



- [Home](#)
- [About this system](#)
- [Release history](#)
- [Contact us](#)

## Efficient network design with optimal slot offering for grocery home delivery.

Lead Research Organisation: [Lancaster University](#)

Department Name: Mathematics and Statistics

[Go back](#)

- [Overview](#)
- Organisations
- People
- Related Projects

### Abstract

#### [Funding details](#)

Online grocery delivery is an increasingly used service in society and is becoming something people rely on more and more by the day. The main challenge of online grocery delivery problems, as opposed to other kinds of delivery problems, is the requirement for the customer to select a time slot in which they wish to receive their delivery, which the route then has to accommodate. In principle, being able to choose any slot they desire is ideal for customers; however it can lead to the creation of highly inefficient routes. Consider for example a scenario in which there are two deliveries on the same road which have been ordered for delivery windows six hours apart: from a perspective of minimising the distance being travelled, this is not a good situation to be in, as it will involve sending delivery vans to the same road twice in one day.

The aim of this project is to research methods that can help the supermarket decide which delivery slots to offer customers when they place an order on the company website. There are two objectives, which typically conflict: maximizing customer choice, and minimising the total driving time. As well as having two objectives, the problem has stochastic and dynamic aspects, since customers visit the web site more or less at random over time. Moreover, the problem has combinatorial aspects, due to the selection of delivery slots and the need to produce routes for the vehicles. In order to solve this highly complicated optimisation problem, heuristic methods are likely to be necessary. It may also be necessary to use simulation, to assess the (expected) performance of various heuristics.

In partnership with Tesco.

### Planned Impact

This proposal will benefit (i) the UK economy and society, (ii) our industrial partners, (iii) the wider community of non-academic employers of doctoral graduates in STOR, (iv) the scientific disciplines of statistics and operational research and associated academic communities, (v) UK doctoral students in STOR, and (vi) the CDT students themselves.

Below we outline how each of these communities will realise these benefits:

(i) The UK economy will gain a competitive edge through a significant increase in the supply and diversity of doctoral STOR professionals with the skills required to undertake influential, responsible and impactful research, and who have been trained to become future leaders. Our goal is that our future alumni who enter industry assume leading roles in realising the major impact that STOR can make in achieving effective data driven decision-making. Our existing alumni are already starting to achieve this. A wider societal benefit will accrue from research contributions to EPSRC Prosperity Outcomes, e.g. to the UK being a Productive and Resilient Nation.

(ii) Our industrial partners will particularly benefit from the skills supply identified in item (i), as likely employers of STOR-i graduates. They will further benefit from teaming with a community of leading edge STOR researchers in the solution of substantive industrial challenges. Mechanisms for the latter include doctoral projects co-supervised with industry, industrial internships, engagement in research clusters and industrial problem-solving days. Our training programme will give students the skills they need to ensure that research is conducted responsibly and that outcomes are successfully communicated to beneficiaries. The value that our industrial partners place on working with STOR-i can be seen through the pledged cash support of £1.7M.

(iii) A wider benefit will accrue from the employment of STOR-i graduates, equipped as described in items (i) and (ii), across non-partner public and private sector organisations. The breadth and depth of training provided by the CDT will enable students to quickly make a difference in these organisations, using their research skills to affect significant change.

(iv) The STOR academic community will benefit from methodological advances and from the increase and diversity in the supply of STOR researchers who value, and have experience of, collaborative research. Our alumni will be leaders in 21st Century Statistics with a strong culture of, and training in, reproducible research and a focus on achieving impact with excellence. Our recruitment strategy will further benefit this community in achieving a healthier supply of high-quality doctoral candidates from diverse backgrounds. Our research internship programme gives top mathematically able individuals from across the UK an experience of STOR research and has been shown to increase applications for STOR PhD programmes across the UK.

(v) Elements of the STOR-i programme will benefit the wider community of UK doctoral students in STOR. Using financial support from our industrial partners, we will continue our National Associate Scheme. This will provide up to 50 UK STOR doctoral students with funding and access to elements of STOR-i's training programme. An annual conference will provide opportunities for learning, networking and sharing research progress to members of the scheme.

(vi) STOR-i students will benefit from a personalised programme that will support each individual in fully achieving their research leadership potential, whether in academia or industry. Students will be given the tools and opportunities to develop research and broader skills that will enable them to achieve maximum scientific impact for their work. Our current alumni provide strong evidence that these future graduates will be extremely employable.

**Student:**

[Matthew Randall](#)

**Period of Study:**

Sept 19 - Jun 24

**Funder:**

EPSRC

**Project Status:**

Closed

## Project Category:

Studentship

## Project Reference:

2284260

## Research Topic:

[Unclassified](#)

## Organisations

- [Lancaster University \(Lead Research Organisation\)](#)
- [Tesco \(United Kingdom\) \(Student Project Partner\)](#)

## People

## ORCID iD

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[Matthew Randall \(Student\)](#)

## Publications

The following are buttons which change the sort order, pressing the active button will toggle the sort order

[Author Name](#)

[descending \(press to sort ascending\)](#)

[Title](#) [Publication Date](#) [Published](#)

[10](#) [25](#) [50](#)

## Studentship Projects

Project Reference	Relationship	Related To	Start	End	Student Name
<a href="#">EP/S022252/1</a>			30/09/2019	30/03/2028	
<a href="#">2284260</a>	Studentship	<a href="#">EP/S022252/1</a>	30/09/2019	29/06/2024	<a href="#">Matthew Randall</a>

## Data

[The Data](#) on this website provides information about publications, people, organisations and outcomes relating to research projects

## APIs

A set of REST [API's](#) enable programmatic access to the data. Refer to the application programming interfaces [GtR](#) and [GtR-2](#)

## Contact

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