Data Report: Single- carrier consolidation - Central London trial

Consolidating deliveries of retail and non- retail clients into single electric van deliveries

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Abstract

This document is the Monitoring Data report for the Gnewt Cargo Agile Cat 3 project. It presents in detail the data and the trial performance. It includes details of the monitoring methodology used, assumptions made and provides data references.

In this data report, Gnewt focuses on the presentation of the main series of 'raw' data collected during the period of the Agile Category 3 Demonstrator project, and is meant to complement information from the main final report.

If not otherwise stated, all data presented here is original data collection on freight transport and logistics in Central London. Goods transport is a field of activity currently lacking in good quality data for public sector policy development. This report contributes to filling gaps in that data.

Beyond this report, the Case Study Final Report presents further calculations, in-depth results obtained, data analysis, legacy and recommendations.

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List of Abbreviations

Agile Cat 3	Agile Category 3 Demonstrator project
BEV	battery electric vehicle
B2B	Business to Business trade
B2C	Business to Consumer trade
Boxer	Peugeot Boxer van
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
Cons	Consignment
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EC	East Central London (UK Postcode area in London)
EFAO	European Alternative Fuel Observatory
EU	European Union
EV	electric vehicle
ft^2	square feet
GHG	greenhouse gas
GLA	Greater London Authority
goe	gramm of oil equivalent
GPS	Geo Positioning System
HGV	heavy goods vehicle
Km	kilometre
Kg	kilogramme
Kgoe	kilogramme of oil equivalent
kWh	kilowatt-hour
LGV	light goods vehicle
LSP	logistics service provider
m^3	cubic metre
MB	Mercedes Benz Vito van
NAEI	National Atmospheric Emission Inventory
NO_x	nitrogen oxides
OEM	original equipment manufacturer
Pieces	Number of parcel units
PM	particulate matters
PM10	particulate matters with a size <10 micron
R&D	research and development
RK Maxi	Renault Kangoo Z.E. Maxi van
SE	South East London (UK Postcode area in London)
SW	South West London (UK Postcode area in London)
TfL	Transport for London
UK	United Kingdom
veh	Vehicle
W	West London (UK Postcode area in London)
WC	West Central London (UK Postcode area in London)

1. Executive summary

This document is the data report of the Mayor of London's single - carrier consolidation - Central London trial (Agile 3). The trial was delivered by Gnewt Cargo Limited. The trial explored scenarios for consolidating deliveries of multiple retail and non- retail clients using a single carrier (Gnewt Cargo) in a single van. All deliveries were done using electric vans. The aim of the trial was to reduce the number of delivery trips, reduce congestion and improve air quality outputs compared to a diesel equivalent approach by utilizing zero emissions electric freight delivery vehicles.

During this demonstrator, Gnewt carried parcels for final delivery in central London for multiple businesses, e.g. TNT, Marlborough Grove depot in Southwark, SE16 biscuit Factory and Emakers, all of which are active in business-to-consumer (B2C), home deliveries, and business-to-business (B2B) operations in London and the UK. Gnewt also carried parcels for other retail companies including Client B (local produce on-line grocery store), Emakers (e-commerce delivery business), and Spicers (leading uk wholesale office suppliers).

This report is the Monitoring Data report for the "Agile 3" project. It is labelled as Milestone M7.2. It focuses on the data collected and made available during the trial between 1st July 2015 and 30th June 2016. In this report case study data, general data on the business characteristics and relevant data on the market situation are presented. Detailed analysis and explanations are shown in the final report, Milestone M8.4.

Gnewt produced this monitoring and data analysis in order answer the key questions of the Agile Cat 3 demonstrator.

Case Study 1: Consolidation into one depot in Central London and use of 2.2t electric vans (4.5m^3 capacity, about 100-150 parcels of average size) for the retail clients Farmdrop and Emakers.

What is the business case for clean urban freight consolidation and single carrier deliveries for retail clients?

Case Study 2: Consolidation and electric vehicle use for non-retail clients such as TNT.

What is the business case for clean urban freight consolidation and single carrier deliveries for non-retail clients in Central London? What are the differences with retail clients?

Case Study 3: *Testing the Fitness for Purpose of Different Electric Vehicles for Different Clients.*

Generic study 1: Testing Design of Technology Tests.

What is the best solution for designing technology tests and how do we manage them efficiently?

Generic study 2: Improved Data Collection.

What is the best method for collecting data consistent with previous information systems in place?

The full and finalised set of data collected and monitored is presented in this report. As of 30 June 2016, the data collection and monitoring of the Agile Gnewt project operations relevant for Cat 3 was collected for all case studies and mostly for business dealing with the clients Hermes, Emakers, Farmdrop, TNT international and TNT domestic distribution services.

Gnewt collected data on 13,360 freight deliveries via electric vans, covering 148,500 miles, delivering about 2 million parcels during this 12-month project, between 1st July 2015 and 30th June 2016. The volume for Hermes grew by nearly 100% over the last 3 years. Compared with the 300,000 trucks and vans driving every day in London, Gnewt Cargo's market share, of about 100 vans, is very small.

The market share for electric vans in UK is also very small: in 2015, around 0.1% of all new registered commercial vehicles are Battery Electric Vehicles (BEV).

If not otherwise stated, all data presented here is original data collection on freight transport and logistics in Central London. Goods transport is a field of activity currently lacking in good quality data for public sector policy development. This report contributes to filling gaps in that data.

The average overall performance demonstrates how efficient and clean this logistics solution is: the average successful distribution is 151 parcels per van per day, average distance travelled is 11 miles per van per day and 119 metres per parcel delivered, the average driver working time is 6 minutes per parcel, and the average completion rate is 87%.

There were very many unique challenges for individual companies, based on e.g. business size, location, technology, type of vehicles, size and weight of parcels etc. For example, none of Gnewt Cargo's city centre depots are accessible for larger lorries and articulated trucks. To cope with that challenge, the customers send goods to Gnewt Cargo on smaller trucks, usually 12 tonne lorries. Many modifications were needed to accommodate the different needs of the clients, and these operational challenges are reported in detail below in the case studies.

The logistics industry has key peaks during its annual cycle e.g. lower delivery movements during the summer and above average delivery volumes during the Christmas period. By collecting the trial data over a twelve-month period, Gnewt was able to demonstrate the impact of these key periods. To cope with the increased volume, Gnewt Cargo rented 11 electric vans from October 2015 to January 2016. This was effective but the issue of lack of space remains crucial and the search for a bigger depot in Central London, accessible by large truck, is compulsory.

With this volume of robust data, Gnewt has demonstrated the potential to scale and replicate the positive impacts across the wider London area. Quantitative impacts and benefits are presented below and explained in detail in the final report. Why is this demonstration scalable and replicable in London? The key ingredients are the central depots close to final delivery area, the full-electric fleet, and know-how.

2. Data monitoring plan of the Agile Gnewt Cat 3 project

Gnewt Cargo conducts data collection, monitoring and processing following the methodology of the University of Westminster. The method for data collection was started and developed in multiple previous projects. The 'before-after' approach was implemented after having been adapted to fit well with the IT solutions.

The main methodology consisted of preparing the data collection whilst trialling the solutions. In parallel, Gnewt Cargo organised its internal data collection using the current software solution. Past data collection was used to obtain the background information and the baseline data.

Start of data collection was 1st July 2015. End of data collection was 30 June 2016. The key performance data relevant for the assessment of the objectives was collected for the full duration of one year:

- Number of vehicles in use
- Vehicle monitoring data
- Driver monitoring data
- Clients served
- Distance per day
- Number of parcels
- Energy use

The assessment of the degree to which the objectives were attained, is provided in the M8.4 Case Study report. Beyond these key performance data, the data of Table 1 below are considered relevant and were collected.

This monitoring and technology data was complemented with other impact data.

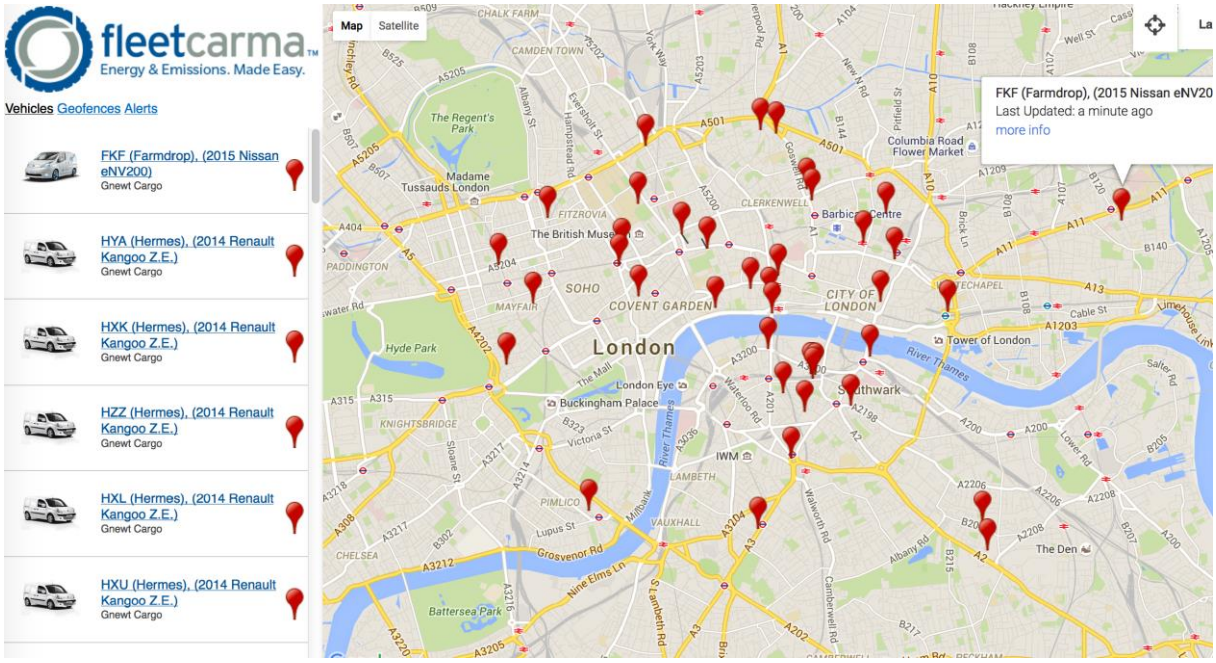
Table 1: Parameters collected for the monitoring of business case at Gnewt Cargo

General data	Trip data
Date, time	Number of parcels
Vehicle, driver	Trip distance driven
Mileage on tachograph	Fuel use
Battery use	kWh use
Client name	Area served
Depot location	

Mileage data enabled the calculation of congestion reduction, since it is assumed that a distance reduction per parcel, if widely implemented, will lead to substantial traffic reduction. For the fuel use, data provides the basis for the calculation of CO2 by multiplying diesel litre amount by the emission factor 1l=3.1kg CO2 equivalent. To calculate the air pollutant emissions, the diesel litre amount was multiplied with the emission factors of the National Atmospheric Emission Inventory NAEI, given for several air pollutants.

Some additional very specific data such as the geographical distribution of the fleet in Central London at a certain time was be collected for one month, week or day, or for a time of the day.

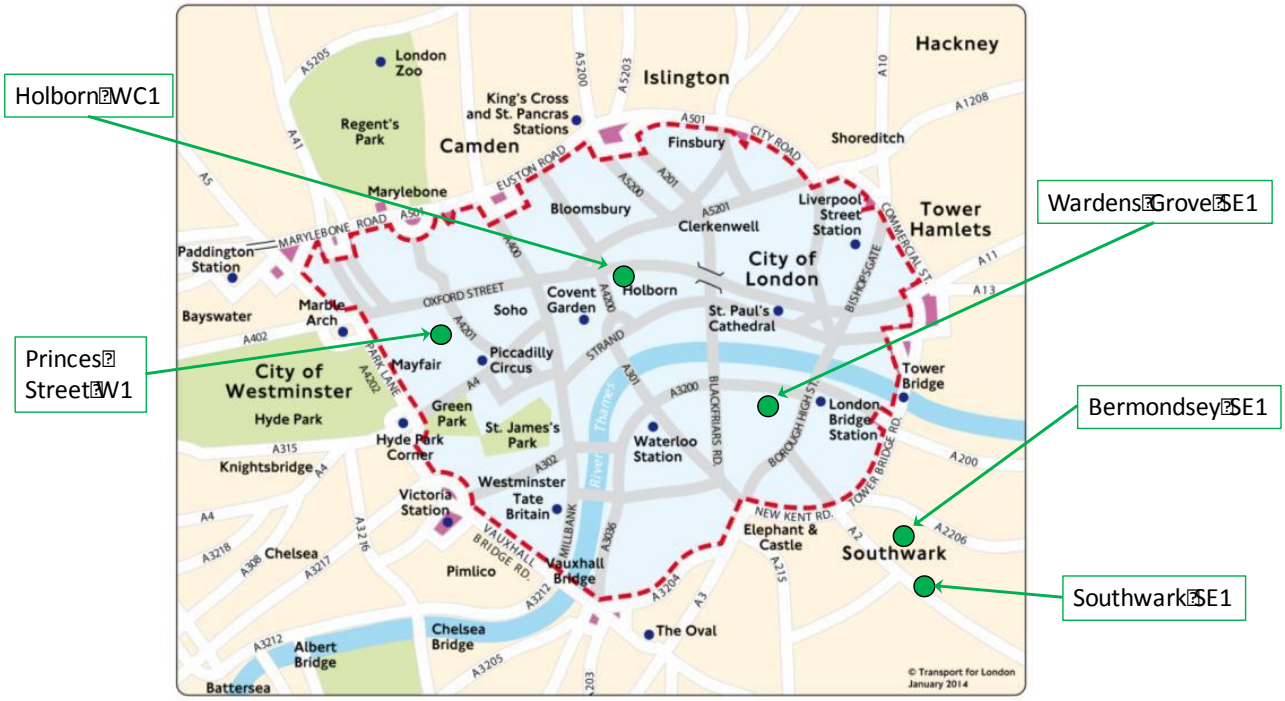
Figure 1: Geographical distribution of the fleet of Gnewtcargo on 16 October 2015



Source: Agile Cat 2 data

The Figure above shows the location of the fleet of vehicles equipped with the Fleetcarma software on 16 October 2015, in the afternoon at 15:30. This map demonstrates that Gnewt Cargo is not only active within the Congestion Charge Zone in central London but that a few vehicles are also performing deliveries outside of this zone. The Figure below shows the depot locations.

Figure 2: Locations of the Gnewt Cargo depots used for electric deliveries in Central London



Source: Gnewt Cargo Cat 3 demonstrator, 2016

Additional data relevant for London urban freight policy

During the Case Study trial period, the "Agile 3" project collected information on a number of other variables relevant for public sector policies. This data benefits London because it demonstrates the beneficial impacts of the Gnewt Cargo business case, thus helping reduce congestion, reduce emissions and increase the market share of clean vehicles in Central London.

These data indicators and definitions are:

- Vehicle movement reductions
- Reduction in miles travelled per parcel
- Time vehicles spent on the road
- CO_2, NO_x, and PM reductions of a van delivering the same freight in the same area versus the Diesel alternative
- Efficiencies of varying types of electric vehicle
- Noise reduction
- Business case and KPI data such as:
  - costs of vehicle solutions purchase and/or leasing
  - variable running costs per parcel or per stop for different clients, different area and different depots
  - fixed and variable depot management costs, depot rental and
  - other fixed and variable costs
- Disruptions and risk management for delivery operations

This data was collected between 1st July 2015 and 30th June 2016.

3. Data monitoring of the Case studies

3.1 General data relevant for all case studies

3.1.1 Quantitative monitoring results for business volume and performance

General data on distance and number of parcels was collected for the Baseline data and the same data was monitored further on, throughout the entire project duration.

Gnewt Cargo baseline data was collected from 1 July 2015. During the period 1-31 July, there were about 1170 rounds driven on London roads by Gnewt Cargo.

Table 2 shows an extract of the information collected and presents key general statistics findings for the month of July 2015.

Table 2: Gnewt Cargo baseline statistics on rounds and deliveries, July 2015

	Miles per day	Km per day	Km per delivery
Average	12	18.721	0.25
Max	56	90.123	39
Min	0.1	0.2	0.03

Source: Gnewt Cargo data

This data confirms the great variability of the day to day business.

The main business data was collected for the Wardens Grove depots and delivery activities for the client Hermes. A main business Table was produced. In this Table, one line represents the activities of a van during one day. On each line, the data is collected for one driver's performance during one day, using one van. A total of 13,360 lines represents the number of van-days' information collected for the Agile Cat3 project period.

The 23 indicators of the main business Table are presented below.

- Date
- Courier Number
- Successful deliveries
- Attempted
- Unsuccessful
- Successful pickups
- Successful collections
- Carried forward
- Bulk Catalogue
- Total to pay
- Start duty
- Depot depart
- Depot return
- End duty
- Mileage start
- Mileage end
- Van ID
- Daily Mileage/ van

- Metres/ parcel
- Km/day
- Completion rate in %
- Time spent start-end duty
- Time spent per parcel

It is not suitable for a report to present all 13,360 lines of the full dataset. This data is available as a separate spread sheet file, with the title "Freight delivery performance with electric vans in Central London". It is planned to upload this file to the London Data Store (https://data.london.gov.uk/).

This original data was used as the main reference point to calculate logistics performance statistics presented in Table 3. This statistic is a result of the monitoring, calculated from original data. The performance is expressed either as total volume of parcels delivered for the whole year of observation, or as an average per week, average per van per day, an average distance per parcel or an average completion rate for the whole period. The miles driven are only the miles effectively driven by the Gnewt Cargo fleet, excluding the other parts of the entire supply chain that are controlled by other companies.

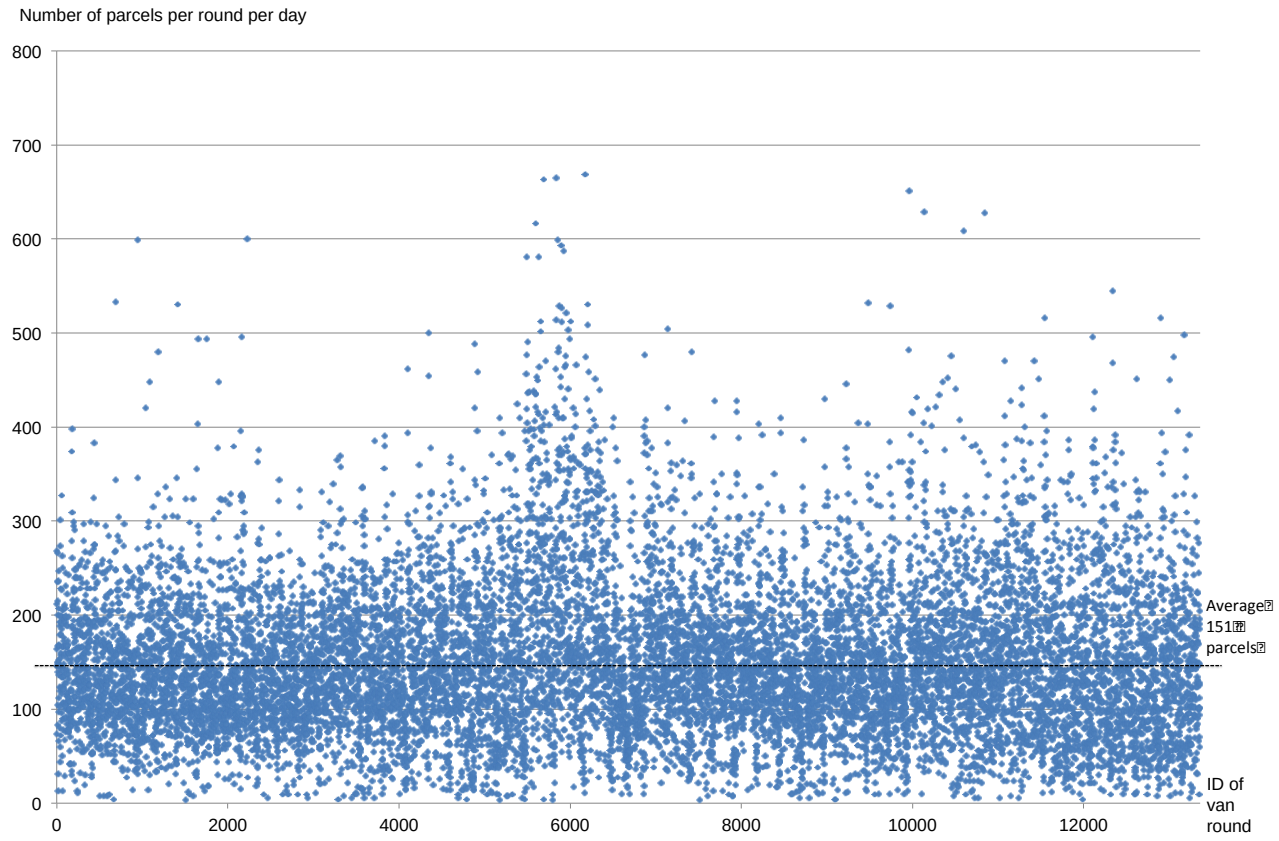
Table 3: Performance indicators of Gnewt Cargo business 1 July 2015-30 June 2016

Metadata	Business, data ownership	Gnewt Cargo Ltd
	Project	Agile Category 3
	Period of observation	1 July 2015-30 June 2016
	Clients	Hermes (and a small proportion of parcels from DX, TNT, Emakers, Farmdrop)
	Vehicles in use	Renault Kangoo ZE, Nissan 2-NV200
	Area of delivery	Congestion Charge Zone and Central London
Performance Indicators	Total parcels delivered	2,005,728
	Average parcels delivered per week	38,572
	Average parcels per van per day	151
	Max parcels/van/day	668
	Min parcels/van/day	1
	Total miles driven	148,545
	Average miles per van per day	11
	Average metres per parcel	119
	Average completion	87%
	Total driver working time in minutes per parcel	6

Source: Agile Cat 3 demonstrator, 2016

Figure 3 presents an extract of this data, focusing on the volume of freight. The indicator is the number of parcels per vehicle per day. This indicator is the real number of parcels delivered on that day, for which a payment has been made.

Figure 3: Number of parcels delivered per round per day, 1 July 2015 – 30 June 2016



Source: Gnewt Cargo Agile Cat 3 demonstrator, 2015-2016

3.1.2 Overview, business characteristics, specifications and operation details

Besides quantitative monitoring, a lot of qualitative business data was collected in order to better understand the business case for single carrier consolidation centres in London.

The following observations (Table 4) were made on current developments at Gnewt Cargo. These qualitative business specifications and quantitative survey results are valid and similarly important for retail and non-retail clients (Case Study 1, Case Study 2) and relevant for the fleet analysis (Case Study 3).

Table 4: Overview, business characteristics, specifications & details, July 2015-June 2016

Load, type of goods	On arrival at Gnewt Cargo, parcels are delivered by clients in roll-cages, sacks and/or pallets. Parcels: average weight of one parcel is between 0.5kg and 10 kg; on average 100-300 boxes fits within vans of 4 m^3. The average volume is about 0.03 m^3 per parcel, equivalent to the size of a shoebox. The dimensions of Farmdrop parcels is about triple the size of other clients. Farmdrop delivers food and the food boxes are much bigger than normal parcels (because usually food supplies are ordered for more than one person). So there about 4 parcels on average per delivery. On arrival, parcels are usually pre-sorted by delivery round and postcode area.
Depots for Hermes / TNT/ DX / retail distribution operations	The warehouses of the 5 main clients Hermes (Enfield depot), TNT (Barking. Standsted, and Bermondsey depots), DX (Marlborough Grove depot in Southwark), Farmdrop (SE16 biscuit Factory) and Emakers (Airmail via Heathrow or Stansted, then DHL van delivery) are Regional Distribution Centres for London and its surroundings. From these regional warehouses, the diesel vans would be loaded and would start their delivery rounds. In classical urban logistics, each round starts during morning peak traffic from the suburbs, at least 10-15 miles away from Central London. This is what happened "before", the so-called "baseline" situation. Instead, now (after), the clients send larger urban trucks to the depots of Gnewt Cargo. These trucks travel mostly at night, reducing the daytime congestion in London. Each truck transports parcels between depots thus replacing several smaller van deliveries which reduces the number of trips on the main roads towards Central London at peak traffic time in the mornings and afternoons. Gnewt Cargo then runs its own delivery operations from its depots: • West Central Street depot: 10,000 ft2 • Wardens Grove depot: 25,000 ft2 • DX depot by Old Street in London, 1000 ft2 • Princes Street near Regent Street: <500 ft2 The main functions of the depots are 'cross-docking' operations (receiving goods during the night, unloading, sorting, loading the electric vans and distributing these goods on the same day). Another main task is recharging the batteries of the vans parked overnight. No overnight stay occurs in Princes street depot, and therefore no charging, due to lack of space.
Business	Starting from July 2015, about 5-7000 parcels/day were delivered during 'normal' times. During Christmas peak time, a period starting in September 2015 and ending in early January 2016, the day to day business consisted of up to 20,000

	parcel deliveries per day. The area served was the Central London Congestion Charge area. The type of business is B2C and B2B; there are both business and residential customers in this area of London. Each driver has a specific area, different from other drivers, to serve in Central London. Each driver knows their area very well.
Area of delivery and traffic	Delivery areas are almost exclusively the EC, SW, WC, W, SE postcodes (Congestion Charge zone) in the central Boroughs of London. The area is characterised by a mix of very busy narrow roads or, if a wide road, no stopping (double red) lines and heavy traffic in the morning peak hours, and quiet residential streets. The Farmdrop delivery area is much extended beyond this Central London zone, and reaches within and slightly beyond the North and South circular roads. Visual observation of the morning traffic: between a third and a half of the traffic consists of vans of various sizes and small trucks, the other half being cars.
Vehicle fleet	Christmas peak period saw an increase in the Gnewt cargo fleet: Up to 100 electric vans were in daily use. 13 hired electric vans were added to the fleet during peak, starting at the end of November 2015 up until the end of February 2016. Hire costs were £490+ VAT/month. The van type was Renault Kangoo ZE. Fleet status as of March 2016: slightly decreased compared to Christmas peak: 79 electric vans in own fleet, +9 electric vans owned by subcontractors = 88 vans total fleet in use. Spring data about the fleet: 61 electric vans and one cycle in daily use at the Wardens Grove depot. Other vans are used at the other depots on rotation depending on the needs of the operation. Last purchase of an electric van occurred in August 2014. Fleet composition: • Renault Kangoo ZE (55) • Nissan eNV200 (6) • Mercedes Vito (4) • Goupil G5 (4) • Peugeot Boxer (2) • Cargocycles (2 runs for Zipjet, 2 runs for Dropit, 1 runs for Betterbankside)

Drivers	Between 60 and 100 drivers and subcontractors were employed in the period July 2015- June 2016, covering the London delivery area. Maximum peak drivers allocation to clients was: • 74 to Hermes including 9 management and 9 subcontractors • 5 for Farmdrop • 11 for TNT + Emakers + Spicers • 10 for DX • 1 for Dropit
Goods arrival by diesel trucks at the Gnewt depots	Depending on the total volume of the day, in normal times 4 Hermes trucks (DAF FT45), deliver at night to the Wardens Grove depot. During peak times, the number of Hermes truck trips increased to up to 9 per night. 2 TNT trucks deliver at night to the West Central Street depot. During peak, 4 Hermes trucks arrive at the West Central Street depot. The DX depot is a warehouse where the goods are sorted and rounds prepared. The electric vans from Gnewt Cargo start their Central London delivery round from the DX depot. No diesel trucks are used by DX, and for this last mile delivery operation, the CO_2 reduction is 100%, and air pollutant reduction is near 100% for exhaust emissions. For the DX business, there is no increase in total number of vehicles.
Loading	This activity takes place during the morning. The drivers arrive at the depots between 07:00-08:00.All vans are loaded by Gnewt Cargo drivers. Vehicle loading time is, on average, 45-60 minutes per van. Most clients prepare orders to be delivered on the day's rounds. Within the area, the driver sorts the parcels according to their understanding of their own round. They do this sortation out of a pool of parcels allocated to a certain area in Central London. The drivers sort parcels in the right order and manually load vehicles themselves, during the morning hours.
Parcel collection	The collection consists of return loads (broken, not needed, etc). Between 0 and max 5 items are collected per driver per day. There were a maximum of 74 parcels collected for all 11 drivers of TNT observed on one day on 23rd March. TNT is the business with the most volume on collection.
Working times and time windows for delivery	08:00-18:00 is the main time window for deliveries in Central London. The driver carries out the deliveries in the most logical geographical order. In a few cases, it is necessary for the driver to come back to the same street later in

	the delivery round to deliver to another client. This is due to delivery time windows that are not coherent for all clients in the same area. Typical day of operations at Gnewt Cargo is as follow: • 08:00 First drivers leave depot • 10:00 Almost all drivers are out on delivery trips • 18:00 Most drivers are back to the depots • 19:00-20:00 Last drivers are returning to the Gnewt Cargo depots
Trolley	2 wheel trolleys are in use by some drivers.
Walking	The pedestrian part of the delivery trip is important in terms of time and costs. Long walking times are standard. A driver can spend more than two thirds of the working day walking, or waiting for the client. At a maximum, one third of the working time is spent in the vehicle driving on the road. There is currently limited scope to reduce walking time and increase the driver productivity. One possibility would be to increase the number of parcels from different clients to be delivered to the same customer.
Van mileage and age	About 3,000 miles/year is the average distance travelled by each electric van. Fleet age is less than 4 years old.
GPS use	All vehicles are now equipped with a GPS on-board unit with data recording and telematics transferring geolocation to the head office. However, the accuracy of the localisation data is rather low, due to the poor conditions with the high rise buildings in Central London.
Handheld device, other IT and software, driver knowledge	Each carrier client gives Gnewt Cargo its own hand held device for signature and proof of delivery. No round optimisation or tour scheduling support system is in constant daily except during the trials of the Agile Category 2 project. Postcode order is finalised by the driver according to his knowledge. Driver knowledge takes about 2-3 months to build up which affects efficiency.
Mixing goods from clients into one single van	For the Category 3 demonstrators, Hermes vans were used to deliver a mix of goods from different clients e.g , Farmdrop and Emakers.

Source: Agile Cat 3 demonstrator, 2015-2016

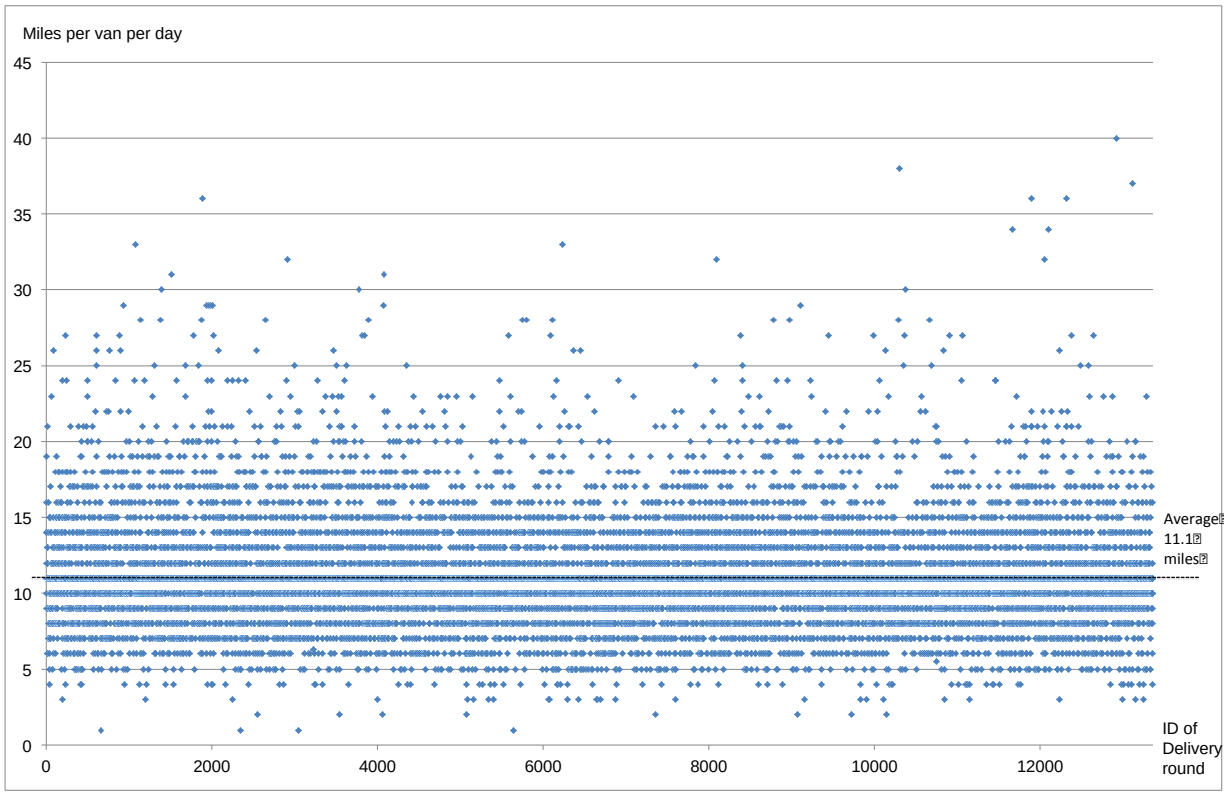
3.1.3 Distance driven and impact on London traffic

Figure 4 below shows the distance driven in miles per round per day. Each dot represents the distance covered in Central London by one driver driving one van during one working day.

The distance record is generated by 3 different data processing steps in the project Agile Cat 3:

- driver's manual entries,
- depot manager's entries
- Researcher's data cleaning, including verification and validation

Figure 4: Distance driven in miles per round per day, 1st July 2015 – 30 June 2016

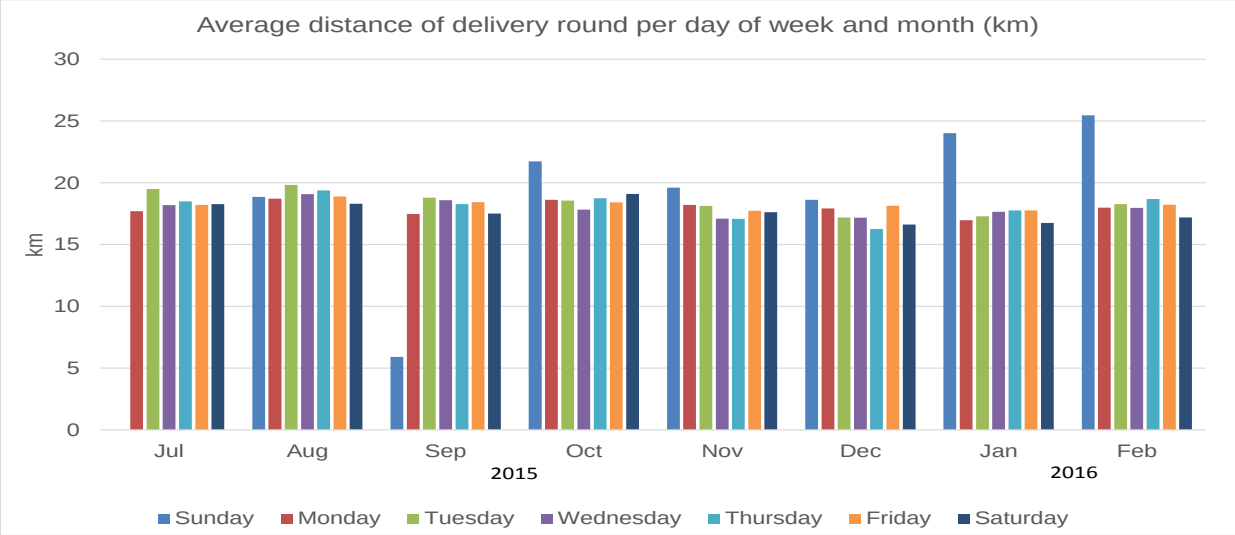


Source: Agile 3 demonstrator, 2015

The average distance per day is 11 miles (about 18 kilometres). For more than 95% of the trips, the daily distance was between 5 and 22 miles per van. The final report presents an analysis on causes and impacts on traffic in London.

We also looked at the average distance driven per day for an entire month (Figure 5). The values between the week-days are very stable, except for Sundays. The variations between months are also marginal, except for Sundays. The reason for the differences in Sunday values is the very low number of parcels delivered on that day.

Figure 5: Average distance of Hermes fleet per day and month

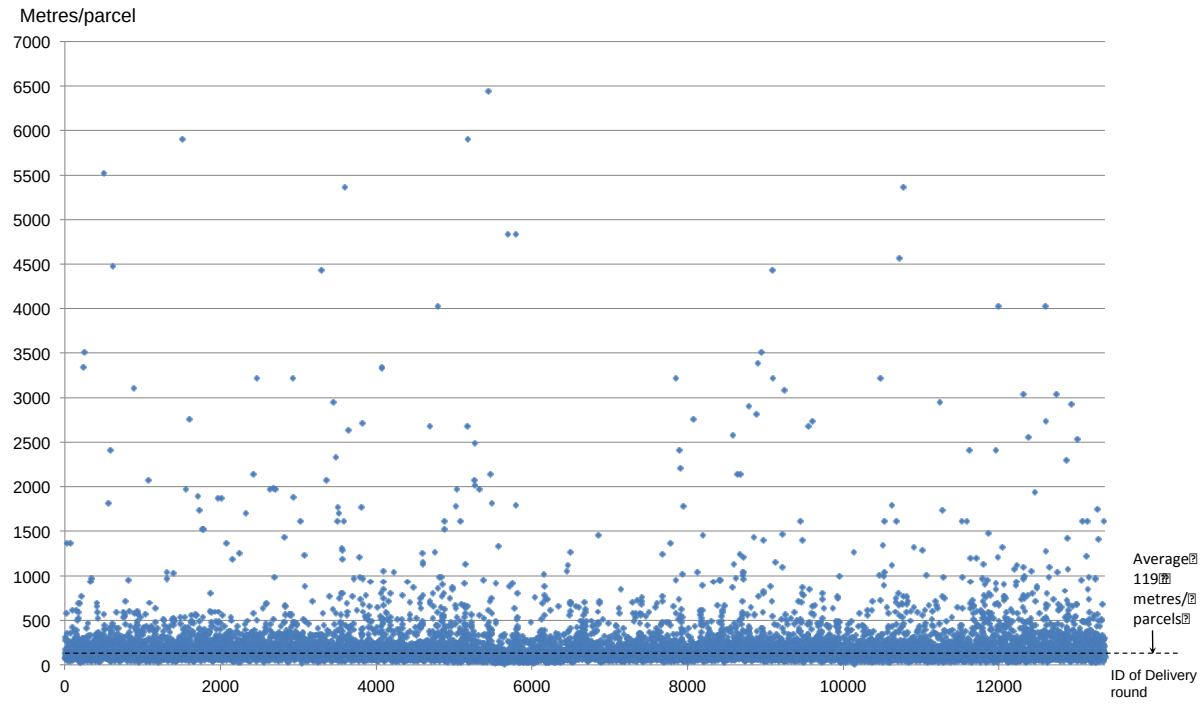


Source: Gnewt Cargo Agile Cat 3 demonstrator, 2015

3.1.4 Distance per parcel as key metrics for efficient logistics in London

Finally, the most important indicator for future improvements in London was the distance per parcel (Figures 6 and 7).

Figure 6: Metres per parcels delivered, 1st July 2015 – 30 June 2016

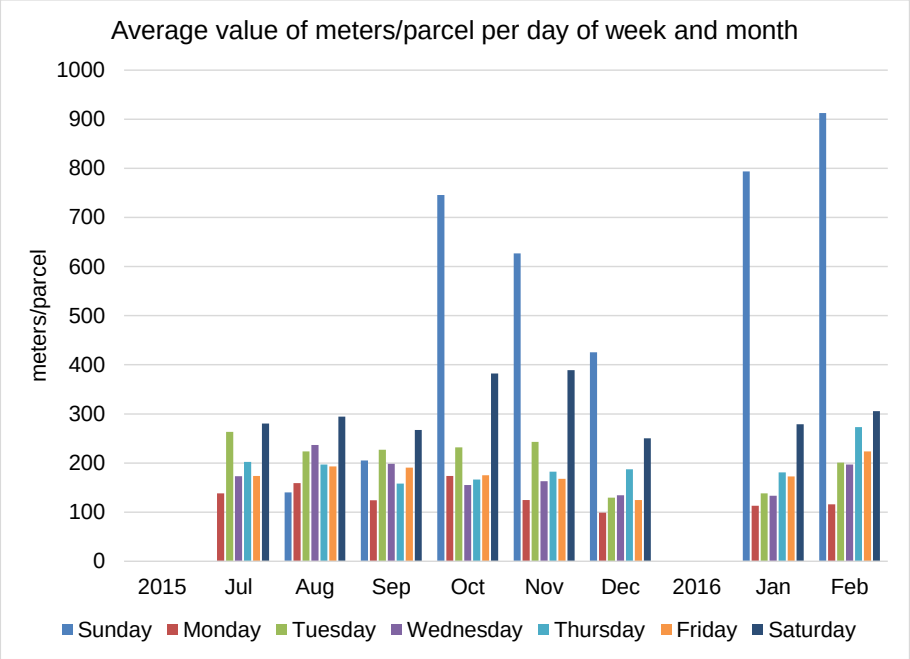


Source: Agile 3 demonstrator, 2015

If we look at the distance needed on average, the value obtained for Gnewt Cargo on its last mile trips for Hermes is 193 metres per parcel, when counting the total logistics system, and 119 metres per parcel, when observing only the distance driven with electric vehicles. Driving distance varies between

20 metres per parcel in dense areas and on busy days, and almost one kilometre per parcel in least dense areas and on less busy days.

Figure 7: Metres per parcel per day of week and month for the Hermes fleet

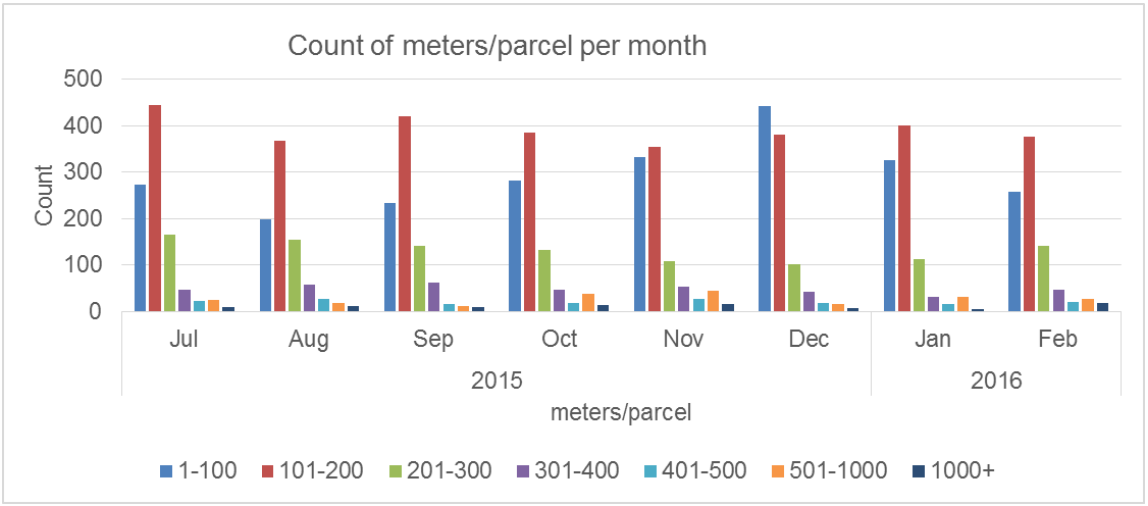


Source: Gnewt Cargo Agile Cat 3 demonstrator, 2015

Figure 7 shows that Sundays and Saturdays are less effective, due to the lower number of parcels per round. Mondays are slightly better than other weekdays, which might be explained with a higher number of parcels being delivered.

To confirm that a better performance is effectively realised when more parcels are delivered, the next graph (Figure 8) shows clearly that December has the shortest distance of all months. For this graph, all the Hermes trips of one month were counted according to their distance class.

Figure 8: Metres per parcel per month for Hermes deliveries, July 2015 to Feb 2016



Source: Gnewt Cargo Agile Cat 3 demonstrator

Again evidenced in Figure 8 are many round trips showing rather ineffective performances above 500 metres per parcel.

3.1.5 High completion rate is another key metric for efficient logistics in London

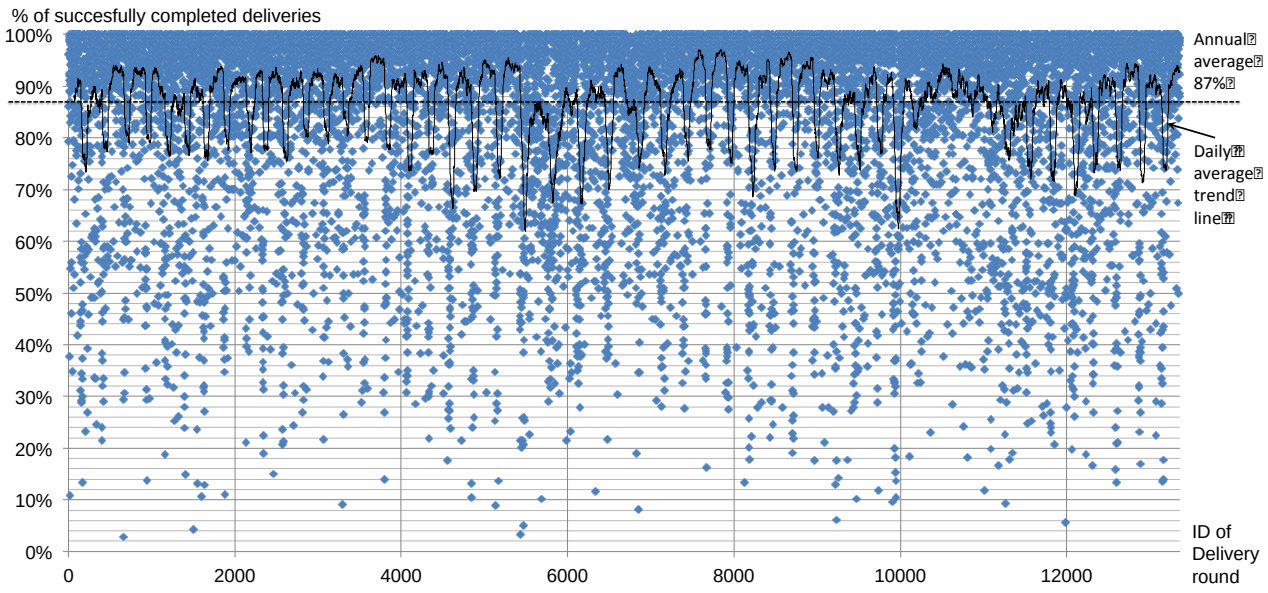
One of the key business indicators of performance is the metric "completion rate", in which we look at a percentage (%) for the number of parcels successfully delivered, compared to the total number of parcels loaded on the vehicle and planned to be delivered on that day. This completion rate factor is a comparison between target and achievement on a daily basis, for each driver.

Every transport service provider pursues the ideal to have a 100% completion rate, for which all drivers deliver all parcels successfully every day to all clients. In reality, a completion rate of 100% occurs for only 10-20% of all day trips; and a weekday score of 95-97% is very common and is considered a good result. In practice some parcel delivery service providers have been known for being very demanding on this criteria, and giving penalties to their drivers if more than 5 or even 3% of the parcels were not delivered.

The drivers of Gnewt Cargo performed an annual average of 87% for Hermes in the period, due to various reasons, for example lower completion rates on weekends.

When looking at the Figure 9 graph on completion rates, and the trend line showing an average for all vehicles each day, there is a clear dip at the end of each week. Positive is the rather constant average well above 90% for weekdays, the days with a much higher number of parcels.

Figure 9: Completion rate



Source: Gnewt Cargo Agile Cat 3 demonstrator

3.1.6 Working time per parcel

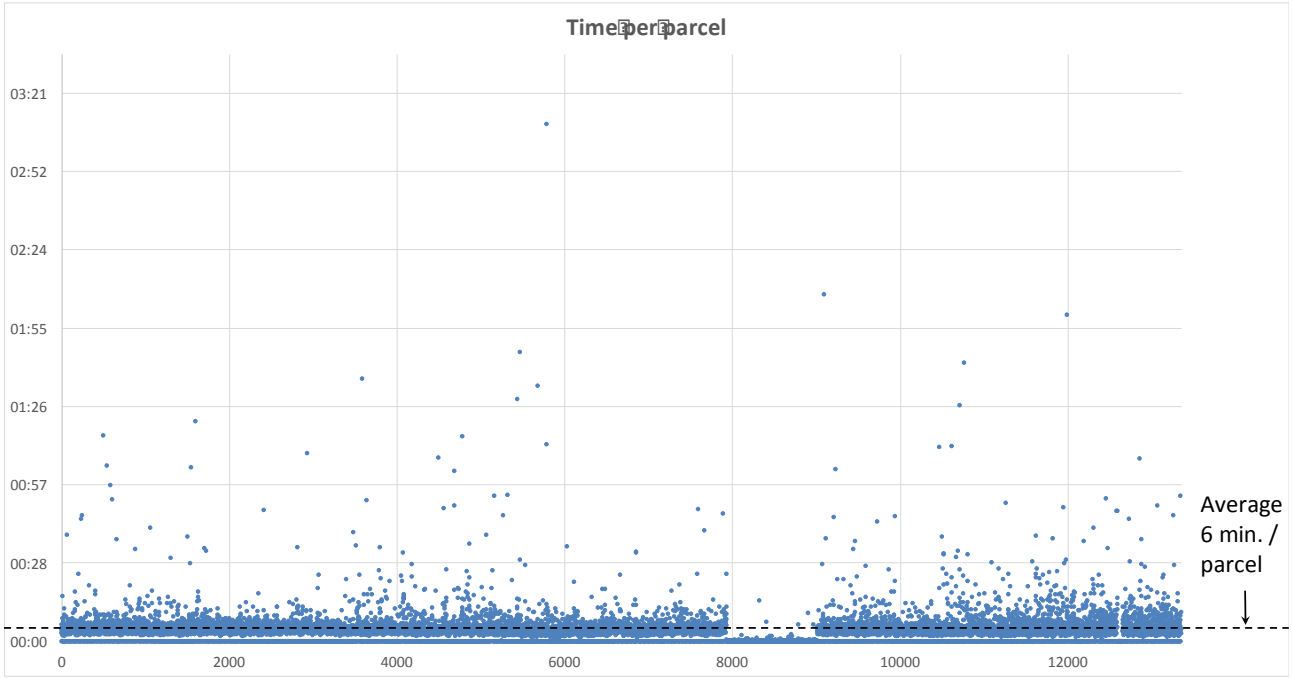
The calculation of the indicator "working time per parcel" accounts for all time spent from starting the work, loading the van, through to the end of duty in the evening divided by the number of parcels. This indicator is presented in Figure 10.

Transport time data is always difficult to collect and analyse. Difficulties occur in terms of accuracy and validation. To address this, all missing data were excluded. The remaining data cover the period 1 July 2015-30 June 2016, but with many interruptions.

Again, the average of 6 minutes per parcels hides the fact that there is a large variation between 1 minute and 50 minutes spent per parcel delivered. All very high values above 10 minutes per parcel occur at week-ends, this is due to the low number of parcels.

The data visualisation is like previous Figures: Each blue dot represents the daily average time per parcel, for one driver during one day making deliveries in Central London with one van (Figure 10).

Figure 10: Working time per parcel, daily average/van, 1 July 2015-30 June 2016



Source: Gnewt Cargo Agile Cat 3 demonstrator

These data are analysed in the final report of the Agile Cat 3 project.

3.2 Case Study 1: Data on consolidation into one depot and use of one electric vehicle for retail clients

Figure 11: Farmdrop electric vans

Source: Agile 3 demonstration

Figure 12: Farmdrop electric van at delivery site, May 2016

Source: Agile Gnewt Cargo Cat 3 demonstration

Main data collected and results of Case Study 1 are presented in following Tables.

Table 5: Addresses used in Case Study 1

Depot name	Address
Farmdrop depot	Drummond Road 100. SE16 4
Before Farmdrop LSP depot	Enfield, EN3
After Farmdrop main supplier depot	Enfield, EN3
Zara LSP depot before	Enfield, EN3
Pull&Bear LSP depot before	Enfield, EN3
Gnewt Cargo West Central	West Central Street
Gnewt Cargo Carlton House Terrace	Carlton House Terrace

Source: Agile 3 demonstrator 2016

3.2.1 Distance data

Table 6: Distances observed in Case Study 1

Distances of main trips	Miles	Km
Farmdrop delivery round per day before	16	26
Emakers Zara delivery round per day before	34	55
Emakers Pull&Bear delivery round per day before	34	55
Gnewt Cargo delivery round per day after	16	26
One way gnewt depot to Farmdrop depot	4	6
One way Farmdrop supplier to Farmdrop depot	10	16
One way Emakers Zara depot to Gnewt Cargo depot after	10	16
One way Emakers Pull&Bear to Gnewt Cargo depot after	10	16

Source: Agile 3 demonstration

3.2.2 Baseline data used for comparison BEFORE and AFTER

Table 7: Baseline data for Farmdrop, Zara, Pull&Bear deliveries starting from Enfield

Route ID	Depot start	Vehicle Type	MPG	Week distance in km	Parcels delivered during week	Distance in km/ parcel	l/100km	Total litres /week	Litres/ parcel	kgCO2e/ parcel
1	Farmdrop	Van	31	288	300	0.96	9.1	26.2	0.09	0.228
2	Farmdrop	Van	31	288	300	0.96	9.1	26.2	0.09	0.228
3	Farmdrop	Van	31	288	300	0.96	9.1	26.2	0.09	0.228
4	Farmdrop	Van	31	288	300	0.96	9.1	26.2	0.09	0.228
5	Farmdrop	Van	31	288	300	0.96	9.1	26.2	0.09	0.228
6	Farmdrop	Van	31	288	300	0.96	9.1	26.2	0.09	0.228
7	Zara	Van	31	274	300	0.91	9.1	24.9	0.08	0.217
8	Pull&Bear	Van	31	274	300	0.91	9.1	24.9	0.08	0.217

Source: Agile 3 demonstrator 2016

This data was collected with field observation and calculated using the standard UK conversion factor for carbon emissions (DEFRA 2016).

Table 8: Analysis of distance driven for Farmdrop deliveries, 17 Sept – 31 Dec 2015

	Number of vehicles	Total distance in km	Parcels delivered during period	Distance in km/ parcel
BEFORE: Farmdrop deliveries starting from Farmdrop depot				
Total	4	16,436	12,950	1.269
Average		4109	3238	1.269
AFTER: Gnewt trunking from Farmdrop depot + deliveries starting from Gnewt Cargo				
Truck	1	595	12,950	0.046
Electric Van	4	14,054	12,950	1.085
Total	4	14,649	12,950	1.131
Average				1.131
% Reduction		11		11

Source: Agile 3 demonstrator 2016

There is an 11% distance reduction attained for the Farmdrop retail business.

3.2.3 Energy data

Table 9: Energy use comparison of the Farmdrop demonstration

		Without Gnewt: Diesel van	With Gnewt: Diesel truck	With Gnewt: Nissan eNV200	With Gnewt: Total	Without-With reduction %
Distance	km	16,436	595	14054	14649	11
Electric energy used	kWh			2473		
	kWh/km			0,176		
Conversion factor	goe/kWh			85.984523		
Total period	litres	1,479	112		112	92
Conversion factor	goe/litre	845	845			
Total energy use	kgoe	1,250	95	213	307	75
Results energy per km	goe/km	76	159	31		90
Results energy per parcel	goe/parcel	97	7	16	24	75

Source: Agile 3 demonstrator 2016

Gnewt achieved a 75% energy use reduction for the Farmdrop retail business.

Table 10: One week analysis for energy use of electric and diesel vans, and diesel truck, Farmdrop case, Case Study 1

Indicator	Unit	Kangoo ZE	Diesel van before	Diesel truck after
Distance in one week	km	458	2,822	483
Electric energy used	kWh	119		
Electric energy efficiency	kWh/km	0.260		
Conversion factor	goe/kWh	121		
Total diesel in one week	litres		257	91
Conversion factor	goe/litre		845	845
Total energy use	kgoe	14	217	77
Results energy per km	goe/km	31	77	159
Results energy per parcel	goe/parcel	9.5	73	26

Source: Agile 3 demonstrator 2016

3.2.4 CO_2 reduction data

Gnewt calculates the carbon dioxide (CO_2) emissions with the DEFRA greenhouse gas conversion factor 2016, with 1 litre diesel = 2.61163 kg CO_2 equivalent ($kgCO_2e$).

Table 11: CO2 comparison of the Farmdrop demonstration of Gnewt Cargo

	Mpg	**l/ 100 km**	**Total litres**	**Litres/ parcel**	**kgCO2e/ parcel**
BEFORE: Farmdrop deliveries starting from Farmdrop depot					
Total 4 large vans		9	1479		
Average	31	9	374	0.11	0.298
AFTER: Gnewt trunking from Farmdrop depot + deliveries starting from Gnewt Cargo					
1 truck	15	18.8	112	0.01	0.023
4 Electric Vans		-	-		0
Total all vehicles			112		
Average all vehicles				0.009	0.023
Reduction in %			**92**	**92**	**92**

Source: Agile 3 demonstrator 2016

Gnewt achieved a 92% CO_2 emission reduction for the Farmdrop retail business.

3.2.5 Air pollutant reduction data

In the absence of average values for emissions of air pollutants of electric vehicles compared with diesel vehicles, it is assumed that the exhaust emissions of electric vans are down to zero. Gnewt is aware that particulate matters (PM) are emitted when driving on London roads due to tyres and brakes, but this cannot be quantified at the moment. The following target calculation is based on the values of the UK National Atmospheric Emission Inventory from 2011 (NAEI 2011).

Table 12: Emission factors used for air quality impacts calculation

	g/km	g/km
	NOx	PM10
Diesel truck	3.603	0.058
Diesel van	0.898	0.055

Source: NAEI 2011

To calculate this air pollutant impact, we took the kilometre distance per parcel and multiplied it with the emission factor per km. We observed only NOx and Particulates because these pollutants are widely considered to be the most harmful.

However, studies on health impacts of exhaust emissions show that there are many hundreds of harmful molecules emitted, and a reduction of these additional impacts can be considered as included into this target.

Table 13: Air pollutant emissions of the Farmdrop demonstration

BEFORE: Farmdrop deliveries starting from Farmdrop depot	**NOx g/ parcel**	**PM_{10} g/ parcel**
Truck	1.1401	0.0701
AFTER: Gnewt trunking from Farmdrop depot + deliveries starting from Gnewt Cargo		
Truck	0.1657	0.0027
Electric Van exhaust	0	0
Average	0.1657	0.0027
Reduction in %	***85***	***96***

Source: Agile 3 demonstrator 2016

Gnewt achieved a reduction of 85 % for NOx and 96% for Particulate Matter for the Farmdrop retail business.

3.2.6 Empty distance reduction data

There is a problem of inefficiency in urban logistics that is due to empty runs in London. One of the benefits achieved with the Gnewt concept is that the electric vans are returning empty from their last point of delivery to the Gnewt depot close by. The empty distance is reduced by 59%, shorter than usual because the depot is closer to the delivery area, due to its Central location.

Table 14: Empty distance reduction achieved for the Farmdrop demonstration

BEFORE: Farmdrop deliveries starting from Farmdrop depot	**Empty distance in km**
Truck	1191
AFTER: Gnewt trunking from Farmdrop depot + deliveries starting from Gnewt Cargo	
Truck	298
Electric Van	185
Total	483
Reduction in %	59

Source: Gnewt Cargo Cat 3 demonstrator 2016

3.3 Case Study 2: Gnewt Cargo TNT data

Figure 13: TNT van in use at Gnewt Cargo, May 2016

Source: Agile 3 demonstrator 2016

Main baseline and monitoring data collected and the intermediate results of Case Study 2 are presented in the following Tables.

Analyses and explanations are provided in the Final Report.

Table 15: Gnewt Cargo daily operations data at West Central St. 1-30 Sept 2015

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
01-sept-15	220	Boxer	55	108	284	18774	18,789	15	24	0.085
01-sept-15	221	RK Maxi	60	144	155	4253	4,264	11	18	0.114
01-sept-15	222	MB	74	105	155	5994	6,008	14	23	0.145
01-sept-15	224	MB	59	89	131	2231	2,240	9	14	0.111
01-sept-15	225	RK Maxi	73	132	143	2076	2,099	23	37	0.259
01-sept-15	230	RK Maxi	75	123	148	3623	3,636	13	21	0.141
01-sept-15	231	RK Maxi	74	127	148	3945	3,962	17	27	0.185
01-sept-15	232	RK Maxi	68	118	128	4621	4,640	19	31	0.239
01-sept-15	234	RK Maxi	72	148	157	4533	4,543	10	16	0.103
01-sept-15	235	RK Maxi	80	133	141	6834	6,864	30	48	0.342
01-sept-15	236	RK Maxi	71	128	145	4651	4,674	23	37	0.255
Total					**1,735**			**184**	**296**	
Average								17	27	0.180
02-sept-15	220	Boxer	31	55	55	0	0	8	13	0.234
02-sept-15	221	RK Maxi	52	79	91	4200	4,212	12	19	0.212
02-sept-15	222	MB	60	92	110	6008	6,023	15	24	0.219
02-sept-15	224	MB	54	69	80	2240	2,249	9	14	0.181
02-sept-15	225	RK Maxi	58	85	93	4760	4,781	21	34	0.363
02-sept-15	230	RK Maxi	51	68	91	3635	3,653	18	29	0.318
02-sept-15	231	RK Maxi	61	81	103	3959	3,975	16	26	0.250
02-sept-15	232	RK Maxi	45	70	79	4646	4,664	18	29	0.367
02-sept-15	234	RK Maxi	66	111	121	4549	4,559	10	16	0.133
02-sept-15	235	RK Maxi	50	88	90	6863	6,891	28	45	0.501
02-sept-15	236	RK Maxi	49	68	70	4674	4,701	27	43	0.621
Total					**983**			**182**	**293**	
Average								17	27	0.309
03-sept-15	220	Boxer	16	23	24	15761	15,767	6	10	0.402
03-sept-15	221	RK Maxi	65	88	106	3112	3,124	12	19	0.182
03-sept-15	222	MB	46	58	82	6023	6,039	16	26	0.314
03-sept-15	224	MB	53	61	70	2249	2,256	7	11	0.161
03-sept-15	225	RK Maxi	47	69	88	4781	4,801	20	32	0.366
03-sept-15	230	RK Maxi	61	85	106	3863	3,872	9	14	0.137
03-sept-15	231	RK Maxi	55	58	78	3975	3,990	15	24	0.309
03-sept-15	232	RK Maxi	41	71	72	4664	4,684	20	32	0.447
03-sept-15	234	RK Maxi	59	70	70	4559	4,575	16	26	0.368
03-sept-15	235	RK Maxi	55	82	96	6891	6,915	24	39	0.402
03-sept-15	236	RK Maxi	36	57	66	4701	4,723	22	35	0.536

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
Total					**858**			**167**	**269**	
Average								15	24	0.330
04-sept-15	220	Boxer	13	24	25			8	13	0.515
04-sept-15	221	RK Maxi	60	102	109	3,125	3,138	13	21	0.192
04-sept-15	222	MB	45	61	72	6,039	6,058	19	31	0.425
04-sept-15	224	MB	51	63	78	2,256	2,265	9	14	0.186
04-sept-15	225	RK Maxi	61	95	111	4,801	4,821	20	32	0.290
04-sept-15	230	RK Maxi	56	82	108	3,672	3,692	20	32	0.298
04-sept-15	231	RK Maxi	57	83	86	3,991	4,004	13	21	0.243
04-sept-15	232	RK Maxi	38	59	77	4,684	4,699	15	24	0.314
04-sept-15	234	RK Maxi	64	88	89	4,573	4,592	19	31	0.344
04-sept-15	235	RK Maxi	51	76	89	6,912	6,931	19	31	0.344
04-sept-15	236	RK Maxi	54	75	84	4,723	4,744	21	34	0.402
Total					**928**			**176**	**283**	
Average								16	26	0.323

Table 15 cont'd: Gnewt Cargo daily operations data at West Central St. 1-30 Sept 2015

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
07-sept-15	220	Boxer	22	30	33	11807	11812	5	8	0.244
07-sept-15	221	RK Maxi	61	93	132	3138	3153	15	24	0.183
07-sept-15	222	MB	56	75	105	6058	6074	16	26	0.245
07-sept-15	224	MB	65	79	121	2265	2275	10	16	0.133
07-sept-15	225	RK Maxi	52	67	77	4699	4716	17	27	0.355
07-sept-15	230	RK Maxi	60	90	108	3692	3716	24	39	0.358
07-sept-15	231	RK Maxi	55	74	109	4008	4029	21	34	0.310
07-sept-15	232	RK Maxi	36	63	76			8	13	0.169
07-sept-15	234	RK Maxi	82	123	127	4592	4615	23	37	0.291
07-sept-15	235	RK Maxi	29	52	60			8	13	0.215
07-sept-15	236	RK Maxi	72	103	105	4744	4766	22	35	0.337
Total					**1053**			**169**	**272**	
Average								15	25	0.258
08-sept-15	220	Boxer	7	26	26	4717	4722	5	8	0.309
08-sept-15	221	RK Maxi	58	72	79	3153	3168	15	24	0.306
08-sept-15	222	MB	48	62	68	6074	6091	17	27	0.402
08-sept-15	224	MB	55	61	69	2275	2285	10	16	0.233
08-sept-15	225	RK Maxi	47	61	63	4828	4847	19	31	0.485
08-sept-15	230	RK Maxi	33	46	50	3716	3732	16	26	0.515
08-sept-15	231	RK Maxi	67	93	112	4029	4036	7	11	0.101
08-sept-15	232	RK Maxi	36	64	79	4722	4744	22	35	0.448
08-sept-15	234	RK Maxi	41	65	69	4615	4641	26	42	0.606
08-sept-15	235	RK Maxi	55	79	81	6940	6965	25	40	0.497
08-sept-15	236	RK Maxi	53	67	86	4767	4790	23	37	0.430
Total					**782**			**185**	**298**	
Average								17	27	0.394
09-sept-15	220	Boxer	8	11	11	11487	11494	7	11	1.024
09-sept-15	221	RK Maxi	54	89	99	3168	3179	11	18	0.179
09-sept-15	222	MB	46	62	79	6091	6107	16	26	0.326
09-sept-15	224	MB	54	60	74	2285	2295	10	16	0.217
09-sept-15	225	RK Maxi	66	101	137	4848	4868	20	32	0.235
09-sept-15	230	RK Maxi	55	65	75	3732	3749	17	27	0.365
09-sept-15	231	RK Maxi	66	85	90	4043	4060	17	27	0.304
09-sept-15	232	RK Maxi	37	65	83	4744	4763	19	31	0.368
09-sept-15	234	RK Maxi	69	98	100	4641	4665	24	39	0.386
09-sept-15	235	RK Maxi	55	85	109	6965	6988	23	37	0.340

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
09-sept-15	236	RK Maxi	51	71	79	4790	4798	8	13	0.163
Total					**936**			**172**	**277**	
Average								16	25	0.355
10-sept-15	220	Boxer	7	21	21	15894	15900	6	10	0.460
10-sept-15	221	RK Maxi	64	94	99	3180	3192	12	19	0.195
10-sept-15	222	MB	51	63	86	6107	6124	17	27	0.318
10-sept-15	224	MB	56	76	107	2295	2304	9	14	0.135
10-sept-15	225	RK Maxi	54	71	86	4868	4888	20	32	0.374
10-sept-15	230	RK Maxi	41	60	75	3749	3766	17	27	0.365
10-sept-15	231	RK Maxi	49	74	84	4056	4072	16	26	0.307
10-sept-15	232	RK Maxi	48	74	81	4763	4777	14	23	0.278
10-sept-15	234	RK Maxi	64	88	88	4657	4673	16	26	0.293
10-sept-15	235	RK Maxi	50	83	88	6988	7018	30	48	0.549
10-sept-15	236	RK Maxi	59	82	84	4813	4831	18	29	0.345
Total					**899**			**175**	**282**	
Average								16	26	0.329
11-sept-15	220	Boxer	20	37	60	15911	15918	7	11	0.188
11-sept-15	221	RK Maxi	59	95	109			13	20	0.187
11-sept-15	222	MB	49	57	68	6124	6140	16	26	0.379
11-sept-15	224	MB	53	62	97	2304	2313	9	14	0.149
11-sept-15	225	RK Maxi	56	83	96	4888	4910	22	35	0.369
11-sept-15	230	RK Maxi	55	69	93	3766	3787	21	34	0.363
11-sept-15	231	RK Maxi	46	76	91	4071	4082	11	18	0.195
11-sept-15	232	RK Maxi	51	70	81	4777	4795	18	29	0.358
11-sept-15	234	RK Maxi	77	120	124	4674	4691	17	27	0.221
11-sept-15	235	RK Maxi	57	96	97	7018	7044	26	42	0.431
11-sept-15	236	RK Maxi	22	23	23	0	0	21	33	1.434
Total					**939**			**180**	**290**	
Average								16	26	0.389

Table 15 cont'd: Gnewt Cargo daily operations data at West Central St. 1-30 Sept 2015

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
14-sept-15	220	Boxer	17	73	88	4795	4801	6	10	0.110
14-sept-15	221	RK Maxi	68	131	134	3223	3233	10	16	0.120
14-sept-15	222	MB	75	102	109	6140	6154	14	23	0.207
14-sept-15	224	MB	60	115	149	2313	2322	9	14	0.097
14-sept-15	225	RK Maxi	61	98	117	4912	4936	24	39	0.330
14-sept-15	230	RK Maxi	65	74	91	3782	3812	30	48	0.531
14-sept-15	231	RK Maxi	71	103	118	5307	5327	20	32	0.273
14-sept-15	232	RK Maxi	60	91	108	4801	4819	18	29	0.268
14-sept-15	234	RK Maxi	75	118	125	4691	4703	12	19	0.154
14-sept-15	235	RK Maxi	67	108	118	7046	7064	18	29	0.245
14-sept-15	236	RK Maxi	72	105	110	4849	4867	18	29	0.263
Total					**1267**			**179**	**288**	
Average								16	26	0.236
15-sept-15	220	Boxer	4	10	10			6	10	0.966
15-sept-15	221	MB	57	78	93	3230	3244	14	23	0.242
15-sept-15	222	MB	69	112	127	6154	6168	14	23	0.177
15-sept-15	224	MB	65	79	83	2322	2333	11	18	0.213
15-sept-15	225	MB	54	82	88	4936	4962	26	42	0.475
15-sept-15	230	RK Maxi	44	79	89	3812	3834	22	35	0.398
15-sept-15	231	RK Maxi	55	78	81	3000	3011	11	18	0.219
15-sept-15	232	RK Maxi	35	49	51	4867	4890	23	37	0.726
15-sept-15	234	RK Maxi	62	99	103	4703	4720	17	27	0.266
15-sept-15	235	RK Maxi	30	44	53	7064	7081	17	27	0.516
15-sept-15	236	RK Maxi	49	63	64	4867	4890	23	37	0.578
Total					**842**			**184**	**296**	
Average								17	27	0.434
16-sept-15	221	MB	50	5	102	3242	3258	16	26	0.252
16-sept-15	222	MB	68	11	90	6168	6181	13	21	0.234
16-sept-15	224	MB	70	12	97	2334	2346	12	19	0.200
16-sept-15	225	MB	64	20	98	4968	4988	20	32	0.329
16-sept-15	231	RK Maxi	47	5	79	3839	3848	9	14	0.184
16-sept-15	232	RK Maxi	43	18	96	4847	4867	20	32	0.335
16-sept-15	234	RK Maxi	61	20	81	4720	4735	15	24	0.300
16-sept-15	235	RK Maxi	41	3	102	7081	7098	17	27	0.270
16-sept-15	236	RK Maxi	53	15	91	4890	4909	19	31	0.336
Total					**834**			**141**	**227**	
Average								16	25	0.271

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
17-sept-15	220	Boxer	13	25	25	4867	4873	6	10	0.386
17-sept-15	221	MB	56	82	110	3258	3270	12	19	0.176
17-sept-15	222	MB	56	96	113	6181	6195	14	23	0.199
17-sept-15	224	MB	56	74	100	4345	4359	14	23	0.225
17-sept-15	225	MB	55	76	100	4988	5006	18	29	0.290
17-sept-15	230	RK Maxi	49	69	86	3848	3860	12	19	0.225
17-sept-15	231	RK Maxi	55	73	86	?	?	7	11	0.131
17-sept-15	232	RK Maxi	36	50	78	4873	4892	19	31	0.392
17-sept-15	234	RK Maxi	70	95	97	4735	4751	16	26	0.265
17-sept-15	235	RK Maxi	61	92	101	7098	7121	23	37	0.366
17-sept-15	236	RK Maxi	57	84	87	4910	4930	20	32	0.370
Total					**983**			**161**	**259**	
Average								15	24	0.275
18-sept-15	220	Boxer			60			6	10	0.165
18-sept-15	221	MB	50	87	100			13	21	0.206
18-sept-15	222	MB	53	98	119			15	24	0.205
18-sept-15	224	MB			98			11	17	0.173
18-sept-15	225	MB	65	98	111			21	34	0.306
18-sept-15	230	RK Maxi	51	77	107			19	31	0.290
18-sept-15	231	RK Maxi	53	95	100			12	20	0.197
18-sept-15	232	RK Maxi	45	67	78			19	31	0.395
18-sept-15	234	RK Maxi	57	81	93			18	29	0.309
18-sept-15	235	RK Maxi	22	40	49			22	36	0.735
18-sept-15	236	RK Maxi	43	57	62			19	30	0.485
Total					**977**			**175**	**282**	
Average								16	26	0.315
21-sept-15	220	Boxer	19	33	34	4914	4919	5	8	0.237
21-sept-15	221	MB	67	144	173	3283	3295	12	19	0.112
21-sept-15	222	MB	82	137	153	6212	6225	13	21	0.137
21-sept-15	224	MB	61	111	158	2358	2368	10	16	0.102
21-sept-15	225	MB	57	105	120	5021	5037	16	26	0.215
21-sept-15	230	RK Maxi	57	76	90	3878	3891	13	21	0.232
21-sept-15	232	RK Maxi	42	55	62	4919	4935	16	26	0.415
21-sept-15	234	RK Maxi	78	155	170	4771	4785	14	23	0.133
21-sept-15	235	RK Maxi	41	78	81	7133	7145	12	19	0.238
21-sept-15	236	RK Maxi	61	106	108	4950	4964	14	23	0.209
Total					**1149**			**125**	**201**	
Average								13	20	0.203

Table 15 cont'd: Gnewt Cargo daily operations data at West Central St. 1-30 Sept 2015

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
22-sept-15	220	Boxer	38	65	70			0	0	0.000
22-sept-15	221	MB	68	93	112	3295	3307	12	19	0.172
22-sept-15	222	MB	50	76	93	6225	6239	14	23	0.242
22-sept-15	224	MB	58	87	138	2369	2378	9	14	0.105
22-sept-15	225	MB	52	90	120	5037	5057	20	32	0.268
22-sept-15	230	RK Maxi	57	87	103	3891	3904	13	21	0.203
22-sept-15	231	RK Maxi	29	45	49	4218	4225	7	11	0.230
22-sept-15	232	RK Maxi	52	76	87	4942	4960	18	29	0.333
22-sept-15	234	RK Maxi	56	86	100	4785	4808	23	37	0.370
22-sept-15	235	RK Maxi	54	80	92	7145	7170	25	40	0.437
22-sept-15	236	RK Maxi	41	54	64	4964	4984	20	32	0.503
Total					**1028**			**161**	**259**	
Average								15	24	0.260
23-sept-15	221	MB	71	112	124	3307	3318	11	18	0.143
23-sept-15	222	MB	77	136	155	6239	6254	15	24	0.156
23-sept-15	224	MB	64	86	128	2378	2384	6	10	0.075
23-sept-15	225	MB	58	96	119	5057	5072	15	24	0.203
23-sept-15	230	RK Maxi	49	84	116	3904	3919	15	24	0.208
23-sept-15	231	RK Maxi	51	68	87	4225	4232	7	11	0.129
23-sept-15	232	RK Maxi	45	72	94	4960	4966	6	10	0.103
23-sept-15	234	RK Maxi	67	96	98	4823	4840	17	27	0.279
23-sept-15	235	RK Maxi	57	105	111	7171	7199	28	45	0.406
23-sept-15	236	RK Maxi	55	75	99	4984	5001	17	27	0.276
Total					**1131**			**152**	**244**	
Average								14	22	0.204
24-sept-15	220	RK Maxi	75	125	135	4528	4540	12	19	0.143
24-sept-15	221	MB	73	111	122	3318	3330	12	19	0.158
24-sept-15	222	MB	78	94	110	6254	6266	12	19	0.176
24-sept-15	224	MB	41	81	119	2380	2390	10	16	0.135
24-sept-15	225	MB	61	88	109	5072	5090	18	29	0.266
24-sept-15	230	RK Maxi	50	76	81	3919	3935	16	26	0.318
24-sept-15	232	RK Maxi	47	77	87	4985	5003	18	29	0.333
24-sept-15	234	RK Maxi	63	82	93	4850	4868	18	29	0.311
24-sept-15	235	RK Maxi	60	103	123	7199	7214	15	24	0.196
24-sept-15	236	RK Maxi	48	71	73	5001	5017	16	26	0.353
Total					**1052**			**161**	**259**	
Average								15	24	0.236

Table 15 cont'd: Gnewt Cargo daily operations data at West Central St. 1-30 Sept 2015

Date	Round	Van Type	Stops	Cons	Pieces	Mileage start	Mileage end	miles	km	km/parcel
25-sept-15	221	MB	61	91	101	3330	3340	10	16	0.159
25-sept-15	222	MB	50	68	93	6266	6278	12	19	0.208
25-sept-15	224	MB	70	94	126	2389	2399	10	16	0.128
25-sept-15	225	MB	57	100	126	5090	5112	22	35	0.281
25-sept-15	230	RK Maxi	44	67	81	3945	3956	11	18	0.219
25-sept-15	231	RK Maxi	53	85	96	4275	4291	16	26	0.268
25-sept-15	232	RK Maxi	52	78	89	5003	5026	23	37	0.416
25-sept-15	234	RK Maxi	62	88	99	4860	4880	20	32	0.325
25-sept-15	235	RK Maxi	53	73	75	7219	7243	24	39	0.515
25-sept-15	236	RK Maxi	57	83	85	5016	5038	22	35	0.417
Total					**971**			**170**	**274**	
Average								17	27	0.294
29-sept-15	220	Boxer	40	58	66	4309	4321	12	19	0.293
29-sept-15	221	MB	70	84	126	3377	3389	12	19	0.153
29-sept-15	222	MB	51	66	103	6290	6308	18	29	0.281
29-sept-15	224	MB	63	75	89	2408	2418	10	16	0.181
29-sept-15	225	MB	54	78	86	5134	5153	19	31	0.356
29-sept-15	230	RK Maxi	39	68	101	3981	3995	14	23	0.223
29-sept-15	232	RK Maxi	38	59	63	5053	5072	19	31	0.485
29-sept-15	234	RK Maxi	57	82	86	4892	4909	17	27	0.318
29-sept-15	235	RK Maxi	44	77	81	7260	7282	22	35	0.437
29-sept-15	236	RK Maxi	50	68	71	5067	5083	16	26	0.363
Total					**872**			**159**	**256**	
Average								16	26	0.309
30-sept-15	221	MB	60	92	101	3391	3402	11	18	0.175
30-sept-15	220	RK Maxi			60	5072	5078	6	10	0.161
30-sept-15	222	MB	54	61	69	6308	6325	17	27	0.397
30-sept-15	224	MB	55	104	133	2418	2423	5	8	0.061
30-sept-15	225	MB	59	80	84	5152	5168	16	26	0.307
30-sept-15	230	RK Maxi	63	92	109	4015	4039	24	39	0.354
30-sept-15	231	RK Maxi	42	0	89	4321	4333	12	19	0.216
30-sept-15	232	RK Maxi	48	66	87	5078	5098	20	32	0.370
30-sept-15	234	RK Maxi	66	96	97	4909	4923	14	23	0.232
30-sept-15	235	RK Maxi	52	74	81	7290	7305	15	24	0.298
30-sept-15	236	RK Maxi	59	75	82	5083	5104	21	34	0.412
Total					**992**			**161**	**259**	
Average								15	24	0.271

Source: Agile 3 data

Vehicle specification data for the diesel fleet used at TNT Barking depot is presented in Table 16.

Table 16: Fleet specifications. TNT Barking depot. baseline data. September 2015

Vehicle type	Truck	MB Sprinter	Box van Luton
Gross Vehicle Weight	7.5t	3.5t	3.5t
Length in metre	5.18	3.4	4
Width in metre	2.31	1.7	2
Height in metre	2.16	1.7	2.2
Payload (load capacity by weight) in kg	2,500	1,200-1,500	1,100 -1,200

Source: Agile 3 data

Table 17: Gnewt Cargo weekly logistics data September 2015, West Central Street depot

Week 1: Tuesday 1- Saturday 5 Sept	Mileage reading at start on first day	Mileage at end of last day	Week distance in miles	Week distance in km	Average parcels/ day delivered during week	Distance in km/ parcel
1	4,040	4,121	81	130	99	0.263
2	4,771	4,863	92	148	90	0.329
3	3,789	3,855	66	106	98	0.217
4	6,923	7,015	92	148	110	0.269
5	4,561	4658	97	156	104	0.300
6	4,739	4,832	93	150	90	0.333
7	4,229	4,326	97	156	110	0.284
8	2,231	2,289	58	93	141	0.132
9	3,170	3,229	59	95	114	0.167
10	6,104	6,160	56	90	104	0.173
Total van 1-10			791	1,273	5,300	
Average						0.240
Week 2: Mon 7- Sat 12 Sep	**Mileage reading at start on first day**	**Mileage at end of last day**	**Week distance in miles**	**Week distance in km**	**Average parcels/ day delivered during week**	**Distance in km/ parcel**
1	4,121	4,199	78	126	98	0.256
2	4,863	4,960	97	156	95	0.329
3	3,855	3,923	68	109	99	0.221
4	7,015	7,112	97	156	109	0.286
5	4,658	4,749	91	146	101	0.290
6	4,832	4,929	97	156	93	0.336
7	4,326	4425	99	159	110	0.290
8	2,289	2,339	50	80	130	0.124
9	3,229	3,291	62	100	119	0.168
10	6,160	6,221	61	98	112	0.175
Total van 1-10			800	1,287	5,330	
Average						0.242

Week 3: Mon 14-Sat 19	Mileage reading at start on first day	Mileage at end of last day	Week distance in miles	Week distance in km	Average parcels/ day delivered during week	Distance in km/ parcel
1	4,199	4,276	77	124	99	0.250
2	4,960	5,056	96	154	91	0.340
3	3,923	3,995	72	116	101	0.229
4	7,112	7,222	110	177	114	0.311
5	4,749	4,842	93	150	103	0.291
6	4,929	5,023	94	151	89	0.340
7	4,425	4,521	96	154	113	0.273
8	2,339	2,386	47	76	134	0.113
9	3,291	3,352	61	98	121	0.162
10	6,221	6,284	63	101	115	0.176
Total van 1-10			809	1,302	5,400	
Average						0.241

Source: Agile 3 demonstrator, 2015

Table 17 cont'd: Gnewt Cargo weekly logistics data September 2015, West Central Street depot

Week 4: Mon 21-Sat 26	Mileage reading at start on first day	Mileage at end of last day	Week distance in miles	Week distance in km	Average parcels/ day delivered during week	Distance in km/ parcel
1	4276	4355	79	127	96	0.265
2	5056	5151	95	153	88	0.347
3	3995	4062	67	108	94	0.229
4	7222	7330	108	174	112	0.310
5	4842	4933	91	146	104	0.282
6	5023	5115	92	148	88	0.336
7	4521	4619	98	158	115	0.274
8	2386	2431	45	72	137	0.106
9	3352	3412	60	97	122	0.158
10	6284	6352	68	109	119	0.184
Total van 1-10			803	1292	5375	
Average						0.240
Week 5: Mon 28-Wed 30	**Mileage reading at start on first day**	**Mileage at end of last day**	**Week distance in miles**	**Week distance in km**	**Parcels delivered during week**	**Distance in km/ parcel**
1	4355	4437	82	132	97	0.176
2	5151	5243	92	148	84	0.176
3	4062	4128	66	106	94	0.176
4	7330	7434	104	167	104	0.176
5	4933	5028	95	153	112	0.176
6	5115	5204	89	143	86	0.176
7	4619	4710	91	146	119	0.176

8	2431	2476	45	72	134	0.176
9	3412	3469	57	92	126	0.176
10	6352	6417	65	105	121	0.176
Total van 1-10			786	1265	5385	
Average						0.235

Source: Agile Gnewt Cargo Cat 3 demonstration

Table 18: Monthly average Gnewt Cargo business. West Central Street

van 1-10 1-30 Sep 2015	Month distance in miles	Month distance in km	Parcels delivered during Month	Distance in km/ parcel
Total	3989	6420	26790	
Average				0.240

Source: Agile Gnewt Cargo Cat 3 demonstration

Table 19: TNT logistics data for the Barking depot. (BEFORE dataset) September 2015

Week 36: Tuesday 1-Saturday 5 Sept	**Week distance in miles**	**Week distance in km**	**Parcels delivered during week**	**Distance in km/ parcel**
143	225	363	425	0.852
144	261	420	417	1.007
145	248	399	427	0.934
146	275	443	532	0.832
147	118	190	422	0.450
148	259	417	562	0.741
150	483	777	562	1.381
151	192	308	509	0.605
152	212	342	507	0.674
153	322	518	589	0.879
Total van 1-10	2595	4176	4953	
Average				0.843
Week 37: Monday Saturday Sept	**Week distance in miles**	**Week distance in km**	**Parcels delivered during week**	**Distance in km/ parcel**
143	282	453	614	0.738
144	385	619	539	1.148
145	314	505	532	0.949
146	336	541	664	0.815
147	149	240	529	0.454
148	248	399	692	0.577
150	604	971	634	1.533
151	240	386	571	0.675
152	266	427	698	0.612
153	415	668	879	0.760

Total van 1-10	3238	5211	6352	
Average				0.820
Week 38	**Week distance in miles**	**Week distance in km**	**Parcels delivered during week**	**Distance in km/ parcel**
143	282	453	619	0.732
144	418	673	491	1.371
145	312	502	584	0.861
146	264	425	598	0.710
147	157	253	523	0.483
148	251	404	719	0.562
150	604	971	534	1.819
151	237	381	554	0.688
152	211	339	564	0.601
153	402	648	819	0.791
Total van 1-10	3138	5049	6005	
Average				0.841

Table 19 cont'd: TNT logistics data for the Barking depot. (BEFORE dataset) September 2015

Week 39	**Week distance in miles**	**Week distance in km**	**Parcels delivered during week**	**Distance in km/ parcel**
143	282	453	635	0.713
144	264	425	566	0.750
145	320	515	584	0.883
146	328	528	735	0.719
147	148	238	522	0.457
148	209	336	716	0.470
150	602	969	655	1.479
151	240	386	579	0.667
152	269	433	554	0.781
153	417	671	742	0.904
Total van 1-10	3,078	4,954	6,286	
Average				0.788
Week 40	**Week distance in miles**	**Week distance in km**	**Parcels delivered during week**	**Distance in km/ parcel**
143	293	471	529	0.892
144	322	518	559	0.927
145	351	565	600	0.941
146	389	627	660	0.949
147	160	258	566	0.455
148	256	412	812	0.508

150	604	971	668	1.455
151	241	389	621	0.625
152	266	427	721	0.593
153	385	619	755	0.820
Total van 1-10	*3,266*	*5,256*	*6,489*	
Average				*0.810*

Source: Gnewt Cargo Cat 3 demonstrator, 2015

Table 20: Monthly summary TNT business, Barking depot, September 2015

	Month distance in miles	**Month distance in km**	**Parcels delivered during Month**	**Distance in km/ parcel**
Total	15,315	24,647	30,089	
Average / day	73	117	143	0.820

Source: Gnewt Cargo Cat 3 demonstrator, 2015

Table 21: Comparison of similar Gnewt Cargo and TNT delivery businesses in Central London

1 Sept 2015 – 30 Sept 2015	**Parcel units**	**Miles**	**Km**	**Km/parcel**
Gnewt Cargo (TNT international) delivery journeys	21211	3519	5663	
Average Gnewt (TNT international) delivery distance				0.267
Total TNT domestic deliveries	30089	15315	24647	
Average TNT domestic distance				0.820
Truck journeys TNT to Gnewt	21211	924	1487	
Average truck journeys TNT to Gnewt				0.070
Total Gnewt + Truck journey	21211	4443	7150	
Average Gnewt + Truck journey distance				0.337
Reduction in %		**71**	**71**	**59**

Source: Gnewt Cargo Cat 3 demonstrator, 2015

3.3.1 Distance data in Sept 2016 (AFTER)

In Sept 2016, Gnewt Cargo had an average distance per parcel of 267 metres for the TNT international business. As can be seen in Table 14, TNT had in September 2015 an average last mile distance of 792 metres per parcel, driven between depot and final point of distribution. As of September 2016, the TNT distance was observed only for 10 rounds, and the average was 820 metres per parcel.

When looking at the situation in September 2016, with the two distribution systems compared and presented, the distance reduction between the two last mile trips of TNT and Gnewt is shown below (Table 22). As in previous case studies, the baseline data showed longer distances for conventional distribution.

Table 22: Distance of TNT and Gnewt Cargo business analysis, Sept 2016

Distances	Miles	Km
Average TNT delivery round per day before	73	117
Average Gnewt Cargo delivery round per day after	16	26

Source: Gnewt Cargo Cat 3 demonstrator, 2016

3.3.2 Distance and fleet reduction of TNT demonstration: target data

The number of trips observed was 10 delivery trips per day for 10 diesel vans run by TNT UK for the domestic business and 10 delivery trips per day for 10 electric vans run by Gnewt Cargo for the international business (Table 23).

There was a 67 % distance reduction observed between TNT domestic business operated by TNT from the depot in Barking and the TNT international business operated by Gnewt Cargo. This reduction was measured in km/ parcel, and not as an overall distance reduction. The observed vehicles drove a much shorter distance to do the same job.

There was an overall total distance reduction of 77%. The current business volume (number of parcels) of TNT domestic was higher than TNT international. The detailed results of the before-after distance analysis are presented in Table 23.

Table 23: TNT distance reduction, before-after comparison, September 2016

BEFORE deliveries starting from Barking	Number of vehicle trips	mpg	Monthly distance in km	Parcels delivered during month	Distance in km/ parcel
Van TNT domestic	10		24,647	30,089	
Average		31			0.82
AFTER Gnewt Cargo operations					
Electric Van Gnewt	10	-	5663	21,211	0.267
Total	10		5663	21,211	0.267
Average					0.267
% reduction	**0**		**77**		**67**

Source: Gnewt Cargo Cat 3 demonstrator, 2016

The beneficial results were strongly influenced by the location of the depots and this will probably not change. So, the final target achievement figures seem rather robust. For example, if the number of vehicles switched from Barking to Bermondsey increases in the future, it is likely that the benefits will be similar.

3.3.3 CO_2 and air pollutant reduction data

Baseline data in Table 24 shows levels of CO_2 emitted by diesel vehicles that are rather normal for London logistics activities.

The CO_2-emissions for 20 routes and 5 weeks were about 12 tonnes in September 2015. The average value of 220 grams of CO_2 per parcel for TNT is an average baseline value. Using this average value, the 2 million parcels a year that Gnewt Cargo represents, would mean that a total CO_2 emission of 440 tonnes per year can be potentially fully avoided. This example shows how the potential future reduction might occur if the Gnewt Cargo logistics solution, or a similar system, was further developed in London.

The climate impact of the changed routes occurring in the TNT distribution system is a 100% CO_2 reduction, because no diesel truck is used to transport the goods between the TNT depot and the Gnewt Cargo depot. So the last mile operation under observation and for which the data collection occurred was 100% electric.

Fuel use before was 0.07 litre per parcel, equalling 0.195 kilograms of CO_2 equivalent per parcel (kg CO_2/parcel), and this represents a value that is similar to other diesel vans in urban logistics. The lowest CO_2 emissions measured before as an average of one day, was 47 grams of CO_2e per parcel and the maximum was a daily round with an average of 2.38 kgCO_2 per parcel.

Table 24: TNT CO_2 reduction, before-after comparison, September 2016

BEFORE deliveries starting from Barking	**Number of vehicle trips**	**l/ 100km**	**Total litre/month**	**Litres/ parcel**	**kgCO2e/ parcel**
Van TNT domestic	10		2,243		
Average		9		0.07	0.195
AFTER Gnewt Cargo operations					
Electric Van Gnewt	10	-	-		
Total	10				
Average			0	0	0
% reduction	**0**		**100**	**100**	**100**

Source: Gnewt Cargo Cat 3 demonstrator, 2016

The number of vehicles in use was stable for the Gnewt Cargo business after the changes, due to the use of the electric vans directly starting from the TNT depot in Bermondsey.The distance travelled was reduced by 77%. This had a strong impact on traffic and on costs, and it is estimated that travel times were also reduced. The cost reduction and the traffic reduction will be monitored further if the implementation is extended in the future.

The total fuel use and CO_2 emissions per parcel were reduced by 100% in the situation after, due to the 100% electric vehicle fleet in use from the TNT depot. The air pollutant emissions of PM10 and NOx also decreased by 100% for the same reason. (As a reminder, only the tailpipe emissions are considered, as no data is available on any other air pollutant emissions from electric vehicles. It is likely that rubber contact with asphalt produces emissions, but the amount is unknown at this stage).

The energy use expressed in goe/parcel takes into account the diesel energy of the diesel vans and compares it with the kWh energy of the electric vans. The value of 87% reduction in energy use per parcel was even higher than the reduction in total distance driven (77%). The conversion factors are the same than for Case Study 1, see above.

3.3.4 Energy reduction: target analysis

Table 25: Energy reduction for the TNT demonstration, September 2016

BEFORE deliveries starting from Barking	**Number of vehicle trips**	**goe/ parcel**
Van TNT domestic	10	
Average		63
AFTER Gnewt Cargo operations		
Electric Van Gnewt	10	8.4
% reduction	**0**	**87**

Source: Gnewt Cargo Cat 3 demonstrator, 2016

3.3.5 Empty distance reduction: target analysis

The empty distance was much reduced as well (93%) due to the fact that electric vans were only empty between the last drop and the return to depot. This empty distance was estimated as 1 km per van per day.

The van trip back to the TNT depot in Barking was an empty return, except when the delivery trips were combined with a collection trip, which is estimated to occur in one tenth of all trips. The empty distance for TNT in Barking is estimated to be 16 km, and the empty trip is counted when starting from the last delivery point of the day, for the part of the journey going back to the depot.

Table 26: Reduction in empty distance for the TNT demonstration, September 2016

BEFORE deliveries starting from Barking	**Number of vehicle trips**	**Monthly empty distance in km**
Van TNT domestic	10	2,984
Average		
AFTER Gnewt Cargo operations		
Electric Van Gnewt	10	210
Total	10	210
Average		
% reduction	0	93

Source: Gnewt Cargo Cat 3 demonstrator, 2016

Potential strategies that might change or greatly improve the KPI "empty distance" in future are:

- more parcel collections (after the end or during the same delivery trip)
- parking some Gnewt Cargo vehicles at the TNT depot overnight.

3.4 Case Study 3: Testing the Fitness for Purpose of Different Electric Vehicles for Different Clients

Gnewt Cargo has a fleet of different battery electric vehicles comprising mainly Renault Kangoo ZE, Nissan e-NV200. A few other types of older electric vans, cars and cycles are in use or were in use during the period of the Agile project: Mercedes eVito, Peugeot Boxer, Goupil G3, Toyota Yaris. Gnewt Cargo is testing a very small number of these other types of vehicles, so that the trial of an individual vehicle cannot lead to results that are representative for the fleet of the entire area of Greater London. Tests details on Renault and Nissan are available for a great number of vehicles and for more than one year, allowing a more robust validation.

In this section, data from two statistics sources are used: The European Alternative Fuel Observatory, and the Department for Transport in UK.

3.4.1 Market development is still at a very early stage

The market for light goods vehicles with Battery Electric propulsion is very young. Statistics are available from 2011 from the European Alternative Fuel Observatory. In 2016, data was extracted for new registrations of goods transport vans <3.5t in Europe (Table 27, Figure 14).

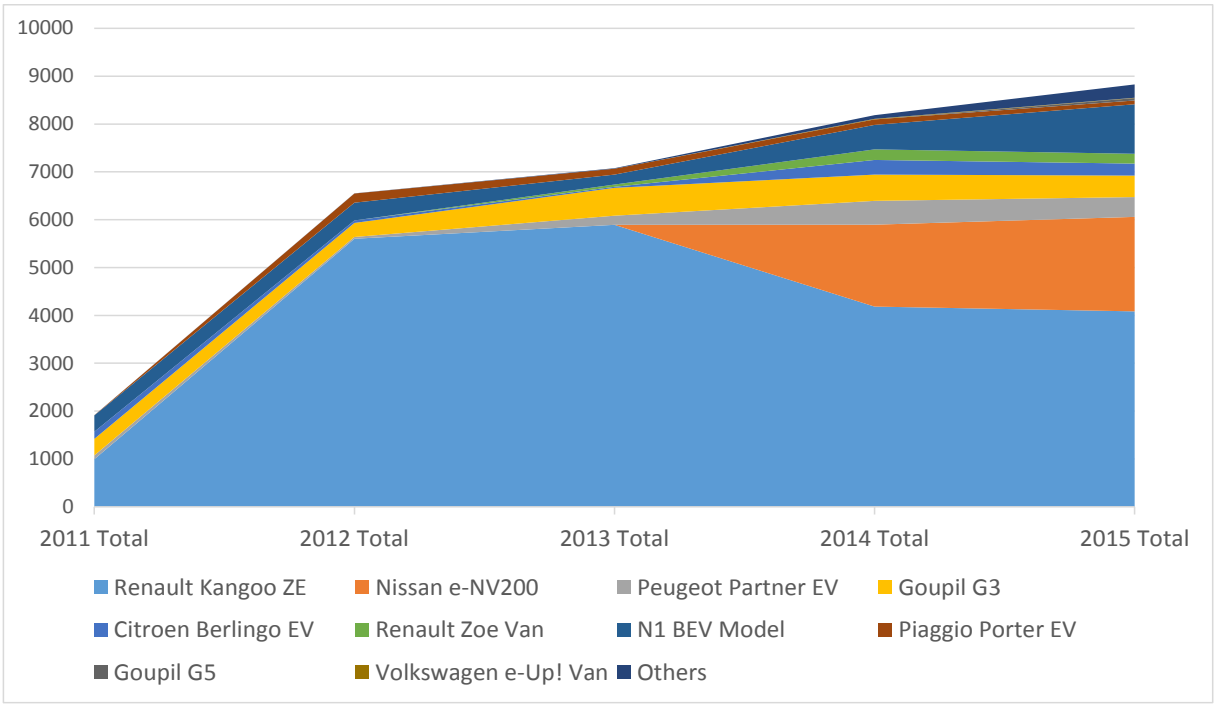
Table 27: Light Commercial Vehicles - Battery Electric Vehicles – new registrations in EU

Ranking	Make	Model	2015 Total	2014 Total	2013 Total	2012 Total	2011 Total
1	Renault	Kangoo ZE	4084	4184	5893	5602	994
2	Nissan	e-NV200	1975	1712	0	0	0
3	Peugeot	Partner EV	414	498	191	37	80
4	Goupil	G3	449	549	582	293	345
5	Citroen	Berlingo EV	251	306	22	52	149
6	Renault	Zoe Van	205	221	47	0	0
7	Unknown	N1 BEV Model	1035	512	208	372	341
8	Piaggio	Porter EV	79	114	123	192	3
9	Goupil	G5	50	0	0	0	0
10	Volkswagen	e-Up! Van	7	12	0	0	0
Others			279	77	11	3	2
Total			**8,828**	**8,185**	**7,077**	**6,551**	**1,914**

Source: European Alternative Fuel Observatory 2016 http://www.eafo.eu/vehicle-statistics/n1

In Europe, the year on year growth rate of new registrations was 8% in 2013, 16% in 2014 and 8% in 2015.

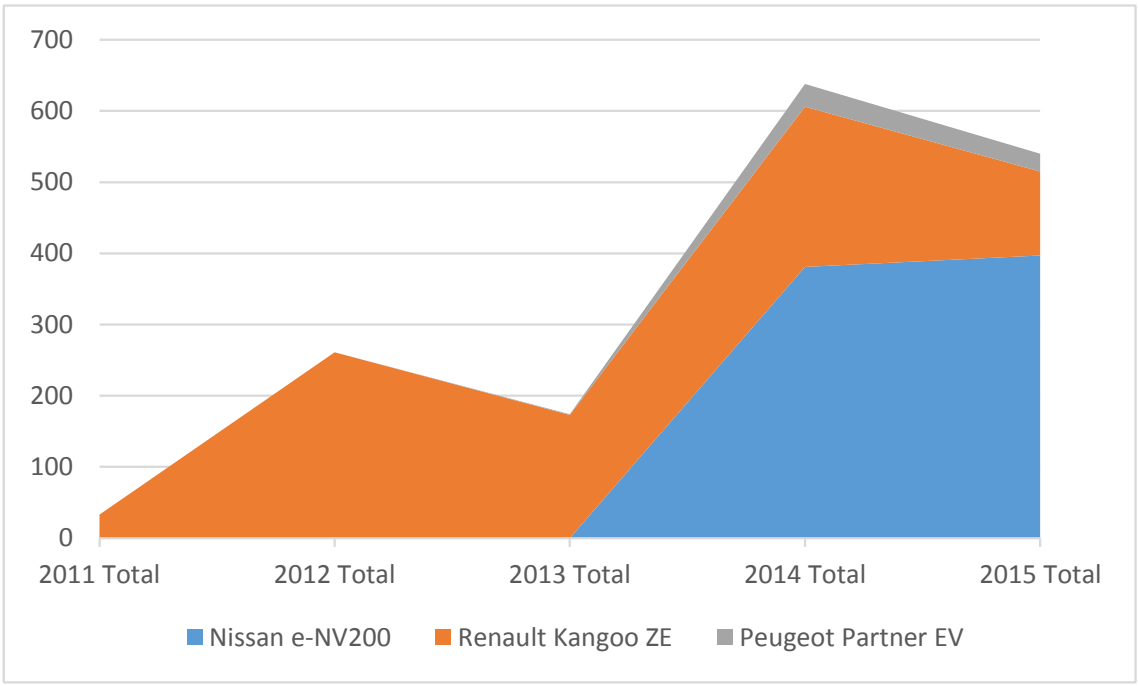
Figure 14: Development of new registrations of Battery Electric Light Commercial Vehicles in Europe, 2011-2015



Source: European Alternative Fuel Observatory 2016

For the UK market, the two main types of vehicles newly registered in recent years are the same ones in use at Gnewt Cargo: Renault Kangoo ZE and Nissan e-NV200 (Figure 15).

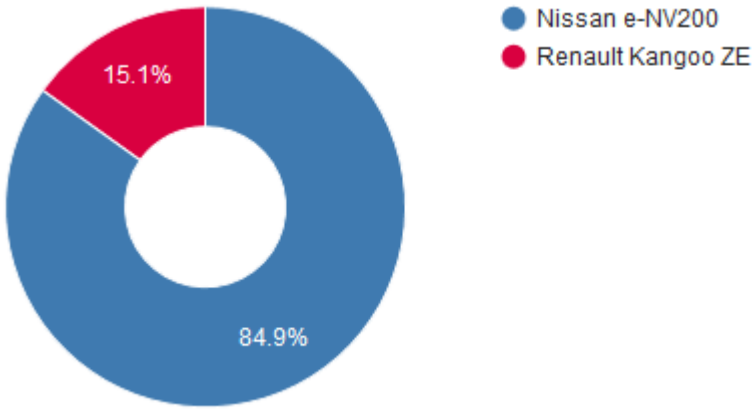
Figure 15: New registrations of Battery Electric Light Commercial Vehicles 2011-2015 in UK



Source: European Alternative Fuel Observatory 2016

In 2015, the new Nissan e-NV200 dominates the sales of new vehicles in the UK (Figure 16).

Figure 16: Market Share in UK, Light Commercial Vehicles, Battery Electric, New Registrations 2016



Source: European Alternative Fuel Observatory 2016

Current new registrations of all UK commercial light goods vehicles was about 400,000 in 2015, and the new registrations of battery electric vehicles was, with 540 new vehicles, about 0.1% of all new registrations (EAFO, 2016).

Turning our attention now to the total market for Light Goods Vehicles (LGVs) in the UK (Table 20) including all vehicles running on the roads and streets of the UK: The market share of commercial battery electric vans in the UK is currently around 0.1% (Department for Transport, 2016) (Table 20).

Table 28: Licensed light goods vehicles by propulsion or fuel type in UK

United Kingdom						Thousands/ Percentages
Year	Petrol	Diesel	Gas1	Electric	Other2	Total
Total number of vehicles						
2014	137.7	3,417.4	9.8	4.1	0.6	3,569.6
2015	134.6	3,587.4	8.7	4.6	0.7	3,736.0
Percentage of vehicles						
2014	3.9	95.7	0.3	0.1	-	100
2015	3.6	96.0	0.2	0.1	-	100

Source: Department for Transport (2016) Statistics. https://www.gov.uk/government/statistical-data-

3.4.2 Comparison of Renault Kangoo ZE and Nissan e-NV200 in daily use

Quantitative average fleet data was collected for the period 1st July 2015 to 30 June 2016 (Table 21). The objective was to assess if there are important differences in performance. All data was sorted according to the vehicle type.

Table 29: Performance/van, average data of all Nissan and all Renault vans, 1 Jul 2015-30 Jun 2016, Gnewt Cargo, London

Criteria Veh. type	Annual Distance/van(km)	Average Daily Distance (km)	Idle (%)	Electricity Usage (kWh)	Eco Driving Score	Hard Acceleration (%)	Hard Braking (%)
Nissan e-NV200	9118.3	52.8	55.5	1636.3	66.7	5.7	7.0
Renault Kangoo ZE	4622.2	22.1	71.6	1288.8	74.3	5.6	5.9

Source: Gnewt Cargo Agile 3 data collection

The difference in total distance and daily distance is due to the different types of clients. For some clients such as Farmdrop, the delivery area was wide and the distance covered longer. The Nissan was used for such clients with longer trip distances. With 110 miles (about 180 km), it has a similar range than the Renault (107 miles). Gnewt used the Nissan vans for a total distance double the distance of the Renault. But all trips made with the Nissan could have been made with the Renault anyway. The question of battery range was not an issue throughout daily business.

The Nissan is equipped with a fast charging option. But this feature was not used and all vans were recharged with a standard charging plug.

In conclusion, none of the quantitative parameters observed provided noticeable differences between Renault and Nissan. For all indicators (volume capacity, distance per day, energy use in kWh, maintenance, driving style (hard acceleration or hard breaking)), the two vehicle types showed similar results.

The only noticeable difference was in qualitative parameters. The drivers reported a slight inconvenience with the Nissan - when stopping the vehicle, it would have the tendency to keep moving if the brake wasn't continuously depressed.

Both vehicle types are therefore considered suitable for future use at Gnewt Cargo.

4. Concluding remarks

Multiple datasets were successfully collected during the trials for the Agile Gnewt Cargo Cat 3 project.

The datasets provided evidence that Gnewt Cargo is reaching its quarterly objectives.

The data demonstrates a very low distance driven per day in Central London.

The data demonstrates a high number of parcels delivered per day for most clients.

The data shows different average trip distances and number of parcels for the different clients.

For some clients, a low number of parcels indicates a high potential for future consolidation.

The consolidation effect was assessed against the baseline, using a before-after comparison.

The trials were completed. Monitoring and data collected are available.

The multiple data collection and processing was an essential part of the demonstration.

As of 24 October 2016, data had been collected for the entire project duration. The data processing is now finalised. The total amount of information is very large, so that only a segment of the >13,360 rounds trip data currently available can be shown in this report. The qualitative data allowed us to better understand the business case for single carrier delivery in Central London.

Extracts of all datasets are provided in this report.

ANNEX

Conversion factors used in this report

Source: DEFRA greenhouse gas conversion factors 2016

Energy conversion factors

		GJ	kWh	therm	toe	kcal
Energy	Gigajoule, GJ		277.78	9.47817	0.02388	238 903
	Kilowatt-hour, kWh	0.0036		0.03412	0.00009	860.05
	Therm	0.10551	29.307		0.00252	25 206
	Tonne oil equivalent, toe	41.868	11 630	396.83		10 002 389
	Kilocalorie, kcal	0.000004186	0.0011627	0.000039674	0.000000100	

Distance Conversion factors used in this report

		m	ft	mi	km	nmi
Length / distance	Metre, m		3.2808	0.00062137	0.001	0.00053996
	Feet, ft	0.30480		0.0001894	0.0003048	0.00016458
	Miles, mi	1609.34	5280		1.60934	0.86898
	Kilometres, km	1000	3280.8	0.62137		0.53996
	Nautical miles, nmi or NM	1852	6076.1	1.15078	1.852	