC when these orders had arrived. Contractors then placed a delivery order with the LCCC for the materials they required. This was assembled at the LCCC and delivered to the sites. Approximately a sixth of all the deliveries requested from the LCCC by the construction sites were needed within less than 24 hours notice (i.e. on a just-in-time basis). This level of service would probably have been difficult to achieve if deliveries were being made direct to site by suppliers.

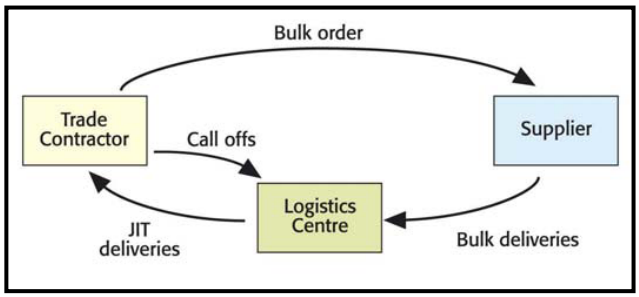
A short lease site was selected in Bermondsey, due to its proximity to the four construction sites to be serviced by the centre. However, the determination of the site was not based on providing an optimal location to minimise road transport requirements but rather based on site availability.

Vehicles making deliveries to the LCCC started their journeys from all over Britain with the majority originating from outside Greater London. The areas generating the greatest concentration of journey origins to the LCCC were the Home Counties, West Midlands and North West England. Figure 3 shows the journey origins for 341 (of the 480) suppliers who delivered to the LCCC. Some journeys to the LCCC originated from outside Britain, with Germany and Switzerland accounting for the vast majority of these foreign journeys.

Figure 3: UK journey origins for vehicles delivering to LCCC

The delivery from the LCCC to the construction sites consolidated numerous contractors' orders onto each vehicle. Figure 4 illustrates the way in which the supply chain was configured.

Figure 4: Supply Chain Configuration for the LCCC



The LCCC served four large construction sites in the City of London (images are shown in Figure 5):

- Unilever House (23,200 sq. m. of office space);
- Coleman Street (16,725 sq. m. of office space);
- Basinghall Street (18,575 sq. m. of office space); and
- Bow Bells House (13,000 sq. m. of office space and 1,350 sq. m. of retail space).

Figure 5: Images of the four construction sites served by the LCCC

Unilever House is the head office of Unilever Plc and will provide 250,000 sq ft of office space

Coleman Street will be the global headquarters of Legal & General, with 10 storeys and 180,000 sq ft of office space

Basinghall Street is being developed into the global headquarters for Standard Chartered Bank, providing 200,000 sq ft.

Bow Bells House is likely to be of mixed use with 140,000 sq ft of offices and 14,500 sq ft of retail space

Figure 6 shows a map of the location of the four construction sites served, while Figure 7 provides an overview of the LCCC operation to these four sties.

Figure 6: Location of the four construction sites served in the City of London

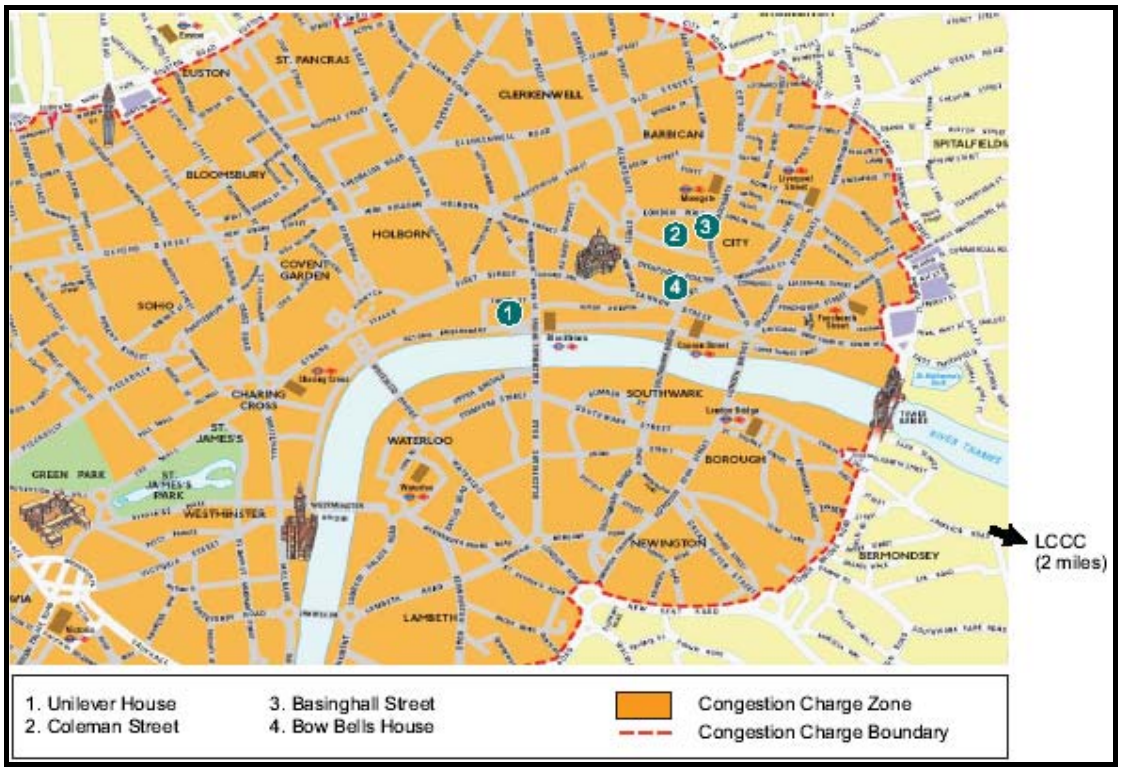
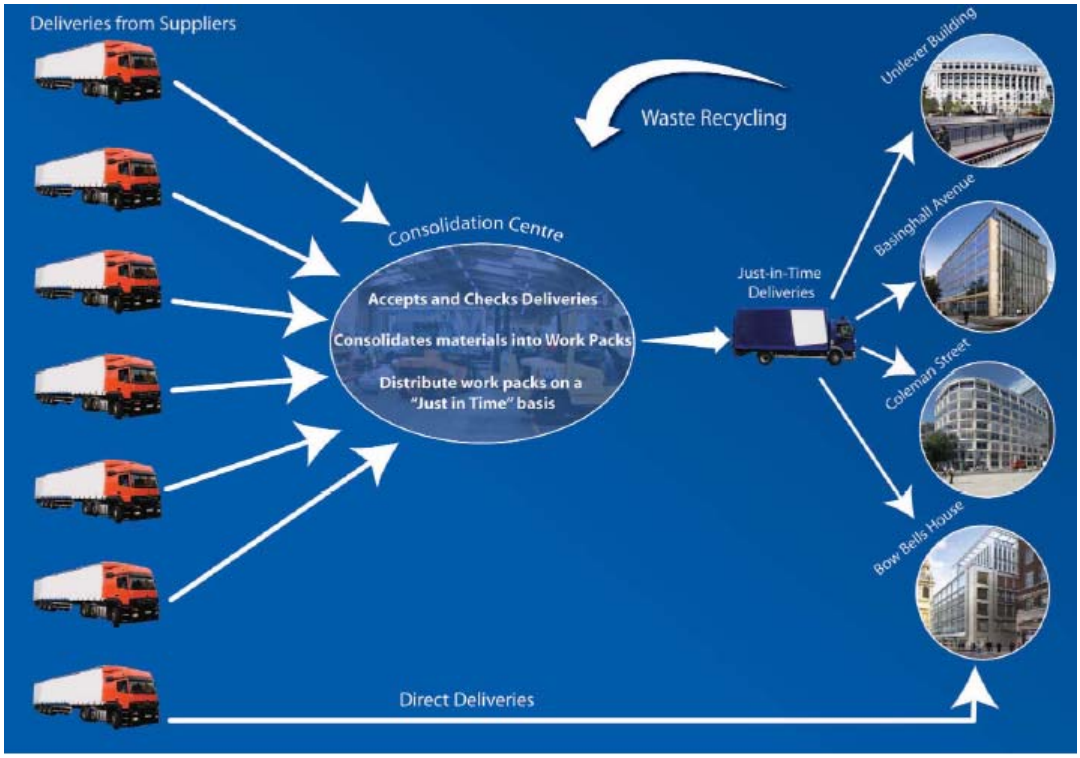


Figure 7: Overview of the LCCC operation to the four construction sites



As well as delivering construction materials to the sites, the vehicles operating from the LCCC also collected recyclable packaging and unused materials from the sites and brought these back to the LCCC. This was then either recycled or returned through the supply chain for re-use, or collected by a waste operator. It is important to note that some deliveries were sent directly to the construction sites rather than via the LCCC this varied between sites and during differing construction phases. These included aggregates, structural steel, ready-mix concrete, escalators and furniture (which were usually delivered as a full vehicle load).

The LCCC was operated from 07:30-17:30 on Monday to Thursday and 07:30-16:00 on Friday, with 24 hour operation available if required.

The LCCC employed 16 staff whose roles were as follows:

- 1 site/project manager;
- 1 depot manager;
- 1 depot supervisor;
- 2 supply controllers (dealt with suppliers and the construction sites and organise inbound and outbound transport);
- 1 administration clerk;
- full time HGV drivers (drove to and from construction sites and helping to load vehicles);
- fork-lift truck drivers; and
- 2 warehouse operatives (could also drive vehicles if necessary).

Due to the nature of the materials different goods vehicle body types were needed at the LCCC. Some materials needed to be kept dry, such as electronic equipment and insulation materials. Other materials were of a bulky or awkward shape, requiring a flatbed vehicle which could be sheeted if necessary. Different sizes and weights of vehicle were required to achieve efficient vehicle utilisation depending on the quantity of goods required at the sites. The LCCC goods vehicle fleet comprised:

- 2 x 26 tonne flatbed rigid (one with hoist) (Euro 3);
- 1 x 18 tonne flatbed rigid with hoist (Euro 3);
- 1 x 7.5 tonne curtain-sided rigid (Euro 3); and
- 1 x 3.5 tonne van (LPG- fuelled).

An integrated vehicle tracking and tracing system was used in the LCCC goods vehicles. This system can be used to create both live and historic tracking and vehicle management information which helped to ensure the LCCC could effectively manage the fleet.

Other equipment at the LCCC included:

- 1 x 4 tonne counter balance forklift;

- 1 x 3.5 tonne telehandler forklift;
- 1 x 2 tonne reach and tier forklift;
- 2 x 2.5 tonne electric hand pump trolleys.

Figure 8: One of the LCCC flatbed rigid vehicles in operation

Figure 9: The 7.5 tonne curtain-sided rigid vehicle operated from the LCCC

4. Financial aspects

The LCCC project cost £3.2 million and involved a partnership between Stanhope PLC, Bovis Lend Lease, Wilson James and Transport for London (TfL). TfL funded £1.85 million, while the developers and construction companies funded the other £1.35 million. The companies participating in the project voluntarily agreed to use the LCCC for the four construction sites. It was never proposed to provide detailed

commercially sensitive breakdowns but purely to provide an overview of direct costs involved. Some of the costs of the LCCC were passed on to the individual building contractors (but no detailed figures have been made available as contracts between the partners and the building contractors remain confidential).

The key financial requirement for the project was to determine the commercial viability for the potential use of consolidation centres in the construction sector. To enable this to happen the project would need to determine where costs had been saved in the supply chain and how this would then potentially benefit a construction project. The data required for this was not obtained during the project due to commercial sensitivity, as a result this aim was not achieved.

5. Summary of results

Operational targets were set for the performance of the LCCC in the project. These are shown in Table 1 together with the actual operational performance achieved.

Table 1: LCCC - targets and achievements

Key Performance Indicator	Target	Achieved
Reduction in freight journeys	40%	60-70% of journeys via LCCC 40% of journeys to construction site
Reduction in journey time of supplier deliveries to contractors	30-60 minutes	120 minutes
Delivery reliability	97%	97%

The indicators were set to provide benefits to all parties and at a level to improve current performance but be achievable on the pilot, as indicated:

- The primary objective for TfL was to show a reduction in journeys and mileage undertaken on London's road network. A reduction of 40% in the number of journeys to central London would show a significant change in behaviour on the roads, especially during congested periods;
- A key benefit is improving the responsiveness of the construction supply chain. It was agreed that for an untried pilot a reduction of up to an hour should be achievable;
- A key benefit for constructors is the reliability of receiving goods at site, which anecdotally is one of the key reasons for excess stocks and delivery. While retail supply chains are able to provide higher degrees of certainty, a target of 97% was set for this closed and controlled operation.

Therefore, the performance targets were met or surpassed during the project.

5.1 Reduction in freight journeys

For those materials delivered via the LCCC, estimates were made of the reduction in the number of vehicles delivering to the four construction sites served by the LCCC compared with if the LCCC had not been established. This estimate can be calculated in two ways:

1. Comparing the number of inbound deliveries to the LCCC with the number of outbound deliveries from the LCCC to the four sites (this assumes that the number of inbound deliveries to the LCCC is equivalent to the number of deliveries that would have been made to the four sites if the LCCC had not been established);
2. Comparing the number of product call-offs made by the four sites with the number of outbound deliveries from the LCCC to the four sites (this assumes that the number of call-offs is equivalent to the number of deliveries that would have been made to the four sites if the LCCC had not been established).

These two methods indicate that for those materials delivered via the LCCC, there was a 60-70 per cent reduction in the number of vehicles delivering to the four sites over the duration of the project compared with if the LCCC had not been established. (Estimation method 1 - inbound deliveries method – indicates a 60 per cent saving in goods vehicle journeys, whereas estimation method 2 – product call-offs method - indicates a 69 per cent saving in journeys).

Figure 10 shows the estimated vehicle journeys savings using method 1 (inbound deliveries method), and Figure 11 using method 2 (product call-offs method) for each of the four construction sites.

Not all materials were delivered to the four construction sites via the LCCC, some materials were delivered direct to the sites. When taking account of all deliveries from suppliers, there was a reduction of approximately 40 per cent in total vehicle deliveries to the site in the case of Unilever House (which was the best managed site in that it had the lowest proportion of deliveries direct).

The use of the LCCC resulted in greater use of rigid goods vehicles for final delivery to construction sites and less use of articulated goods vehicles and vans. In the case of Unilever House, of all deliveries made from the LCCC, 98 per cent were made by rigid goods vehicle and 2 per cent by van. By comparison, of the direct deliveries to the site by suppliers (i.e. not using the LCCC), 13 per cent were made by articulated goods vehicles, 49 per cent by rigid goods vehicles and 39 per cent by vans. Therefore consolidating goods at the LCCC eliminated the use of articulated goods vehicles for site delivery, and significantly reduced the use of vans.

Figure 10: Estimated vehicle journeys savings for materials delivered via the LCCC using method 1 (inbound deliveries method)

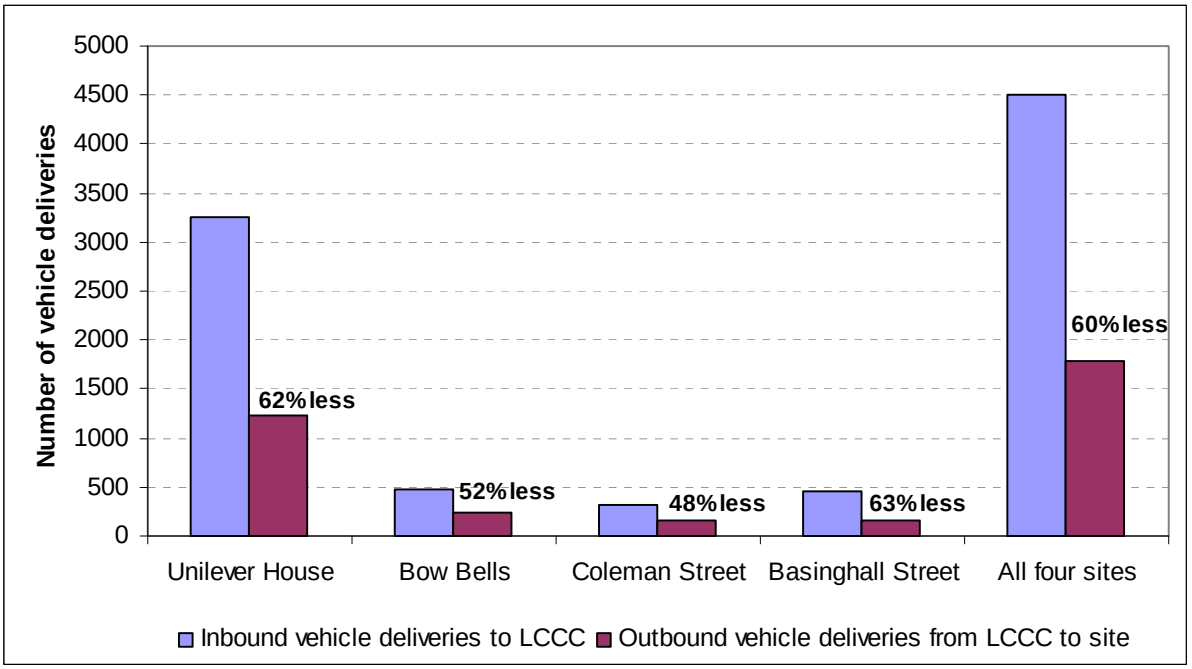
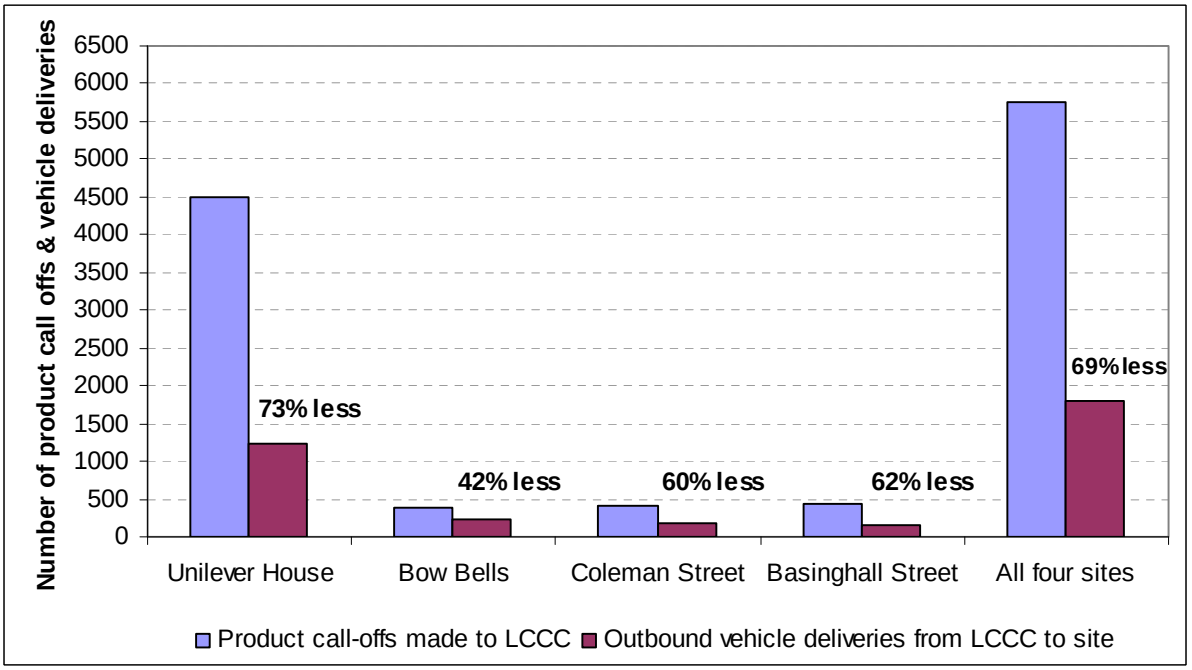


Figure 11: Estimated vehicle journeys savings for materials delivered via the LCCC using method 2 (product call-offs method)



5.2 Reduction in journey times

Interviews with drivers showed the average journey time reduction by going direct to the LCCC rather than driving into the City of London (including loading / unloading time) was approximately two hours, made up of:

- An average of 45 minutes saved in the time to unload a large goods vehicle at the LCCC compared with at a central London construction site;
- An average of 45 minutes saved in the time to reach the LCCC compared to a central London construction site;
- An average of 45 minutes saved when leaving the LCCC compared with departing from the centre of London.

A saving of approximately two hours in a driver's typical 10-hour day implies a potential saving of 20 per cent in a driver's working day as a result of using the LCCC. This time saving can be used to carry out other productive freight transport work, thereby increasing the efficiency of the freight transport operation.

5.3 Delivery reliability

Delivery reliability (in terms of the correct products being delivered when expected and required) has an important bearing on worker productivity at construction sites. The LCCC achieved 97 per cent delivery reliability (i.e. 97 per cent of materials of the correct type and quantity were delivered within 15 minutes of the scheduled time). Anecdotally typical delivery reliability has been considerably less and this does not necessarily include the delivery of the correct product and quantities.

During the LCCC demonstration (pilot) project, data on delivery reliability was also collected from a 'blind' control site in central London that was considered to be 'well managed' but did not use advanced logistics techniques. The delivery reliability at this control site was only 39 per cent.

Although 97 per cent delivery reliability may not be considered to be very impressive in the manufacturing and retail sectors, it was felt to be an extremely good performance in the construction sector.

5.4 Construction site productivity

Using a construction consolidation centre to reduce the number of deliveries to sites and operating materials ordering from sites on a just-in-time (JIT) basis can improve construction project efficiency in terms of time spent receiving deliveries and the management of materials on-site. It can also improve safety as the construction site will be less congested with materials.

Research was carried out by BSRIA (Building Services Research and Information Association) during the LCCC demonstration (pilot) project on two of the four sites served by the LCCC. This showed that the specialist trade contractor workforce on these two sites spent, on average, 5 per cent of the working day collecting or waiting for delivery of materials. By comparison, on 20 other projects that BSRIA studied that did not make use of a construction consolidation centre and related logistics practices, this was found to be 10 per cent of the working day. This is equivalent to a saving of 25 minutes per on-site trade contractor per day.

The BSRIA carried out interviews as part of its research on the two sites. During these interviews respondents identified several specific problems that affected on-site work scheduling and other problems that were related to the use of the LCCC. These included:

- *The use of the LCCC significantly increased the time between placing an order with a supplier and arrival of components at the jobface.*

  Interviewees felt that the use of the LCCC introduced two additional stages into the goods delivery process that were the result of this problem compared to deliveries of materials direct to the construction site. These two stages were: i) the specialist trade contractor having to wait for notification from the LCCC staff that goods had been delivered to the LCCC; and ii) the trade contractor having to complete a call-off order to the LCCC for delivery of materials to site, which then had to be configured into a load and delivered by LCCC staff. The contractors interviewed reported that each of these two stages could take up to three days (i.e. a total of six days). This delay was claimed to reduce the ability of trade contractors to react to late work sequence and programme changes initiated by the principal contractor.

- *The use of the LCCC resulted in some incorrect components being sent from the LCCC to the sites and some items being misplaced at the LCCC.*

  Interviewees felt that the principal cause of these problems was that LCCC staff possessed insufficient product knowledge to enable them to identify specific components.

- *The use of the LCCC resulted in trade contractors having liability for materials held at the LCCC over which they did not have sole control.*

  The trade contractors interviewed had two key concerns about liability for materials: i) in the event of a delay to installation works because materials had not been delivered to the jobface, the principal contractor held the specialist trade contractor responsible. However, this delivery failure may be the responsibility of the LCCC or the on-site logistics team, and these parties were not contractually responsible for installation works progress; ii) the specialist trade contractors could only check the condition and quantity of materials when they arrived at the jobface. The liability for any missing or damaged materials was then difficult to establish between the different organisations that had been involved with the delivery of the materials – the goods supplier, the LCCC and the on-site logistics team.

- *The sign-off process for goods deliveries from the LCCC to the site could have been improved*

  Many interviewees said that they would have liked to have had a formal sign-off process that would have shown when the goods arrived on site, their state when they arrived at the point of use, and confirmation that the required quantity of goods had been provided.

The BSRIA research also found that on the two sites served by the LCCC that were studied, the specialist trade contractor workforce lost approximately one-third of the working day as a result of all types of delay (i.e. in addition to delivery delays). This is almost twice as much as the best performing UK project that BSRIA had studied in the last 13 years and indicates that the overall management control of these two construction sites that the LCCC served, was not good. Whilst this failing is not directly attributable to the use of the LCCC it indicates the need for improved logistics on the construction site, as well as upstream in the supply chain and at the LCCC, if supply chain wide benefits are to be achieved.

5.5 Environmental impacts

It has been estimated that the LCCC resulted in a reduction of 70 – 80 per cent in CO_2 emissions from goods vehicles compared with if all deliveries had been made direct to the construction sites. In producing this estimate an average CO_2 factor of 0.502 kg CO_2 per vehicle km was used (which was achieved by the consolidation centre vehicles at the Heathrow Construction Consolidation Centre also run by Wilson James). This emissions factor is likely to be rather conservative for the LCCC, as the Heathrow Consolidation Centre used a heavier goods vehicle fleet which would emit higher CO_2 emissions than the vehicle fleet at the LCCC.

However, it is important to note that this reduction in CO_2 emissions only applies only to the final leg of the journey (i.e. the last few kilometres of the journey from the LCCC to the construction sites). Peter Brett Associates estimated in the "Wider Use of Construction Consolidation Centres" project for TfL that 98 per cent of total CO_2 emissions occurred during the journey from the point of origin to the consolidation centre.

Approximately 3000 goods vehicles did not enter the London Congestion Charging Zone over the two-year pilot as a result of the LCCC, equating to 6000 vehicle trips within central London. A further benefit, which has not been quantified, is the increase in network capacity resulting from reduced kerbside activity, especially as a significant proportion of the vehicles would otherwise have been large rigid or articulated lorries. This controlled delivery process moves activity away from the peak congested times which assists in smoothing traffic.

In addition to reducing emissions and congestion, the reduction in goods vehicle journeys as a result of using the LCCC is also likely to have helped to reduce noise pollution and casualties from traffic accidents.

5.6 Waste

It proved difficult to measure reductions in material waste as a result of using the LCCC. However, it was felt that the improved reliability of delivery from the LCCC, together with the secure storage offered at the LCCC did help to reduce the quantity of construction materials damaged, lost, stolen and over-ordered. Materials with an approximate value of £200,000 were left over in the LCCC after Unilever House had been completed. Assuming that the value of materials that passed through the LCCC for Unilever House was in the region of £20million, this remainder represented about 1 per cent of the materials handled. Although still a substantial amount of over-ordering, this is far less than the typical 15 per cent of over-ordering quoted by WRAP for construction projects. This indicates that the use of the LCCC did help to mitigate the industry's normal tendency to over-order.

As well as delivering to the construction sites, the vehicles brought recyclable packaging and unused materials back to the LCCC thereby improving vehicle utilisation and reducing waste transport journeys. This was either recycled, returned through the supply chain for re-use, or collected by a waste operator.

The LCCC operated a recover, repair and recycle service for pallets. The savings resulting from these efforts can be as much as 25 per cent of the cost of pallets.

5.7 Employment

The LCCC resulted in several employment benefits:

- Employment of 16 people at the LCCC;
- Enabled employees to gain relevant National Vocational Qualifications; and
- Ran training courses for logistics operator's staff and trade contractors.

However, despite the logistics operator's efforts to train the workforce at the LCCC and on the construction sites, BSRIA's identified a lack of commitment by personnel on the construction sites and a lack of product knowledge among the logistics staff at the LCCC.

5.8 Product throughput and users

There was potential for the LCCC to consolidate stock for 10 construction sites. It was generally felt that, depending on size, six construction sites would be required in order for the LCCC operation to be financially self-sustaining. However, there was a lower than expected take up by other construction projects in London during the demonstration (pilot) project, and as a result, only four construction sites were served by the LCCC.

6. Using consolidation centres in the construction sector

This section discusses the use of consolidation centres in the construction sector drawing on the results and findings of the LCCC demonstration (pilot) project.

6.1 Benefits of using consolidation centres

The LCCC demonstration (pilot) project has shown the benefits of using consolidation centres in the construction sector. These benefits have included:

- Reduction in total goods vehicle journeys to construction sites;
- Elimination of deliveries by articulated goods vehicles, significantly reduced deliveries by vans, and far greater use of rigid goods vehicles for deliveries to construction sites when using a consolidation centre;
- Associated reductions in CO_2 and noise emissions, and traffic casualties;
- Increasing network capacity by reducing kerbside activity;
- Smoothing traffic, by reducing deliveries in the congested peaks;
- Improvements in delivery reliability to construction sites;
- Time savings for drivers delivering to the consolidation centre (rather than having to deliver to the construction site);
- Time savings for trade contractors working at the construction site in collecting or waiting for delivery of materials;
- Indications of reduction in material waste;
- Scope for the consolidation centre to provide packaging, waste and material return collection services for construction sites;
- Scope for the consolidation centre to provide pallet recovery, repair and recycling services;
- Job creation, specialist logistics training and qualification opportunities.

6.2 Key issues to be addressed in using consolidation centres

The LCCC demonstration (pilot) project has also helped to identify several key issues that need to be addressed in using consolidation centres in the construction sector. These include:

- Putting in place appropriate management techniques to ensure that the use of consolidation centres does not increase the time between placing an order with a supplier and arrival of components at the jobface;
- Ensuring that consolidation centre staff are sufficiently knowledgeable about products to prevent incorrect components being sent from to construction sites or being misplaced at the consolidation centre;
- Determining appropriate legal agreements so that trade contractors using a consolidation centre do not have liability for materials held at the centre over which they did not have sole control;

- Devising suitable checking and sign-off processes for goods delivered from the consolidation centre to construction sites to prevent disputes between parties;
- Ensuring that there will be sufficient quantities of product passing through the consolidation centre and that sufficient construction sites are served to ensure that it is financially self-sustaining;
- Prevent the consolidation centre from being used by trade contractors as a long-term storage facility (as it is intended to facilitate short-term storage and just in time delivery);
- Taking steps to ensure that as high a proportion as possible of materials destined for the construction sites is delivered via the consolidation centre;
- Implementing managed call-off processes to improve planning and availability of stock without reducing efficiency within the supply chain;
- A recognition of consolidation being a highly beneficial approach which can be used by the construction industry in certain conditions.

  Use of consolidation (in certain instances) being considered within the planning system.

In addition, the LCCC demonstration (pilot) project has also identified the poor logistics management that takes place in much of the construction sector. As a result a consolidation centre will not by itself be able to dramatically improve construction site performance.

6.3 Key issues to be addressed in construction logistics in general

The LCCC demonstration (pilot) project has raised several key issues in construction logistics that need to be addressed in order to improve productivity and efficiency in the construction sector and thereby ensure that a consolidation centre can be used efficiently:

- That logistics management practices on the construction site need to control the ordering of material and its delivery to site so that there is only as much material on site as needed for the immediate tasks being carried out;
- That logistics practices on the construction site should manage the materials, from arrival at the site, through unloading and on-site distribution, to storage in designated areas near the point of installation, so that it is well planned and controlled;
- The weakest link in the material supply chain is on the construction site itself (i.e. from the vehicle on which goods are delivered to the specified location at which they are needed) – this is due to issues including poor management of on-site distribution routes, and imprecise coordination of storage locations and work locations;
- On-site logistics management is also often hampered by inappropriate or insufficient material handling equipment. Issues relating to handling equipment for vertical movement of materials is often especially problematic (due to problems such as mechanical failure, the number, location and size of hoists, and

shared operation for personnel movement) and affects the efficiency of materials distribution on site;

- The workforce of the specialist trade contractors on the construction site need to provide a commitment to delivering well-organised and safe work areas;
- Suppliers, specialist trade contractors and logistics companies working on the construction site need to standardise how materials and components are identified and referred when placing call-offs from the consolidation centre to help reduce wrongly picked and delivered items;
- The current structure of the construction industry and its commercial practices do not allow for the benefits realised by construction consolidation to result in competitive advantage ie the use of historical data by quantity surveyors when pricing jobs. Once this is more transparent it will enable the benefits of consolidation to be reflected in tenders.
- Clearer explanation of the logistics management process and the role that each construction site worker plays in its success needs to be carried out with the entire site workforce from the outset of the project.

6.4 Closing points about the use of consolidation centres in the construction sector

Other important points about the use of consolidation centres in the construction sector that emerged from the LCCC demonstration (pilot) project include:

- Construction consolidation centres operate in a similar manner to retail consolidation centres. However there are several important differences including:
  - The products required on a construction site vary over the life of the building programme unlike a retail environment where the product range required is generally more stable (albeit with some seasonal variation);
  - The type and range of products required on a construction site typically represent a greater challenge to consolidation centre staff in terms of product knowledge and identification than is the case in a retail consolidation centre;
  - The implications of late deliveries or incorrect deliveries from the consolidation centre may be more serious in the construction sector than in the retail sector. In a retail outlet such problems can result in lost sales, whereas on a construction site it can lead to the need to reschedule work or even halt work;
  - Despite the operational benefits of consolidation centres, the business culture in the construction sector is likely to make it more difficult to adopt this logistics innovation than in the retail sector.
- Consolidation centres have an important part to play in improving productivity and efficiency on construction sites, but is one of several logistics techniques that could be employed (such as logistics planning across the entire supply chain, just-in-time deliveries, 4th party logistics (4PL), and using logistics specialists on the construction site);
- Consolidation centres are mainly applicable to building projects but would also be beneficial on infrastructure projects with significant building and/or mechanical

and electrical systems. Further work will be needed to determine its applicability to certain specialist areas, e.g. to road construction and utilities;

- To help ensure that the benefits of consolidation centres outweigh the costs, and that the costs and benefits are shared between supply chain partners, the following issues need to be addressed:
  - Trade contractors will need to be convinced that logistics specialists are sufficiently familiar with construction to be trusted with planning and managing the complete distribution system;
  - Construction hauliers (most of whom do not yet have the expertise to deploy modern logistics techniques) will need to be convinced that it is in their interests to co-operate with a logistics specialist;
  - Material suppliers will need to introduce transparent pricing that separates the cost of the materials from the cost of delivery;
  - Every party in the supply chain will need to identify sufficient business benefits before co-operating.
- To ensure the consolidation centre is not simply used as a long-term store it may be necessary to adjust terms of contracts to ensure that:
  - Hauliers are entitled to claim payment upon timely delivery to the consolidation centre;
  - Trade contractors are entitled to claim payment when the materials are incorporated in the building works.
- Planning controls should be considered as a means by which to encourage and increase the use of consolidation centres for construction projects;
- The expertise of logistics specialists is needed to help the construction sector benefit from logistics management techniques such as consolidation centres and in general. This assistance is required in activities such as:
  - The forecasting and specifying of materials;
  - Planning the complete distribution from primary source to the workplace, including integrated waste recovery;
  - Designing and managing the storage/buffer (at the consolidation centre and on-site);
  - Designing and managing the entire distribution and waste recovery systems.
- This required logistics expertise is available but it may not yet exist in a single organisation because:
  - The large logistics specialists with proven track records in retail and manufacturing sectors do not yet have sufficient working knowledge of construction processes and products;
  - The few niche logistics specialists in construction do not yet have the scale or technology needed to implement an integrated system across entire supply chains.

- One way to fast track the development of both groups of logistics specialists would be integration by joint venture (or acquisition);
- There are many knowledge gaps in relation to construction logistics that are holding back change. These gaps include:
  - The cost of delivery in relation to the cost of products;
  - The optimum systems for assembling orders in suitable containers for efficient and safe distribution to construction sites;
  - The optimum systems for distributing delivered materials vertically and horizontally on construction sites;
  - The potential impact of logistics management techniques on productivity of construction workers and how to exploit and share these benefits;
  - The potential impact of logistics management techniques on productivity of hauliers and how to exploit and share these benefits;
  - The potential impact of consolidation and consolidation centres on all processes and supply chain parties from planning through to waste recovery;
  - The potential for builders' merchants to provide an equivalent consolidation service to a consolidation centre.

Therefore, although early adopters will discover ways to realise the business benefits of using consolidation centres, it is likely to take some years for this approach to construction logistics to become embedded and for supply chain parties to learn how to make best use of it.

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