

‘SHOP AND WE’LL DROP’ - Understanding the impacts of student e-shopping on deliveries to university halls of residence during Black Friday week

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Abstract

Purpose: Using the University of Southampton as a case study example, this paper presents analysis of incoming parcel deliveries to four of its largest student halls of residences, accommodating around 5,000 students, and results from a questionnaire about student online purchasing behaviour and attitudes. Together, these surveys provided insight into student online shopping for the week immediately following Black Friday (27th November 2015) and the resulting impact in terms of numbers of delivery visits made to the halls.

Research Approach: A week-long survey of halls of residence reception points was undertaken to determine: (i) delivery times; (ii) couriers used; (iii) consignment details (e.g. size and type of package); (iv) suppliers; (v) vehicles used; and (vi) some vehicle round details (origin, destination, previous and next drops). The surveys involved both observation and brief interviews with delivery drivers, using a common survey form to record all information. At the same time, all students living in University of Southampton halls were sent a link to an online questionnaire asking about their typical purchasing practices and their opinions about goods transport and related environmental issues, with 486 students responding.

Findings and Originality: The findings illustrate the extent of courier visits, with the largest hall visited on 90 separate occasions over the week-long period, by 13 different ‘main’ couriers and by several other smaller carriers. The main couriers typically visited every day and sometimes more than once on the same day. Around 3,500 parcels were delivered to the four sites during the week with the largest numbers (around 500 each) being delivered by two carriers (Hermes and Amazon). Total parcel volume was estimated to be 137m³. Numerous deliveries were made throughout the day (9am to 5pm was surveyed), placing a burden on the reception staff who often had to drop other duties to attend to them. Originality lies in the in-depth data collection and analysis of parcel receipt in the higher education sector which constitutes a major freight generator in urban areas and has been little researched up to now.

Research Impact: The main research impact lies in establishing whether and how deliveries to student halls of residence could be made more efficiently, potentially through third-party consolidation, with the aim of improving the working and living environment. An off-site consolidation service could theoretically have reduced the 275 observed courier visits during Black Friday week to around three visits per day (93% reduction) assuming that the delivery service via a local consolidation centre could be mandated by the university.

Practical Impact: The study has a strong practical focus, providing the university sector with detailed information and analysis about the impact their students are having on goods transport and the associated carbon footprint, and suggests practical measures university managers can take to address the issues and make improvements in this area. Off-site consolidation also has parallel applications for any large municipal organisations where a wide range of purchases are being made by multiple buyers using many suppliers and for other forms of high density urban living (e.g. high-rise buildings).

Keywords: parcel distribution, sustainability, green logistics

Introduction

Universities are often one of the largest employers in their area and, in the 2013/14 academic year, saw 2,299,355 students registered across 162 institutions, made up of 1,759,915 undergraduates and 539,440 postgraduates (Higher Education Statistics Agency, 2015). Tradition has it that first year undergraduates are offered a place in a hall of residence and this practice is adhered to by institutions across the UK. In some city universities with one or more higher education institutions, this can result in a population of around 4000 to 8000 students living in complexes with purpose-built facilities.

It has been acknowledged that university students are a particularly active group in terms of online purchasing behaviour (Seock and Bailey, 2008) and younger age groups now do proportionally more of their shopping online than any other with 42% of 18-24 year-olds in 2014 declaring it as their major purchasing medium compared to 37% for 35-44 year olds and 24% for those 55 or over (Statista, 2016). With online retail parcel deliveries continuing to grow from year to year and volumes up by 15.7% in 2015 from the previous year (a record 1.065 billion parcels delivered, of which an estimated 260 million were handled during November and December (IMRG, 2016)) there is a real need to better understand the impacts of e-commerce on parcel delivery and freight traffic generation in urban centres.

As a result, halls of residence are increasingly becoming major generators of freight activity. Deliveries are most often made by couriers using vans and they usually visit halls every working day and occasionally twice a day. Combined with the fact that an individual hall may typically be serviced by ten or more different couriers each day, this gives rise to a proliferation of delivery visits, and the situation seems likely to get worse if there is significant take-up of 'same-day' delivery services offering the buyer receipt within one or two hours of purchase. From the university/student perspective, this may be considered undesirable from an organisational viewpoint, due to halls reception staff having to deal with multiple couriers at unspecified times throughout the working day, and from safety, environmental and aesthetic viewpoints, from having multiple vehicles visiting a residential area. Couriers may also experience delivery problems such as parking and accessing halls reception staff to book in packages at residences which do not have 24-hour portage. These problems can be exacerbated during the peak shopping periods such as Black Friday week when the lure of cheap deals encourages students to start their Christmas shopping early. The extent of such delivery problems and the true extent of parcel delivery to halls is not well understood and was the motivation behind this research with the end goal of evaluating alternative delivery services, particularly off-site consolidation. Previous work has looked at parcel delivery to universities and the scope for consolidation (Zunder et al., 2014) despite the difficulty in finding a workable long-term business model (Kin et al, 2016) once subsidies have run out. Despite this, many case studies have suggested that consolidation can still be viable for specific controlled environments (Allen et al., 2012; Verlinde et al., 2012; van Rooijen and Quak, 2010), particularly with the legislative pressures that might build as a result of the EU2020 CO₂-free city logistics agenda.

The paper presents results from a week-long goods-in survey of the four largest University of Southampton halls of residence, accommodating 1900, 1700, 1100 and 350 students respectively (total = 5,050) for the week immediately following Black Friday (27th November 2015) and from a parallel online student questionnaire survey. Results and discussion are framed in the context of the potential for the introduction of a third-party consolidation service to the halls.

Survey and data analysis methods

Goods-in survey

Incoming goods were delivered by couriers to the reception desks at the four halls, all of which operated 24-hour portage services. Following dialogue with the halls' residency teams, these receipt areas were surveyed between the hours of 9am and 5pm each day from Saturday 28th November to Friday 4th December, 2015, inclusive (excluding Sunday when few deliveries are normally received). Surveys comprised observing all freight-related vehicle activity undertaken during the period along with brief interviews with delivery drivers where consent was given. The data recorded included the courier company name, their arrival and departure time, numbers and sizes of packages, any delivery time window constraints, vehicle type and registration number.

Few deliveries were expected outside of these hours and reception staff were asked to record the same information using the surveyor form for any deliveries that were received out-of-hours. Of interest in this research was the volume of packages received and the implications for consolidating post into single vehicle loads using an out-of-town consolidation centre. To this end, surveyors were equipped with a set of 'small', 'medium' and 'large' empty bags to aid and standardise categorisation of package sizes at the four halls; additional categories of 'extra-large' and 'oversize' were also specified; dimensions are shown in Table 1.

Table 1 – Categorisation of packages sizes

| Category | Dimensions (mm) | Volume (m ³) |
|-----------------|-----------------|--------------------------|
| Small bag | 320 x 240 x 100 | 0.00768 |
| Medium bag | 440 x 320 x 150 | 0.02112 |
| Large bag | 500 x 420 x 200 | 0.042 |
| Small box | 305 x 305 x 305 | 0.028373 |
| Medium box | 406 x 406 x 406 | 0.066923 |
| Large box | 510 x 510 x 510 | 0.132651 |
| Extra large bag | Not applicable | 0.1 |
| Extra large box | Not applicable | 0.25 |
| Oversize | Not applicable | 0.75 |

Online questionnaire survey

All students living in a University of Southampton hall of residence were invited to complete an online questionnaire about their general e-commerce purchasing whilst residing in hall and any specific purchasing made during the week immediately following Black Friday (27th November 2015) when most delivery activity was anticipated. They were also asked about the delivery options they typically choose and their attitudes towards, and their willingness to pay for alternative, more sustainable delivery options. Fifty £10 shopping vouchers were used as an incentive for completion, with the student winners being randomly after the final response cut-off date. The survey elicited 486 responses of which 413 were completed in full with a 60% female/40% male split and a 75%/25% split between 'Home/EU' students and 'Overseas' students, as defined by the respondents fees status.

Results and Discussion

Numbers of observed freight vehicles and visits to halls

An indicator of the scale freight activity was the number of daily courier visits observed at each hall (Table 2) which suggested that the largest (Hall 1) received between 14 and 18 visits each day. Saturday was the least busy day (34 visits), while weekdays saw a fairly even spread between 45 and 51 in total across the four sites.

Table 2 – Number of courier visits (busiest day highlighted in red at each site) across University of Southampton halls of residence during Black Friday (Saturday 28th November to Friday 4th December, 2015).

| | Sat | Mon | Tue | Wed | Thu | Fri | Total |
|--------|-----|-----|-----|-----|-----|-----|-------|
| Hall 1 | 14 | 18 | 14 | 15 | 15 | 14 | 90 |
| Hall 2 | 6 | 10 | 15 | 7 | 8 | 11 | 57 |
| Hall 3 | 9 | 10 | 13 | 16 | 11 | 12 | 71 |
| Hall 4 | 5 | 9 | 9 | 12 | 11 | 11 | 57 |
| Total | 34 | 47 | 51 | 50 | 45 | 48 | 275 |

In many cases, the same courier company, and often the same driver, visited the same hall daily and, occasionally, twice on the same day. The main carriers that were seen regularly (along with the number of visits across the four halls in brackets): Yodel (29), DPD (26), Royal Mail (24), DHL (23), Hermes (20), Parcelforce (19), UPS (19), Amazon (16), Interlink (14), DX (13), with a total of 30 different companies observed during the Black Friday week, making parcel deliveries to halls. Vans were used for 87% of all deliveries, broken down as 61% large (e.g. Ford Transit) and 26% small (car derived). The other vehicles observed were lorries (10%) and cars (4%). At the one hall located in the city centre, small vans tended to be used more often (47% small, 38% large), potentially due to the ease of access and parking.

The licence plate records allowed an analysis of how many different vehicles were used by the main carriers. This suggested that Amazon used the most vehicles (9), followed by Yodel (7), Hermes (6), Interlink (6), Parcelforce (5), Royal Mail (5), UK Mail (5), with other carriers using fewer vehicles. These results suggested that substantial numbers of courier visits could be expected, servicing high-density residential developments in our urban centres, and that some form of delivery consolidation would benefit communities as part of a sustainable city-logistics policy (Savelsbergh and Van Woensel, 2016). This would be from the point of view of reduced vehicle emissions, visual and noise intrusion, risk of accidents but also in the fundamental ways such developments are designed where freight vehicle activity is often not adequately considered or catered for at the planning stage.

Numbers and sizes of parcels delivered

A total of 3,504 parcels (i.e. bags or boxes but not letters) were delivered across the four sites during the Black Friday week (Figure 1) with the halls housing the greatest numbers of students receiving the most. The figures suggested that Wednesday was the busiest day at both Hall 1 and Hall 4, in terms of numbers of parcels received. A breakdown by courier showed that the Royal Mail delivered the greatest number of parcels (834, the vast majority of which (659) were to Hall 1), followed by Hermes (556), Amazon (459), DPD (186), Parcelforce (166) and Yodel (118). Dividing the number of parcels delivered by the number of visits, for each carrier and for each hall gave an indication of the level of efficiency of each operation and on this basis the most efficient was Royal Mail at Hall 1 who delivered an average 94 parcels per visit (their average across the four halls was 35 parcels per visit.) They were followed by Amazon (29 parcels per visit), Hermes (25), TNT (24). All other carriers delivered fewer than 10 parcels per visit. One could argue that these main carriers are already effectively consolidating deliveries through their networks and although further consolidation opportunities exist, it is the carriers delivering small numbers of parcels per visit that represent the greatest opportunity to reduce vehicle arrivals.

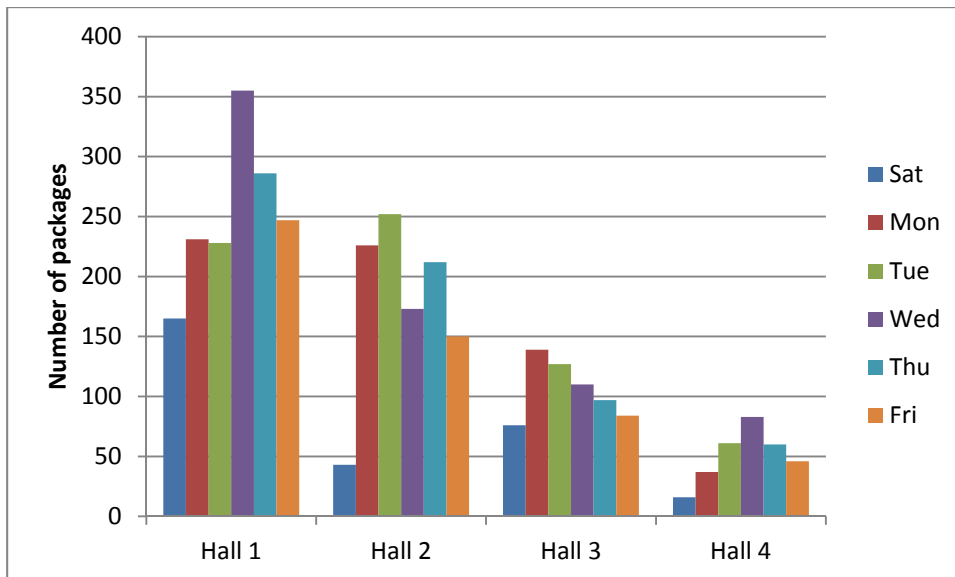


Figure 1 – Numbers of parcels delivered across University of Southampton halls of residence during Black Friday (Saturday 28th November to Friday 4th December, 2015).

In terms of the size of the items delivered, a breakdown by package type (bag or box) and by size (Figure 2) indicated that the most frequently delivered item was a ‘small box’ (33.6% of total), followed by small bag (21.3%), medium box (16.9%), medium bag (14.8%), large bag (7.1%), large box (4.6%), with the extra-large (XL) and oversize categories accounting for less than 1% packages received.

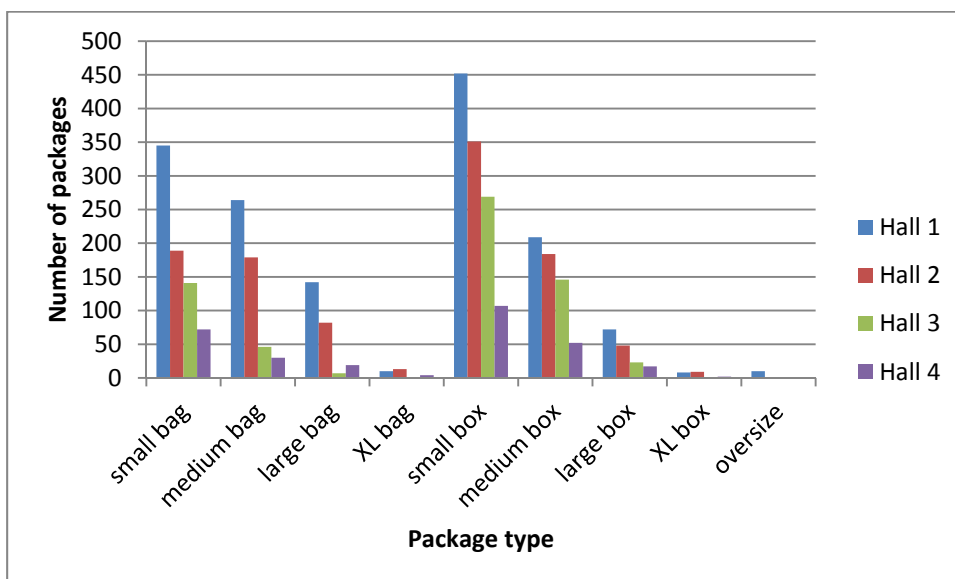


Figure 2 – Package sizes delivered across University of Southampton halls of residence during Black Friday (Saturday 28th November to Friday 4th December, 2015).

The numbers of parcels were translated into estimated volumes (m³), Table 3, to determine vehicle capacity requirements if they were to be consolidated across carriers at a local consolidation centre prior to delivery to the halls. Given that a typical roll cage has a capacity of approximately 1m³ (<http://preview.tinyurl.com/hw3ehrl>), the estimated volumes can be thought of as the numbers of roll cages that would have been required for a consolidated delivery service. Assuming the use of a long wheelbase van with a carrying capacity of 14m³ (<http://preview.tinyurl.com/zbhpnpc>), the

findings suggested that in terms of volume, two or three vehicles would have been required each day to service the four halls during Black Friday week.

Table 3 – Volume of packages delivered (m³) to University of Southampton halls of residence during Black Friday (Saturday 28th November to Friday 4th December, 2015).

| | Sat | Mon | Tue | Wed | Thu | Fri | Total |
|--------|------|------|------|------|------|------|-------|
| Hall 1 | 6.8 | 10.8 | 12.5 | 11.8 | 11.6 | 7.6 | 61.2 |
| Hall 2 | 1.7 | 10.3 | 9.4 | 5.4 | 8.3 | 6.5 | 41.6 |
| Hall 3 | 3.0 | 7.8 | 4.3 | 2.7 | 2.4 | 2.7 | 22.9 |
| Hall 4 | 0.7 | 1.1 | 2.1 | 4.4 | 1.8 | 1.6 | 11.7 |
| Total | 12.2 | 30.0 | 28.3 | 24.3 | 24.1 | 18.4 | 137.3 |

Delivery times and durations

Courier arrivals were observed to take place throughout the main survey period (9am to 5pm), with a few noted by reception staff at other times (Figure 3). At the largest hall (Hall 1), there were approximately the same numbers of visits before 1pm as after, while at the other three halls, there were around twice as many deliveries observed before 1pm as after. One of the main perceived advantages of a consolidated delivery service for hall reception staff would be a move away from this continuous stream of courier arrivals throughout the day to a single delivery at a pre-specified time, allowing halls management teams to better plan and allocate staff time.

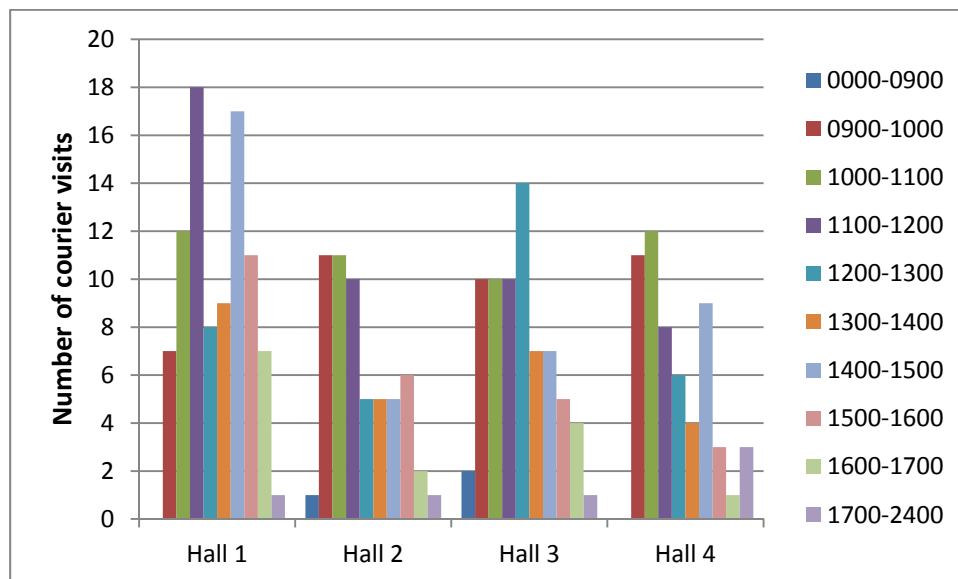


Figure 3 – Courier arrivals by time of day across University of Southampton halls of residence during Black Friday (Saturday 28th November to Friday 4th December, 2015).

Couriers were asked whether any of their deliveries to that hall on that visit were subject to a delivery time window, where a student has specifically requested a non-standard service. At the largest hall of residence (Hall 1), 36 out of 84 recorded visits (43%) had parcels for delivery that were subject to a specific time window, requiring the delivery to be made before or by a certain time of day. In many cases, it was not clear whether the time window was 'demanded' (and often paid for) by the customer at the point of sale or simply the time when the courier had stipulated when the parcel would be delivered by. As an example, one of the main carriers routinely informs the customer that their parcel will be delivered within a two-hour time window, where this is estimated by the driver when loading the vehicle in the morning. Delivery time window constraints would have to be carefully considered when designing a consolidated delivery service to halls of residence as it is

unlikely that halls could regulate against students prepared to pay for premium delivery services for their goods.

The durations of observed delivery visits (time at the reception desk) were typically very short with the median dwell time at each site being 3 or 4 minutes and average dwell times at each site being between 4 and 6.5 minutes. The average dwell times were slightly greater than the median values due to a few long visits of up to 65 minutes in duration, where relatively large numbers of parcels were delivered and were checked in individually (as an example, mean observed dwell times for Amazon were 25, 19.5, 10 and 15 minutes across the four halls).

Delivery options

The questionnaire results suggested that the delivery options chosen by students during Black Friday week (Table 4) were largely ‘standard delivery’, defined as ‘within 2-14 days during the daytime’ (45% of orders), various next day options (35%), and relatively small numbers using same-day, weekend or specific collection options. It should be noted that some retailers might offer next day delivery as a standard option if customers belong to their premium e-retail shopping service, at no additional cost. The survey results suggested that 59% of the student sample were members of either Amazon Prime (free 30-day trial then £79/year) or Amazon Student (free 6-month trial then £39/year), both of which offered unlimited next-day delivery at the time of the survey.

Table 4 – Delivery (or collection) options used during Black Friday week by University of Southampton students in halls of residence.

| Delivery option | Orders (#) | Orders (%) |
|----------------------------|------------|------------|
| Standard | 293 | 45% |
| Next Day (Any time) | 120 | 18% |
| Next Day (7-12) | 35 | 5% |
| Next Day (12-18) | 46 | 7% |
| Next Day (17-22) | 36 | 5% |
| Same-day | 35 | 5% |
| Weekend | 37 | 6% |
| Click and collect in-store | 54 | 8% |
| Total | 656 | 100% |

Attitudes towards alternative delivery options

Students were asked to state their level of agreement with a series of questions regarding their current delivery preferences and their views on a consolidated halls post scenario where their hall’s delivery address would change to ‘care of’ a local distribution centre where parcels would be consolidated for a single afternoon delivery each day. A Likert scale (strongly disagree (-2); disagree (-1); neutral (0); agree (1); strongly agree (2)) was used to gauge their views, with average values shown in Table 5 and bold text used to indicate statistically significant differences in responses between male and female students and between home/EU and overseas fee status students, where the non-parametric Mann-Whitney U test was used at the 95% significance level.

The responses suggested that students were particularly cost conscious when choosing delivery options (females significantly more so than males) with 83% agreeing to some extent that they select the least cost option wherever possible. Overseas fee status students were significantly more likely to choose next day delivery as a first choice option compared to home/EU students and 61% of respondents said they would be willing to pay £2 or more for same-day delivery but this may only apply to items that were required urgently. In terms of attitudes towards a consolidated delivery service, students responded positively to the idea of waiting for deliveries to be bundled together in

order to reduce the carbon footprint (overall score 0.41), and were in favour of the consolidation concept, with females being significantly more positive than males in the view that it was a positive approach to reducing the environmental impacts. Although still in their infancy, same-day delivery services if widely adopted in the future could negatively impact on a consolidation model where next-day delivery is the only realistic option given the additional link created in the supply chain. The fact that 36% of the respondents agreed to some extent that these services would be important to them in the future suggests that the van traffic resulting from the 'I want it now' mentality might increase. This is despite the fact that the students were fairly relaxed about package receipt in the proposed consolidated service with 84% not concerned about the specific time of arrival as long as it was on the requested day. Potential loss or damage to goods was a concern, especially amongst overseas students and the issue of who would be liable in the consolidated goods model was raised.

Table 5 – Student attitudes to delivery options (average Likert scores)

| Delivery considerations | Female | Male | Home/EU | Overseas | Overall |
|--|---------------|-------------|----------------|-----------------|----------------|
| Wherever possible I choose next day delivery | 0.05 | 0.22 | 0.02 | 0.42 | 0.18 |
| I would be prepared to pay extra to have same-day delivery | -0.65 | -0.49 | -0.60 | -0.57 | -0.59 |
| Same-day delivery services will be important to me in the future | -0.11 | 0.12 | -0.05 | 0.07 | 0.01 |
| I would choose whichever is the cheapest delivery option | 1.45 | 1.09 | 1.34 | 1.23 | 1.30 |
| I only choose next-day delivery when I need an item urgently | 1.21 | 1.02 | 1.14 | 1.11 | 1.11 |
| I would prefer a standard delivery with the lowest cost | 1.31 | 0.91 | 1.12 | 1.26 | 1.15 |
| I will always choose the fastest delivery option regardless of the cost. | -1.17 | -1.13 | -1.28 | -0.77 | -1.15 |
| As long as my parcels arrive at halls reception at some point during the agreed delivery day, I'm not too bothered how they arrive | 1.29 | 1.07 | 1.24 | 1.13 | 1.21 |
| Same-day delivery is important to me and the service would need to be able to provide that | 0.06 | 0.04 | -0.01 | 0.25 | 0.06 |
| I am concerned about who would be responsible if my packages were lost or damaged | 1.19 | 1.11 | 1.09 | 1.37 | 1.16 |
| Reducing our carbon footprint is important to me and consolidating deliveries in this way could help that | 0.96 | 0.65 | 0.82 | 0.84 | 0.84 |
| I would be prepared to wait longer for my goods if it meant the retailer could bundle them together into one delivery | 0.49 | 0.27 | 0.37 | 0.49 | 0.41 |

Notes: Likert scale: strongly disagree (-2); disagree (-1); neutral (0); agree (1); strongly agree (2)
Significant differences at 5% level between Female&Male and Home/EU&Overseas indicated in bold

Conclusions

The results of the goods-in and student surveys have highlighted the considerable numbers of daily courier visits to student halls as a direct result of student online purchasing. An off-site consolidation service could theoretically have reduced the 275 observed courier visits during Black Friday week to around three visits per day (93% reduction) assuming that the delivery service via a local

consolidation centre could be mandated by the university, with all first year students signing into the service as part of their halls contract.

In dialogue with halls staff and student residents, the key benefits and drivers for the introduction of such a consolidated delivery service would be: (i) time savings to reception staff no longer having to deal with multiple deliveries throughout the day; (ii) environmental improvements through reduced numbers of freight vehicles (congestion, noise, accident risk and emissions); (iii) potentially fewer losses due to more formal, professional goods receipting procedures being adopted. The main barriers to implementation, typical for any form of consolidation, are the extra cost and the inherent delay introduced by an added link in the supply chain. The cost of the service would have to be charged to the university and would ultimately be paid for by students through their accommodation fees. (Current research being undertaken by the authors is establishing the cost per student per year based on the data collected). The delay incurred may amount to a half or full-day, depending on the delivery arrangements which for non-urgent items may not be too important, given the student attitudes expressed in the survey. However, this may not suit where students require items urgently and are willing to pay a premium for a next or same-day service. In this case, it may be necessary to exclude premium delivery items from the consolidation model, which would work against its underlying principles.

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