



ONLINE READY-TO-EAT MEAL ORDERS AND LAST-MILE DELIVERIES

Summary Report

Technical Report CUED/C-SRF/TR17

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Introduction

Policy commitments to reduce greenhouse gases (GHG) in the UK and many other countries require the road freight industry to achieve major change in relation to this aspect of vehicle activity. In the UK, the road freight industry has pledged support to the government's voluntary commitment to reduce GHG emissions from heavy goods vehicles by 15% by 2025 (from 2015 levels) and will also play its part in the government's commitment to bring all GHG emissions to net zero by 2050. As an ever-increasing proportion of retailing shifts online in the UK, the last-mile deliveries associated with this trend are a growing source of GHG emissions in the road freight industry.

This briefing report summarises ready-to-eat meal online shopping and last-mile delivery in the UK, and their impacts. Ready-to-eat meal deliveries have been increasing rapidly in the UK in recent years but have received little research attention. These deliveries can result in substantial vehicle activity and related GHG emissions.

The term 'last-mile delivery' in this report refers to the final commercial transport stage in the retail supply chain of goods purchased online by consumers. This last-leg of commercial transport takes place between their final point of despatch of the goods (be that a warehouse, depot, fulfilment centre or shop) and the delivery point nominated by the consumer which could be their home, workplace, or a shop, locker bank or other location from which the consumer collects these goods.

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Summary reports on the grocery and non-food parcel online shopping and last-mile delivery sectors, as well as a longer report containing references to all the documents consulted in compiling these summary reports, are available on the SRF website.

Online ready-to-eat meal orders and last-mile deliveries in the UK – transport activity and carbon emissions

Online ready-to-eat meal orders have been growing rapidly in the UK in recent years and were estimated to have generated total sales of approximately £8 billion in the UK in 2019, an 18% growth in sales compared with the previous year (MCA, 2019). This has taken place at the same time that total dine-in spending in restaurants in the UK has been diminishing.

Growth in online meal ordering and delivery has been driven by the emergence of platform providers that offer ordering marketplaces and deliveries from dine-in and takeaway restaurants in urban areas. The largest three of these in the UK are Just Eat (which merged with Takeaway.com in 2020), Deliveroo and Uber Eats. Other major companies in the UK meal delivery market include takeaway chains especially in the pizza sector (such as Domino's, Pizza Hut, and Papa John's). McDonald's and Kentucky Fried Chicken have also commenced online ordering and deliveries, working in conjunction with the platform providers. In addition, some independent restaurants organised their own ordering and delivery services.

Just Eat, the largest of these platform providers which works with 30,000 restaurants in the UK, did not originally provide its own delivery services, instead taking orders and payments and then passing their orders to restaurants for preparation and delivery. However, it began to implement its own delivery operation to provide last-mile services for some of its orders in 2018. By the first half of 2019 it had recruited over 5,000 delivery personnel in the UK (Just Eat, 2019a, 2019b). Deliveroo has a UK delivery personnel of approximately 15,000 working in approximately 100 towns and cities, while Uber Eats also offers its services in about 100 UK towns and cities. Deliveroo has also established about 100 stand-alone kitchens in the UK which it rents to takeaway restaurant businesses. The company refers to these as 'Deliveroo Editions kitchens', and each development can provide accommodation for several different meal retailers (Mintel, 2019; Wearn, 2019). These kitchens are often located in disused carparks and former industrial buildings (Pathiaki, 2017).

Competition in the online meal ordering and delivery market is fierce, and in recent years several other companies have ceased trading, and there have also been mergers and acquisitions. Amazon entered this market in London in 2016 with its Amazon Restaurants service but closed in 2018 due to fierce competition. Deliveroo continues to make large annual losses despite growing its annual revenue (£476 million revenue in 2018 with losses of £232 million – Roofoods Ltd., 2019), with Amazon taking a 16% shareholding in its business in 2020 (Competition & Markets Authority, 2020).

Meal delivery couriers working for platform providers are typically self-employed working on a part-time basis, while some of those working directly for individual restaurants and restaurant chains are employees or dependent workers. A survey by Deliveroo of 900 of its couriers in 2017 suggested that 90% of them did not consider the work as their main source of income with 72% working fewer than 15 hours per week; 19% working between 15 and 29 hours per week; and 9% working 30 hours or more (Field and Forsey, 2018). Some self-employed couriers are unhappy about unpaid working time associated with waiting between deliveries and while meals are being prepared. Others have argued that platform providers over-recruit couriers to ensure fast deliveries. Couriers have taken industrial action and brought several legal challenges about their working status. In addition, a UK Parliamentary enquiry and an independent report for the UK Government (The Taylor Review published in 2017) have investigated the working conditions and rights of those in the so-called 'gig economy', including meal delivery couriers and parcel deliverers. The UK Government is considering how to deal with the issues raised. Some of the platform providers have altered their stance on income protection, public liability and accident insurance for their couriers as a result of the publicity and scrutiny generated. In August 2020, Just Eat announced that it intended to end the use of self-employed delivery couriers in the UK and the rest of Europe and provide them with greater benefits and more workplace protection (Josephs, 2020).

Deliveries of ready-to-eat meals in the UK

The average order value of the largest platform provider, Just Eat, is £19.05 (Just Eat, 2019). Using this average spend and the estimated total market size of £8 billion indicates that there were approximately 400 million last-mile ready-to-eat meal deliveries in the UK in 2019.

Meal deliveries are point-to-point local trips (from a restaurant to a delivery point at the customer's home or workplace, usually with a distance of no more than 3 miles), typically with a single order carried on each trip. These deliveries are carried out using bicycles, mopeds, motorbikes and cars. Although a small number of these mopeds, motorbikes and cars may be electric, 98% of these vehicles were either petrol or diesel fuelled in the UK at the end of 2018 (Department for Transport, 2019). Having delivered the meal, the delivery courier will travel to another restaurant to collect the next meal once they are allocated another order. Couriers often have to wait at or outside the restaurant while the meal is being prepared. When order levels are sufficient, the courier will typically make between two and four deliveries per hour. Couriers working for the major platform providers are provided with an app-based navigation system to assist them in their routing between restaurant and customer and in locating the point of delivery.

Deliveries typically take place within 15-60 minutes of the customer placing the order; the major platform providers aim to make deliveries within 30 minutes of order placement where possible. Meal failed delivery rates (i.e. when no-one is at home to receive the delivery) are typically low as the customer knows when the delivery will be made. Product return rates for meal deliveries are also low.

The busiest ordering periods are usually in the evening and at weekends. An international survey of customers has indicated that the majority of respondents cite speed of delivery as the most important factor in their customer satisfaction. The optimal customer waiting time from order to receiving their meal is no more than 60 minutes (Hirschberg et al., 2016). Meal delivery differs from parcel courier work in several respects: the duration of shifts worked is typically shorter, the age of those doing the work is usually lower, there is little scope to carry more than one delivery at a time, and there is a far greater use of two-wheeled vehicles.

A study of meal deliveries by couriers using bicycles, mopeds and cars for a major platform provider in Greater London in 2017 indicated that only 40-50% of the total time couriers worked was spent making deliveries, with the rest of the time waiting for meals to be prepared or for the next job to be allocated. On average, each delivery took 25 minutes from collection to delivery with an average trip length, from restaurant to delivery point, of 1.4 miles (Allen et al., 2020). The majority of delivery couriers are under the age of 25, and most are male.

Traffic, health and safety impacts of meal deliveries

Using data from the journeys made by its couriers, Deliveroo reported in 2018 that cycling journey times can be lower than for mopeds and cars in dense, busy urban areas in the UK (Reid, 2018). This is due to the levels of road traffic, the provision of cycles lanes, and the manoeuvrability of bicycles in such locations. However, couriers working in less dense, suburban locations tend to make greater use of mopeds and cars than bicycles due to the greater distances often involved.

A study of couriers (and taxi drivers) in the 'gig' economy in the UK found that pressures associated with the work and self-employment may significantly increase their risk of being involved in a traffic collision. Forty-two per cent of respondents (using mopeds, motorbikes, bicycles or cars) reported that their vehicle had been damaged as a result of a collision while working, with a further 10% reporting that someone had been injured (either themselves or another road user) (Christie and Ward, 2018). The road worthiness of the vehicles used plays an important role in road safety, with the majority of self-employed couriers providing their own vehicles which they may not maintain and inspect regularly. Some couriers using bicycles and mopeds ride rapidly and exhibit dangerous behaviour such as weaving in and out of the traffic and travelling the wrong way along one-way streets. This behaviour may be related to self-employed status, the young age profile of couriers reflecting little road experience, and the limited amounts of training available.

Couriers on two-wheeled vehicles are exposed to the elements and are subject to poor air quality while working. In addition, the physical strain of cycling requires a higher and more intense rate of breathing. This results in cyclists being more exposed to polluted air. Chronic exposure to air pollutants can reduce lung function permanently. Some meal delivery couriers working at night have been confronted by aggressive or drunken customers. Working alone after dark and sometimes handling money can also make such work dangerous. Some couriers have been subject to robbery of cash and mopeds.

Some residents living near to the restaurants where couriers wait to collect meals ordered online have been adversely affected by traffic generation, danger of traffic collisions with pedestrians, vehicle and courier noise disturbance, and littering. Some of Deliveroo's 'Editions kitchens' have been built in close proximity to residential accommodation and can generate many courier vehicle trips per hour resulting in these types of negative impacts.

The GHG impacts of meal deliveries

Little research has been carried out into the road transport and GHG emissions impacts of ready-to-eat meal deliveries. However, one study indicates that ready-to-eat meal deliveries in London generate greater vehicle kilometres per tonne of goods transported than other types of last-mile delivery operations (i.e. grocery and parcels) and other more traditional forms of road freight transport using larger, heavier vehicles. Meal deliveries are estimated to generate approximately 100 times more vehicle kilometres per tonne transported than non-food parcel deliveries and 40 times more than grocery next-day deliveries. This is due to the far smaller, lighter quantities of goods transported on these meal delivery trips (Allen et al., 2020).

In terms of greenhouse gas (GHG) emissions, meal deliveries made using manual and electrically-assisted cycles (and cargo-cycles) are emissions-free at the point of use, unlike fossil-fuel powered mopeds, motorcycles and cars. The study referred to above estimated that, per unit weight transported, meal deliveries by a moped using fossil-fuel result in approximately 30 times more GHG emissions than next-day parcel deliveries by van, and 10 times more than grocery next-day delivery by van. Meal delivery by cars using fossil-fuel were estimated to be responsible for approximately 80 times the GHG emissions of a rigid HGV and 200 times the GHG emissions of an articulated HGV per tonne delivered (Allen et al., 2020).

The same study also indicated that the cooking and delivery of ready-to-eat meals generates more GHG emissions than consumers purchasing food in grocery supermarkets by car as part of their weekly shop and then cooking this food at home (approximately 2-3 times greater in the case of a chicken meal and 2.5-4.5 times greater in the case of pizza). Ready-to-eat meals delivered by bicycle were estimated to generate similar GHG emissions to car-based weekly shopping and home cooking (Allen et al., 2020).

Ready-to-eat delivered meals are also responsible for substantial packaging use, with pizzas delivered in cardboard boxes, and other foods and drinks in cardboard or plastic containers, together with the use of plastic or paper bags.

Impacts of the Covid-19 epidemic on ready-to-eat meal purchases and deliveries

Restaurants, bars and pubs in the UK had to cease dining-in operations from the government imposed lockdown on 23 March 2020 during the Covid-19 epidemic (and were not permitted to recommence dine-in services until 4 July in England, 15 July in Scotland and 3 August 2020 in Wales). These establishments were permitted to continue serving takeaway meals and deliveries if they were able to comply with distancing requirements in their kitchens and so wished. Many restaurateurs decided that the operating costs of running the kitchen were not viable while generating only takeaway sales, and therefore closed anyway (Tan, 2020). Others struggled to comply with distancing rules and closed shortly after 23 March 2020. Many major restaurant and takeaway chains announced the temporary closure of all branches (including McDonald's, Kentucky Fried Chicken, Wagamama, Nando's, Costa Coffee, Subway, Pizza Express and Greggs). Many did not commence reopening for takeaways and deliveries, albeit gradually, until late-April 2020 at the earliest. Restaurants, bars and pubs in certain parts of the country were subject to further bans on dine-in and drink-in services in the UK from October 2020, and another almost nationwide lockdown on restaurants, bars and pubs for dine-in services commenced on 19 December 2020. Takeaway meal services and meal deliveries were permitted to continue.

Just Eat, Deliveroo and Uber Eats, the major platform providers in the UK, continued to offer online meal orders during the Covid-19 crisis. Just Eat reported that two-thirds of the restaurants that are members of its UK platform continued to trade during the epidemic. However, it reported that order volumes were reduced in the initial weeks following the 23 March 2020 lockdown, and the times of day and the day of week of orders became more unpredictable with more weekday lunchtime orders than normal, and less

demand in the usual evening and weekend peak periods (The Food Programme, 2020). Reduced order volumes resulted in delivery couriers travelling further between restaurants and delivery locations. However, as restaurants began to re-open and offer takeaway meals and deliveries and households used up their food supplies, demand for meal deliveries began to grow again. Just Eat and Deliveroo both experienced higher order levels in April 2020 than in April 2019, and Deliveroo's order levels in May and June 2020 were above its pre Covid-19 crisis budget forecast for those months (which had been set in February 2020) (Competition & Markets Authority, 2020). Despite the epidemic, Just Eat reported an increase in orders of 18% and revenue of 28% in the UK in the first six months of 2020 compared to same period in 2019 (Just Eat Takeaway.com, 2020).

During Covid-19, Deliveroo signed deals with several major grocery retailers to commence instant deliveries of small order quantities on their behalf. Deliveroo began working with Marks and Spencer, Aldi, McColl's and Budgens during the epidemic to facilitate deliveries as these retailers had no existing delivery operations of their own (IGD, 2020a and 2020b). Deliveroo made deliveries from approximately 150 Marks and Spencer outlets (IGD, 2020c). Deliveroo also worked with Co-op and Morrisons (IGD, 2020d; Morrisons, 2020). In the case of Morrisons, Deliveroo made deliveries from 130 of its stores in geographical areas in which either the retailer had no existing last-mile delivery operations presence or to help it increase its delivery slot availability. Morrisons and Deliveroo offered customers a range of 110 products with ordering permitted until 21:30 for instant delivery as quickly as 30 minutes from order placement (Morrisons, 2020).

The use of Deliveroo by a far greater number of grocery retailers during the Covid-19 epidemic may lead to a longer-term partnership between Deliveroo and grocers who either have no last-mile delivery operations of their own, or who want to expand their existing last-mile services by offering instant delivery services.

Conclusions

The review of online ready-to-eat meal shopping and last-mile delivery carried out and the analysis of the findings of the material reviewed leads to the following conclusions:

- Online ready-to-eat meal shopping has grown rapidly since its inception and is forecast to continue to do so.
- Mopeds, bicycles and cars are all used to make meal deliveries to customers' homes and workplaces. Bicycles are by far the best vehicle type to use for these deliveries in terms of GHG emissions but pose greater safety risks to those using them.
- Ready-to-eat meal deliveries by fossil-fuel powered mopeds and cars result in greater transport and GHG impacts per unit of product transported than van-based grocery and parcel last-mile deliveries. This is due to a single meal order being carried on most meal deliveries.
- Ready-to-eat meal deliveries are also associated with other impacts including packaging waste, computing energy use, the behaviour, safety and wellbeing of delivery workers, and casualisation of labour in these operations.
- The action that will produce the greatest reduction in ready-to-eat meal delivery GHG emissions is the uptake and use of bicycles and other zero-emission delivery vehicles. However, in the case of mopeds and cars it will take time for the use of these clean vehicles to become widespread, and even when they are, their use will still result in transport impacts.
- Due to the immediate nature of ready-to-eat meal deliveries, compared to grocery and parcel deliveries, there are fewer logistics actions that can be taken by meal sellers, platform providers and consumers to reduce the negative transport and environmental impacts of these last-mile deliveries. The actions available are discussed in the next section.

Recommended actions for retailers, delivery companies, consumers and policy makers

Stakeholders in online shopping and last-mile delivery, including retailers, delivery companies, consumers and policy makers can take action to reduce the transport intensity, GHG emissions and other impacts of ready-to-eat meal online shopping and last-mile deliveries. These are summarised in Table 1. These recommended actions have been categorised in terms of the aspects of last-mile delivery operations on which they will positively impact:

- Transport intensity (last-mile delivery vehicle kilometres travelled).
- GHG emissions (due to online shopping and last-mile delivery activity).
- Wellbeing and safety of last-mile delivery workers (including their working conditions and health).

Some of these recommended actions are also expected to result in improvements in last-mile delivery operating costs, while at the same time reducing these negative impacts. This has also been indicated in Table 1.

These recommended actions have been sub-divided into those that could potentially be implemented in the short term (with 18 months), medium term (18-36 months) and long term (more than 36 months). A tick mark denotes a positive link between the recommended action and potential improvements in the sustainability of delivery operations (in terms of transport intensity, GHG emissions and/or worker wellbeing and safety). Those recommended actions that are also expected to have a positive impact on operating costs have also been shown with a tick mark. The impacts of these actions have been assessed by the authors using their expert judgement, drawing on the results of research reviewed in carrying out this work.

The following key has been used to refer to the various stakeholders in Table 1:

- R - retailers
- D - delivery operators (platform provider or restaurant)
- C - consumers
- P - policy makers

Table 1: Possible actions for stakeholders

Initiatives and measures	Potential impacts				
	Transport intensity of last-mile deliveries	GHG emissions	Wellbeing and safety of last-mile workers	Last-mile delivery operating costs	Online shopping sectors related to this action
Short-term					
The use of bicycles rather than fossil-fuelled mopeds and cars for ready-to-eat meal deliveries	✓	✓	✓	✓	D
Place combined orders with others in the household	✓	✓		✓	C
In cases of noise disturbance and nuisance to residents check planning conditions permit takeaway meals	✓				P
Medium-term					
Devise sustainability and decarbonisation plans for last-mile delivery	✓	✓	✓		R,D
Implement delivery charges that reflect operating and external costs (including removal of 'free' deliveries)	✓	✓		✓	R
Obtain grid coordinates of entrance point at delivery location from customers	✓	✓		✓	R
Develop and implement packaging reduction, reuse and recycling plans		✓			R
Use zero emissions vans and other vehicles where possible (electric vehicles etc.)		✓			R
Use IT-based routing and scheduling for drivers	✓	✓	✓		D
Make use of delivery point grid coordinates for entrance door at delivery location routing		✓	✓		D
Provide more training to last-mile delivery workers (including driving style)	✓	✓		✓	D
Pay self-employed/contractors by time period rather per delivery to ensure at least the minimum wage	✓	✓			D,P
Disseminate last-mile information and advice to stakeholders including consumers	✓	✓		✓	P
Implement training requirements for last-mile delivery workers	✓	✓	✓		P
Clarify law on employment status (i.e. greater definition, or remove the 'worker' or 'self-employed' employment categories)			✓		P
Increase requirements for uptake of renewable electricity (for vehicles and computing)		✓			P
Increase requirements for energy saving technology for computers and smartphones		✓			P
Long-term					
Join sustainable last-mile delivery certification schemes (if/when they exist in UK)	✓	✓	✓		R
Continue investigation of pavement drones and aerial droids for last-mile deliveries	✓	✓		✓	D
Improve working conditions for drivers (insurance, sick pay, holiday entitlement, protective clothing, vehicle)	✓	✓	✓		R,P
Join/provide operational data to sustainable last-mile delivery certification schemes (if/when they exist in UK)	✓	✓		✓	D
Use platform providers signed up to sustainable last-mile delivery certification schemes (if/when they exist in UK)	✓	✓	✓		D
Consider implementing delivery tax/charges to prevent 'free' delivery / incentivise green delivery options	✓	✓			P
Plan/provide energy infrastructure for zero emission vehicles (including last-mile delivery vehicles)		✓	✓		P
Require relocation of server farms to locations with cooler ambient temperatures		✓			P

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