



# **Carbon Auditing the “Last Mile”: Modelling the Environmental Impacts of Conventional and Online Non-food Shopping**

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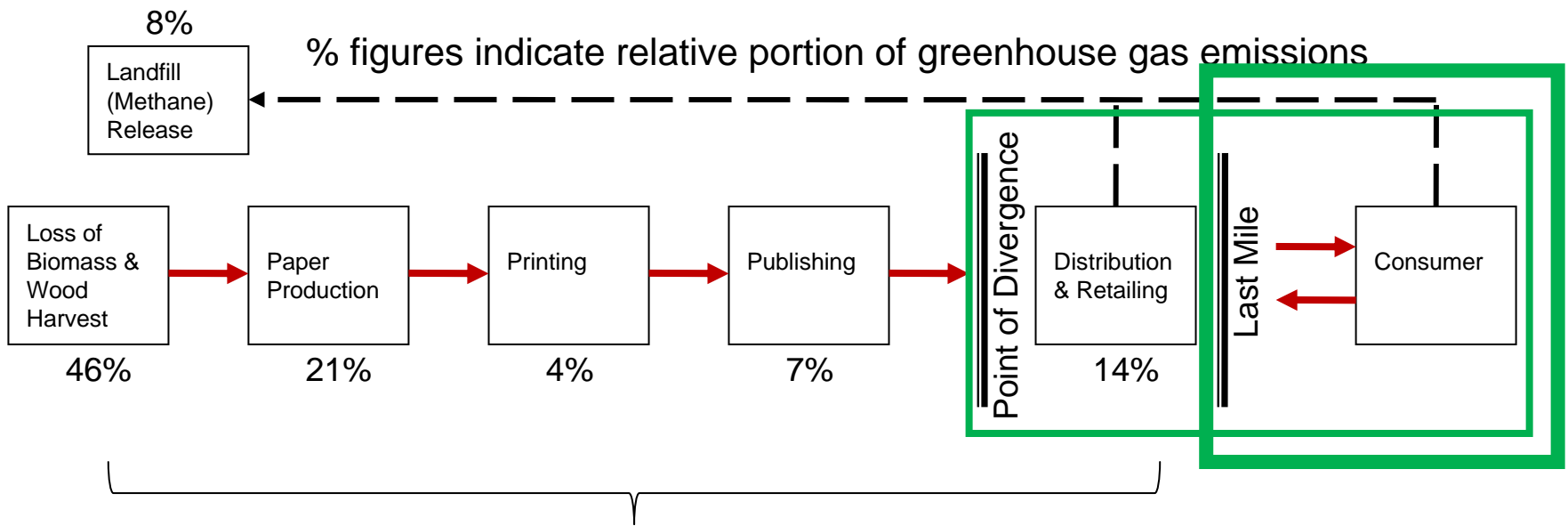
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# Typical conventional or online shoppers?



# Stages of production and distribution

(after Green Press Initiative, 2008)



Borealis Centre for Environment and Trade Research, 2007  
8.85lbs (4.02kg) CO<sub>2</sub> per book

Distribution & Retailing (excluding the last mile)  
= < 600gCO<sub>2</sub>

# Environmental claims by some online retailers



ocado.com

## 15 for 1 offer

Each Ocado van takes up to 15 cars off the road.

Every time you see one of our vans, think of it as 15 people not going to the supermarket. So that's 15 to someone in your neighbourhood, so if you want to you can choose a green van. We also help make our journey even shorter. We also deliver directly from a purpose built fulfilment centre, rather than from a supermarket. If everyone shopped this way we would eliminate the carbon emissions from traditional stores, remove heavy goods vehicles from urban areas and free up precious land.

**G Grocer** Our customers trust us to do their shopping every bit as carefully as they do themselves. We carefully pick Waitrose groceries, we pack them properly and we drop them off in your kitchen. Maybe that's why we have been voted Online Retailer of the Year by The Grocer. So if you haven't tried us yet, why don't you give us a go this week and we'll give you 15% off your first order.\* Just use VOU4415289 at checkout.

Isn't it time you demanded more?

Ocado – Online Retailer of the Year 2007.

Evening Standard, 20 June 2007

Supermarket home delivery service promotes its green credentials | Environment | guardian.co.uk - Windows Inter

http://www.guardian.co.uk/environment/2007/sep/12/plasticbags.supermarkets

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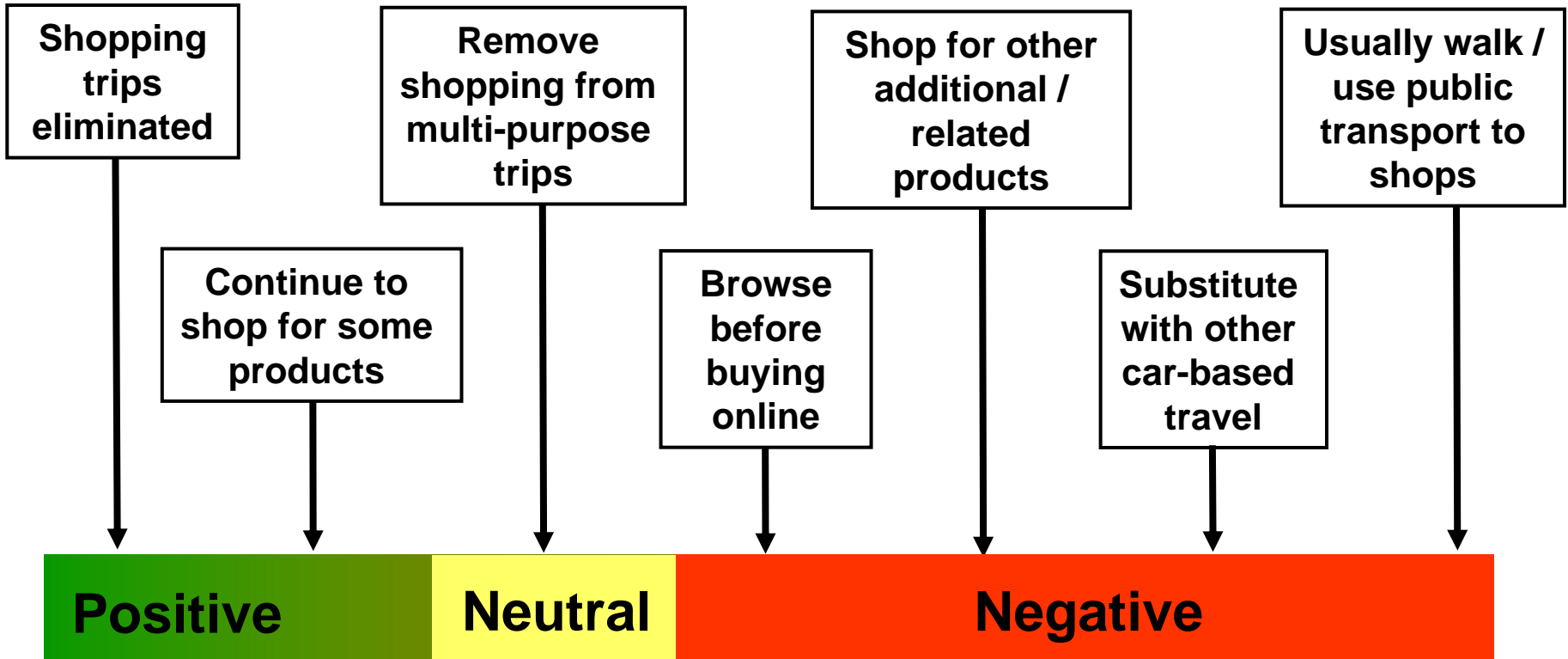
## Supermarket home delivery service promotes its green credentials

Rebecca Smithers Consumer affairs correspondent  
guardian.co.uk, Wednesday 12 September 2007 18.35 BST  
Article history

Ocado's hi-tech warehouse. Photo: David Levene

The Guardian, 12 September 2007

# Personal travel choices & the impact of Home Delivery



**Effects on car traffic**



# Environmental Impact of Online Shopping

- Frequent purchases of small quantities, often from several different web-based companies;
- Additional sortation requirements to combine multiple customers' orders prior to delivery;
- Internet-browsing encouraging people to go shopping for additional &/or supplementary purchases;
- Little travel savings when conventionally goods were purchased as part of multi-activity trip;
- Treatment of failed deliveries and returns.



# Products & Delivery Methods



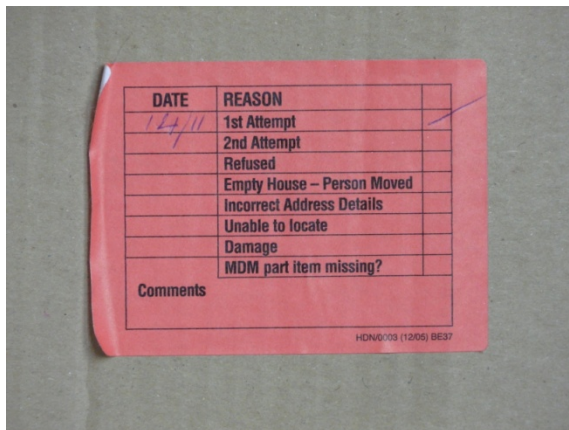
Product type	Typical order size	Main delivery vehicle type
Books	2-3 items	<ul style="list-style-type: none"> <li>• Parcel delivery van</li> <li>• Postman (walk / bike)</li> </ul>
Small electrical	c 2 items	<ul style="list-style-type: none"> <li>• Parcel delivery van</li> <li>• Postman (walk / bike)</li> </ul>
Large electrical	1 item or set	<ul style="list-style-type: none"> <li>• Two-man delivery</li> </ul>
Clothing	2 items	<ul style="list-style-type: none"> <li>• Parcel delivery van</li> <li>• Postman (walk / bike)</li> <li>• Home delivery courier (private car)</li> </ul>
Groceries	c 15-20 orders	<ul style="list-style-type: none"> <li>• Temperature-controlled vans</li> </ul>

Source: Iain Beveridge Associates

# Last Mile Modelling: Methodology

Devised an Excel spreadsheet to model:

1. CO<sub>2</sub> emissions for home delivery for the last mile (from parcel depot to the consumer's home); &
  2. dedicated shopping trips (single trips) versus multi-purpose trips by consumers (trip chaining).
- Representative delivery scenarios;
  - Issue of returns (unwanted goods).





# Freight transport to the home



- What type of vehicle is used for the delivery?  
(diesel / electric van; courier's private car)
- What type of round?  
(urban / rural )
- How many drops per round?
- What happens to failed deliveries?
- Does the parcel carrier collect product returns?

# Typical conventional shopping behaviour?



- Where do people shop?
- How do they travel to the shops?
- How long is a typical shopping trip (distance)?
- How many items do they buy in that one trip?
- What type of goods are bought?
- Do shoppers combine shopping with other activities?

# The Last Mile: Trip assumptions

<b>HOME DELIVERY ROUND</b>	<b>DISTANCE</b>	<b>DROPS</b>
Average van home delivery round	50-miles	120
City centre van delivery round	25-miles	110
Rural van delivery round	80-miles	70
Car-based courier delivery round	25-miles	40
Items per drop	1 (for direct comparison)	
	1.4 (books/CDs/DVDs)	
	2.5 (clothing & household)	

# Emissions for an average non-food home delivery



## *Assumptions*

Round trip (miles)	50
Drops per round	120
Items per drop	1 / 1.4 / 2.5

CO <sub>2</sub> per drop	<b>181g</b>
CO <sub>2</sub> per item (1.4)	<b>137 g</b>
CO <sub>2</sub> per item (2.5)	<b>72g</b>

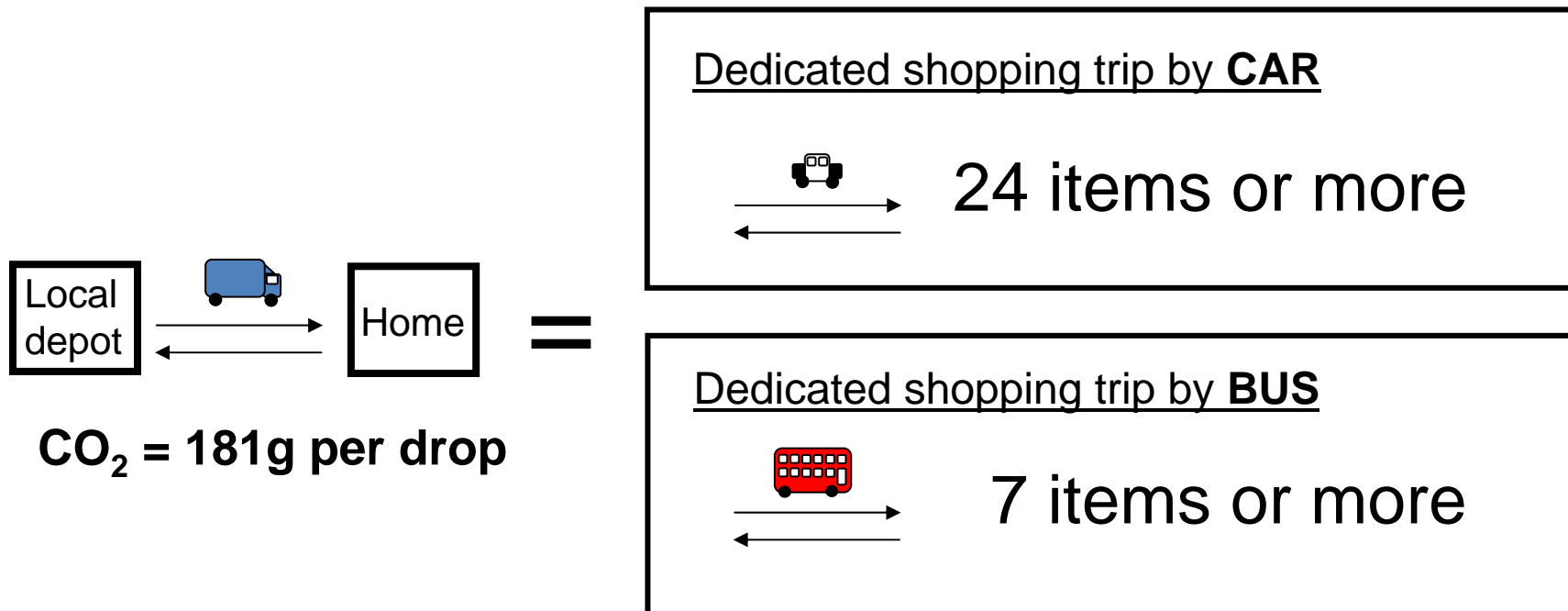
\* Average values, calculated from 4 sources: Defra; NAEI; FTA; RHA

# Emissions for an average conventional shopping trip

<b>Mode</b>	<b>Journey trip</b>	<b>Round trip – miles</b>	<b>CO<sub>2</sub> per trip</b>
Car	Local	2- miles	
	Average	12.8-miles	4,274g CO <sub>2</sub>
	Distant	40-miles	
Bus	Local (urban)	2-miles	
	Average	8.8-miles	1,265g CO <sub>2</sub>
	Inter-urban	40-miles	
	Rural	20-miles	

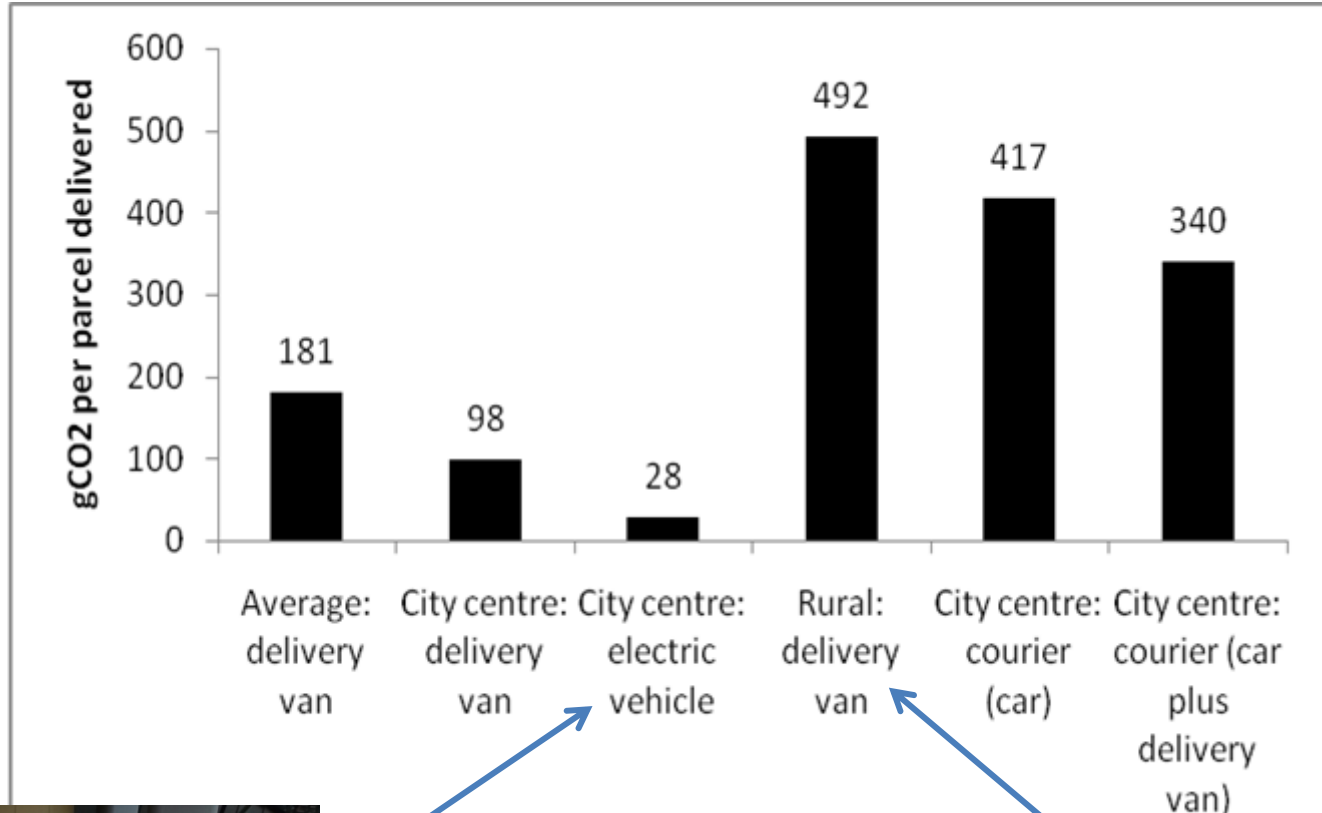


# Carbon intensity of non-food home deliveries 'v' shopping on the High Street



Low emissions car (< 100gCO<sub>2</sub> per km) = 12 items or more  
High emissions car (> 350gCO<sub>2</sub> per km) = 40 items or more

# CO<sub>2</sub> per drop for different home delivery rounds



# Failed delivery: Emissions (gCO<sub>2</sub>) per item



## Sorry We Missed You!

Receivers Name \_\_\_\_\_ Route No \_\_\_\_\_

We called to make a delivery to you on \_\_\_\_\_

(date) \_\_\_\_\_ at (time) \_\_\_\_\_ AM/PM

**We will attempt to redeliver your consignment tomorrow (Monday to Friday) up to a maximum of 2 attempts.**

If you wish to arrange an alternative date for delivery, please visit our web site at [www.parceline.com/redelivery](http://www.parceline.com/redelivery) or call our 24 hour re-delivery helpline on 0871 244 4442. To assure you of our best response please call after 2pm if the enquiry relates to a card the driver has left today.

When making your re-delivery arrangements please have your calling card to hand as the following details are required:

Primary Reference **825480** / Secondary Reference \_\_\_\_\_

For redelivery conditions please see overleaf

Alternatively, we will leave your consignment when you sign the declaration below and leave this card for us to collect.

By my signature I request that Parceline leave this consignment at this address. I agree that Parceline will not be liable for any loss or damage that results from leaving this consignment as I have requested. (Please sign in black ink).

Sign \_\_\_\_\_ Print Name \_\_\_\_\_ Date \_\_\_\_\_

**IMPORTANT NOTE: YOUR CONSIGNMENT WILL BE RETURNED TO THE CONSIGNOR IF YOU HAVE FAILED TO CONTACT US WITHIN FIVE BUSINESS DAYS OF THE INITIAL DELIVERY ATTEMPT.**

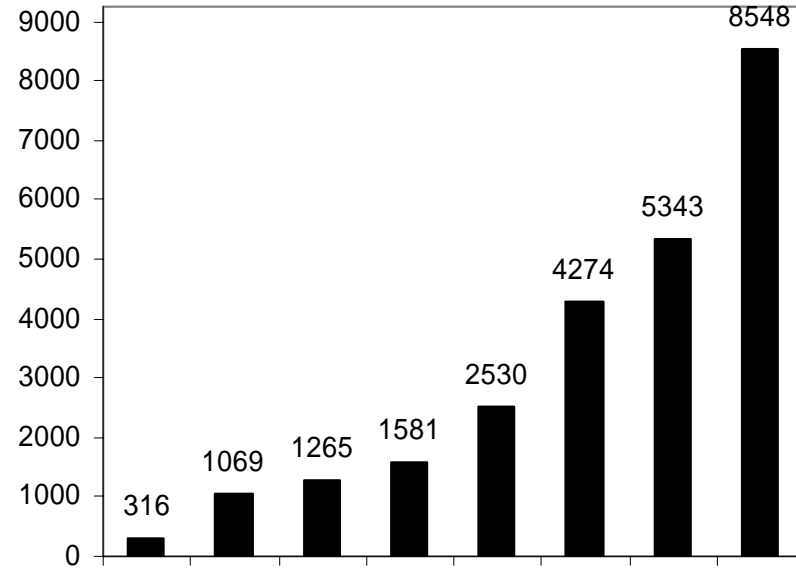
To avoid future delivery disappointment please consider the options available overleaf

PTO

	100% successful first-time delivery	12.5% failure rate	25% failure rate
Average delivery	181g	204g	226g
Urban delivery	98g	110g	123g
Rural delivery	495g	557g	619g



# Implications of shopping trip type on CO<sub>2</sub> emissions (g)



Combined: (bus-based shopping 25%)  
 Combined: (car-based shopping 25%)  
 Dedicated, average trip by bus  
 Browsing: 2 bus trips per purchase  
 Dedicated, average trip by car  
 Combined, then dedicated trip by car  
 Browsing: 2 car trips per purchase

# Summary: Home Delivery



- The Local Level dominates any environmental comparison of online & conventional shopping;
- Emissions from car-based shopping trips can far exceed those from distribution operations back along the supply chain;
- Numerous factors influence emissions from home deliveries: drop densities; distance & nature of delivery round; type of vehicle, failed deliveries & returns.

# Summary: Conventional shopping



- It is always better to maximise the no. of items purchased at any one time;
- When using public transport at busy times & making several purchases, emissions per item are lower than home delivery;
- Consequently, use of public transport needs to be promoted wherever practical, especially for shorter trips.

Neither retail channel has absolute environmental advantage, though, in the case of non-food purchases, the home delivery operation is likely to generate less CO<sub>2</sub>.

## Contact details

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<http://www.sml.hw.ac.uk/logistics>

[www.greenlogistics.org.uk](http://www.greenlogistics.org.uk)