LoCITY Lowering Emissions from Commercial Vehicles

July 2016.

Version 2

How can LoCITY increase operator uptake of Ultra Low Emission Vehicles?

Final Report

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Executive summary

Background and objectives

London's growing population and economy is creating an increase in freight and fleet traffic. Unless action is taken, this will have a significant impact on the environment, the transport system and quality of life in London.

Transport for London (TfL) has developed a range of strategies to respond to these issues, including the Transport Emissions Roadmap (TERM) and the Ultra Low Emission Vehicle (ULEV) delivery plan. One of the key actions of the ULEV Delivery Plan is to increase the uptake of ULEVs in freight and fleet organisations to reduce emissions and improve air quality, and help expand the green economy – creating jobs.

LoCITY is a five year programme to address this action. LoCITY will work with freight and fleet operators, vehicle manufacturers and infrastructure providers to increase the availability and uptake of ULEVs operating in London. To inform the design and delivery of the programme, TfL commissioned research to better understand:

- Operator knowledge and awareness of viable alternative fuels for operational HGVs and vans for business purposes;
- How to influence and subsequently increase uptake of these types of vehicles.

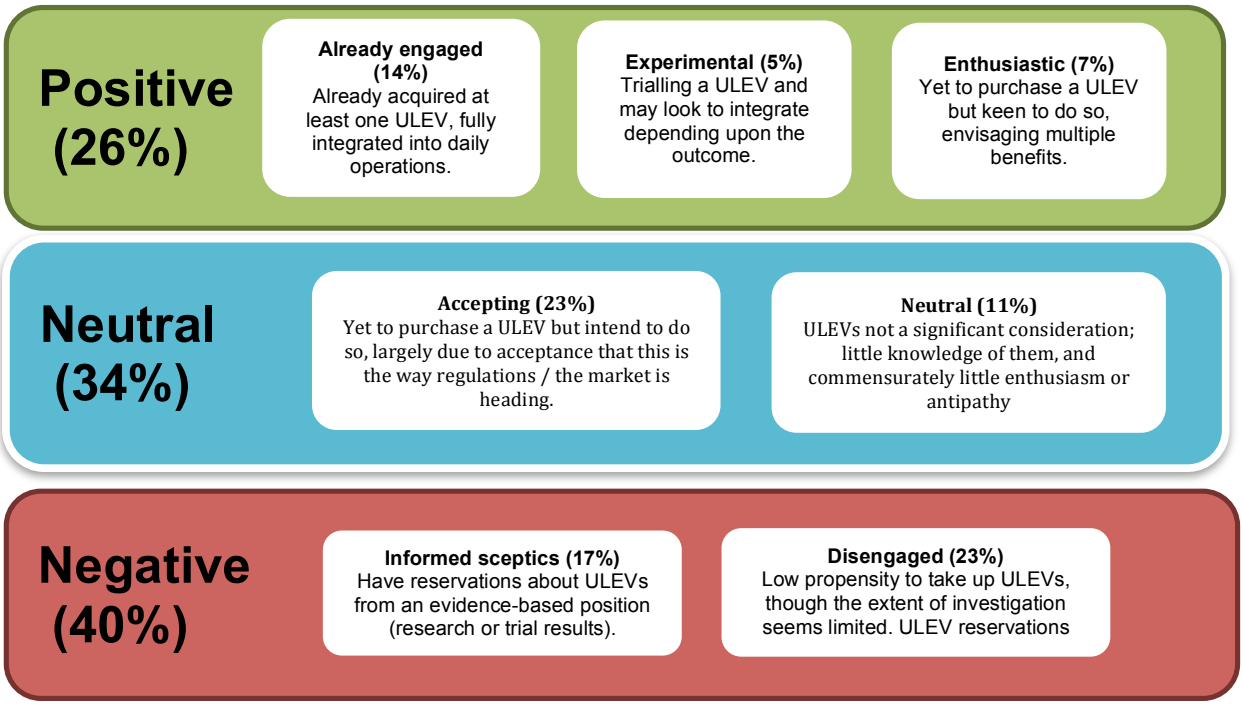
Scope and approach

The research included a literature review of drivers and barriers to ULEV take up, and different operator approaches to purchasing vehicles. This review was followed by:

- Screening calls to identify operators of commercial vans and HGVs in central London.
- A survey of 200 of operators to explore their fleet profile, duty cycles, ULEV take up and specific drivers and barriers to future take up.
- Follow up in-depth interviews with 30 operators, focusing on vehicle purchasing approaches and how vehicle selection might be influenced.
- Interviews with 10 organisations with the potential to influence operators' vehicle selection process (including industry bodies, suppliers and leasing companies). This provided a holistic perspective of drivers and barriers to uptake of ULEVs and identified opportunities for LoCITY to accelerate this uptake.

Current engagement and segmentation

14% of operators surveyed operate at least one ULEV, with a further 33% planning to do so. The most common ULEVs operated were battery electric, plug-in hybrid electric, and compressed natural gas (CNG) vehicles. Interviewees' responses on current ULEV take up and plans to do so enabled segmentation of fleet operators into seven groups.

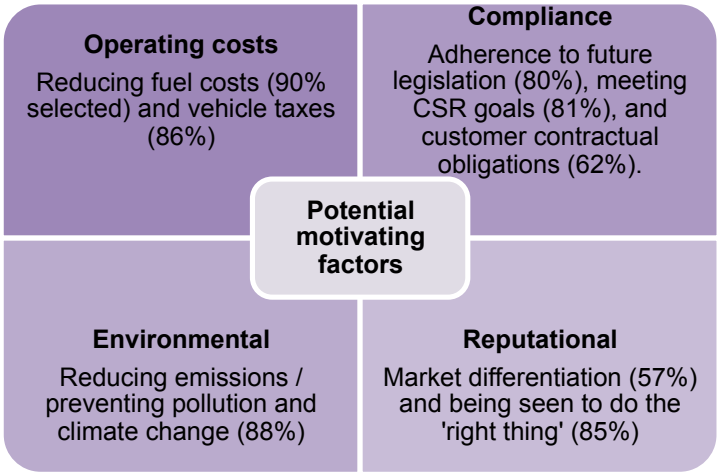


- In addition to fleets already operating ULEVs, **around a third of operators are 'on the road' to take up** i.e. either trialling, enthusiastic to take up, or accepting that take up is inevitable. More than half are 'open' to ULEV take up.
- Smaller businesses are less likely to trial new technologies based on the high upfront capital required and competing priorities for time and finances.
- Around one third of operators have not investigated ULEVs to any significant degree. These operators are likely to ultimately encounter the same practical hurdles as the first group (finance etc.), but most will need additional information before reaching this point in order to understand the potential benefits of ULEVs for their organisation.
- Finally, around one fifth of operators have a negative impression of ULEVs – and a commensurately low propensity to invest - subsequent to investigating available options. It is likely to be challenging to persuade this set of operators to acquire ULEVs in the near term.

There is substantial potential demand for ULEVs that vehicle manufacturers and other suppliers are not currently meeting. LoCITY should work with all stakeholders to provide trusted, impartial information about ULEVs, particularly focusing on their environmental and financial benefits.

Motivations / drivers to take up

Operating costs and sustainability considerations are the primary considerations for fleets which have already acquired ULEVs. Amongst those planning to acquire ULEVs, compliance was by far the most significant consideration (cited more than twice as much as any other motivating factor).



Demand from customers is not a strong motivating factor. A small number of operators – in particular those with public sector clients – reported growing interest in fleet sustainability.

However, most operators reported that their customers were not interested in their vehicle choices, apart from ensuring that the chosen vehicle would meet the job requirements and minimise costs. Fleets also commented that they would usually meet specification requirements rather than emphasising their use of ULEVs.

LoCITY should work with the public sector to improve procurement processes to stimulate accelerated uptake of low emission vehicles.

Awareness of the Ultra Low Emission Zone

The Ultra Low Emission Zone (ULEZ) is already a key consideration for fleet operators. The research found good awareness of the concept (65% of operators aware) and recognition of the effect it could have (63% of operators felt that it would have a 'substantial impact upon their organisation'). However, operators generally need more details about the policy, such as the financial charges associated with non-compliance and the geographical area it will cover, to fully understand how it will impact their operation and what action they should take.

LoCITY should support provision of detailed information about the ULEZ and help operators decide how to respond. LoCITY should consider developing an online calculator to compare the cost of a given trip in a non-compliant vehicle to that in a compliant vehicle, as well as how many trips it would take for a new vehicle to 'pay for itself'.

Factors influencing vehicle acquisition processes

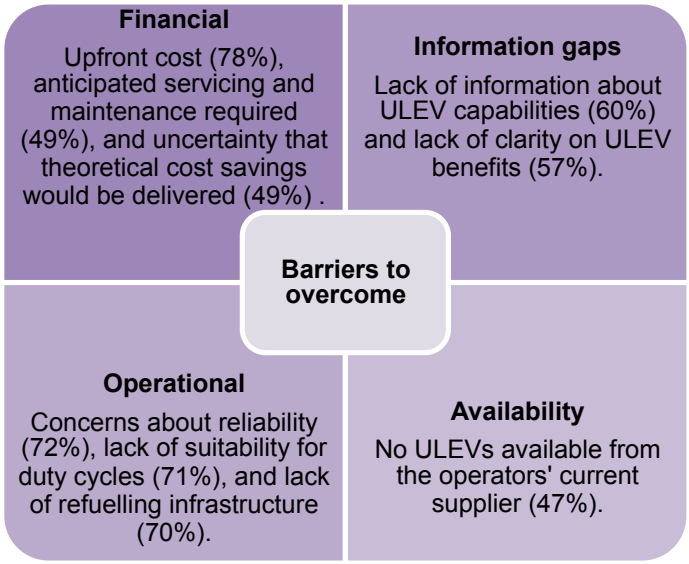
Getting started	• Nearly 80% of operators replace vehicles at regular intervals; typically between three and five years.
Who is involved?	• Vehicle procurement is usually initiated by the fleet manager or equivalent, although the need for procurement is sometimes tested with colleagues and senior decision makers. • Most operators (57%) have multiple internal stakeholders involved in purchasing decisions.
Vehicle and supplier selection criteria	• Vehicle capabilities and cost have the greatest influence on purchasing considerations. • Fleets can be categorised into three groups: (1) Large, public sector fleets have a formalised tender process; (2) Large, private secor fleets tend to have fixed supplier agreements and renew existing orders; (3) Smaller fleets take a more ad hoc approach to selecting suppliers. • Regardless of approach, loyalty to existing suppliers was cited as very strong.
External influences	• Key external influences cited tended to be statutory e.g. legislative requirements. Operators reported limited upselling / promotion of ULEVs by their suppliers / brokers. • Trade bodies were felt to be an important influence by members, but it was noted that smaller organisations and fleets are less likely to be members. • Some respondents mentioned interest in the success of competitor ULEV trials. • Word of mouth between drivers of different organisations was sometimes seen as a powerful influence in broadening consideration of options. • Trade or fleet-specific press were cited to a limited degree.

LoCITY can influence and improve fleet procurement processes by:

- *Providing impartial, trusted information to operators to ensure that they are aware of available ULEVs and any gaps in knowledge are addressed.*
- *Working with leasing companies and vehicle manufacturers to help them engage with clients about ULEVs.*

Commercial and technical barriers to take up

Operators identified up-front costs as the most significant barrier to (additional) uptake of ULEVs, followed by concerns about suitability and refuelling infrastructure. These barriers are well understood and have been covered in depth by previous research.



The identification of up-front cost as a major barrier suggests that financial support for vehicle acquisition will be key to uptake for many operators, regardless of motivations or the removal of other barriers. However, this barrier could also be addressed by providing accurate information about relative whole life costs of ULEVs and conventional alternatives.

Lack of refuelling infrastructure on usual routes was also cited as an operational barrier, suggesting fleets and infrastructure providers could work together to identify suitable sites for installations. In general, the near-term viability of ULEVs increases where operators have localised routes, schedules with some flexibility around loads and timings for vehicles to undergo refuelling, and/or depots that vehicles return to in order to access charge points.

Finally, a key challenge for many operators is lack of data to inform an accurate cost-benefit analysis; even where there exists strong motivation there is often limited information. As well as data relating to business cases for ULEVs, many organisations lack a clear understanding of what a ULEV is, and there are currently variances as to the precise definition.

LoCITY can help overcome these barriers by:

- *Providing clarity to operators about ULEV definition and availability, including performance and operational capabilities.*
- *Facilitating greater collaboration between vehicle manufacturers, infrastructure suppliers and fleet operators.*
- *Providing information and tools to facilitate whole life cost-benefit analysis of ULEVs.*
- *Sharing information about current and planned publicly accessible recharging and refuelling infrastructure. LoCITY could also establish a forum for fleets to make their own (depot) recharging and refuelling capacity available to other fleets.*
- *Signposting sources of funding for ULEV trials or acquisition, and advocate for further financial support for operators.*

1 Introduction

1.1 Research context and objectives

London is experiencing an increase in freight and fleet traffic needed to serve the Capital's growing economy which, unless action is taken, will have a significant impact on the environment, transport users and Londoner's quality of life.

Transport for London (TfL) has developed a range of core strategies to respond to these issues, including the London Freight Plan[1] and Forum, Delivering a Road Freight Legacy[2], Transport Emissions Roadmap (TERM)[3] and the Ultra Low Emission Vehicle (ULEV) delivery plan. The latter focuses on increasing the uptake of Ultra-Low Emission Vehicles (ULEVs)[4] in freight and fleet organisations in order to:

- Reduce emissions and improve air quality – bringing benefits to the environment, health and quality of life for Londoners
- Help expand the green economy – creating jobs.

The LoCITY[5] programme was set up as a five year programme to work with industry to increase the availability and uptake of Low Emission Commercial Vehicles (LECVs) operating in London through working with freight and fleet operators, vehicle manufacturers and infrastructure providers. To inform the design and delivery of the programme, TfL commissioned research to **better understand operator knowledge and awareness of viable alternative fuels for operational HGVs and vans, and how to influence and subsequently increase the uptake of these types of vehicles.**

The specific objectives were to:

- Identify how many organisations are aware of ULEZ and what this might mean for their fleet. Provide details of duty cycles (e.g. mileage, if vehicles are double shifted etc.).

- Determine what influences an organisation's purchasing decision process for new vehicles in each industry sector, who is involved, what their role is and who makes the final decision. Identify the most effective communications channels to influence those individuals who are making the new vehicle purchasing decisions.

1 http://content.tfl.gov.uk/london-freight-plan-executive-summary.pdf
2 http://content.tfl.gov.uk/delivering-a-road-freight-legacy.pdf
3 http://content.tfl.gov.uk/transport-emissions-roadmap.pdf
4Including battery electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs), range-extended electric vehicles (RE-EVs) and hydrogen fuel cell electric vehicles (FCEVs).
5 http://www.locity.org.uk/

- Identify the commercial and technical barriers to purchasing each alternative fuel technology option for operational vehicles and why such barriers exist. Barriers should be detailed enough to provide TfL with useful information. For example, TfL know that lack of charging points is a major barrier and added value would include details on where charge points would be most useful and what type e.g. rapid or slow charge.

- Establish how long organisations retain leased and/or purchased vehicles

- Establish knowledge and awareness of each alternative fuel technology option for operational vehicles and how this was established.

- Determine the refuelling and recharging requirements of these vehicles, including the need for public, depot and (in the case of vans) residential infrastructure.

- Identify the motivators to purchasing each alternative fuel technology option for operational vehicles and why such motivators exist.

The research findings are informing the design and marketing of the LoCITY programme going forward and were shared at a LoCITY launch event in May 2016[6].

The research comprised two key phases of data collection and a reporting phase:

This report integrates findings from the quantitative and qualitative primary research conducted as part of the second phase of the research with findings from the phase 1 review, building upon those. A finalised report and publishable executive summary comprise the outputs of the research, along with a presentation of key findings at the

[6] https://locity.org.uk/event/annual-conference/

LoCITY launch event (slides are available on the LoCITY website). This report is ordered as follows:

- Section 1.2 provides an outline of the phase 1 and 2 method / sampling that underpins the findings.
- Section 2 provides key profile information on the phase 2 quantitative survey sample
- Section 3 explores ULEV take up, motivations and barriers to this, and a segmentation of fleet operators on the basis of responses to the aforementioned topics and other profile data.
- Section 4 examines the range of vehicle purchasing processes across operators, including identification of need and supplier selection.
- Sections 5 and 6 explore several of the key internal and external factors affecting ULEV take up and propensity to take up.
- Section 7 draws upon the findings in preceding sections to consider how the LoCITY programme could support greater ULEV take up.
- Finally, section 8 provides conclusions against the key research questions from the original brief.

1.2 Method outline

1.2.1 Phase 1

This initial stage of the research comprised scoping and research design**.** A review of existing literature (46 sources) was conducted, with each source being scored against criteria on usefulness and relevance. The 21 sources scored as 'highly relevant' were then further reviewed and generated:

- Findings against the key research objectives, which were collated in an interim report and are replicated in the relevant sections of this report.
- Identification of evidence gaps – including awareness of ULEZ, detail on duty cycles, ULEV uptake and detail on vehicle purchasing decisions - to inform the focus and design of the phase 2 research instruments.
- Development of organisational fleet purchase behaviour theories, which are tested and assessed in section 4 of this report.

1.2.2 Phase 2

Phase 2 comprised four key elements:

1. An initial screening study of fleets was conducted in order to identify eligibility for participation in a full survey. Eligibility criteria were that the organisation was operating at least one van / HGV and that a least a fifth of journey routes took the vehicle fleets through central London i.e. through the likely ULEZ boundaries. As

there is no one central database of operators, several sources were used to form a contact database, as follows:

Source	Number of contacts
FORS database (filtered for organisations based in or around London)	603
Plugged-in Fleet Initiative participant list	20
Fleet Heroes 2015 participant list	27
Logistics Carbon Reduction Scheme participants	112
HGV Taskforce	9

It is not possible to know precisely the extent to which each source contributed to the eventual total survey sample of 200 operators, as the sources frequently overlapped i.e. a particular operator appeared on more than one list. The limitations of the sources are discussed below.

2. **A full survey of 200 operators** – with quotas for fleet size and vehicle types (vans/HGVs/both) – focusing upon key profile data such as duty cycle, current ULEV take up, and general barriers and motivations for this. The table below shows the extent to which strata were populated:

Fleet profile	Number of interviews[7]
Operate between 1 and 10 vans (1.2-<3.5t)	113
Operate more than 10 vans (1.2-<3.5t)	55
Operate between 1 and 10 vans (1.2-<3.5t)	80
Operate more than 10 vans (1.2-<3.5t)	85

3. Qualitative interviews with 30 operators that responded to the survey, in order to explore responses in more depth, in particular vehicle purchasing processes and views on potential LoCITY support. These were selected to ensure a mix of fleet profiles and circumstances based upon responses to the quantitative survey.

4. Qualitative interviews with ten organisations viewed as potential 'influencers' of operators, in order to obtain a wider perspective on operator behaviours and support needs.

Limitations of the research that should be considered in interpreting and using the results are:

1. Findings from the qualitative interviews and / or sub-groups within the quantitative sample are based upon small sample sizes, therefore subject to substantial margin of error.

[7] The total exceeds 200 as many fleets qualify for more than one category.

2. The data have not been weighted and are not presented as being representative of *all* fleets. This is because there exists no population statistics or database that would enable weighting of the survey data, in particular within the specific criteria for survey eligibility. Efforts were made to ensure a mix of fleets (in terms of sector, vehicle numbers and types, and size), and findings should give a good feel for general sector trends. **Sample breakdown by key profile information is set out in section 2.**

3. Whilst FORS is becoming more mainstream, as increasing numbers of customers require the accreditation[8], the five database sources used to provide a sample may comprise operators somewhat atypically engaged with sustainability.

[8] For this reason, certain key variables in the report, analysis compares 'established' (pre-2013) FORS sign ups with more recent FORS sign ups.

2 Sample profile

This section provides an overview of the profile of those operators that participated in the quantitative survey, covering both the organisation and fleet. The principal purpose of this section is to demonstrate the range of operators covered in the research and so evidence the representativeness of the findings in sections 3 – 7, albeit with the caveats discussed in section 1 around lack of weighting and limited database sources.

2.1 Respondent role

The research sought to obtain responses to the survey from the individual within the organisation who managed / held responsibility for the fleet. Overall 42% of those interviewed were in a specialist fleet management role (i.e. this comprised all or most of their role) whilst the remainder were individuals for whom the fleet was a responsibility within a wider remit. The most common job titles for specialists included the following: Fleet engineer, Fleet manager, Logistics manager, Operations manager, and Transport manager.

Fleet specialists tended to be found in larger organisations (67% of specialists were found in medium or large organisations compared to 38% of non-specialists) where fleet size / significance and organisational resource mean there is value in such a role.

2.2 Fleet size

For almost all the van / HGV operators, these commercial vehicles comprised the majority of their overall commercial vehicle fleets (including cars). Using a more granular breakdown of commercial vehicle sizes, the following table provides a more detailed summary of the number of organisations operating vehicles and the numbers of each commercial vehicle type:

Table 1: Summary of commercial van / HGV numbers in the survey sample [n=200]

Commercial vehicle weight category	Number of operators with at least one of this vehicle category	Number of vehicles of this category across the sample	Average per fleet operating this category of vehicle
1.2t to <3.5t	168	4,698	201 [Min = 1; Max = 500]
3.5t to <7.5t	101	6,521	101 [Min = 1; Max = 3,500]
7.5t to <18t	95	2,812	94 [Min = 1; Max = 1,000]
18t+	115	15,904	115 [Min = 1; Max = 3,500]

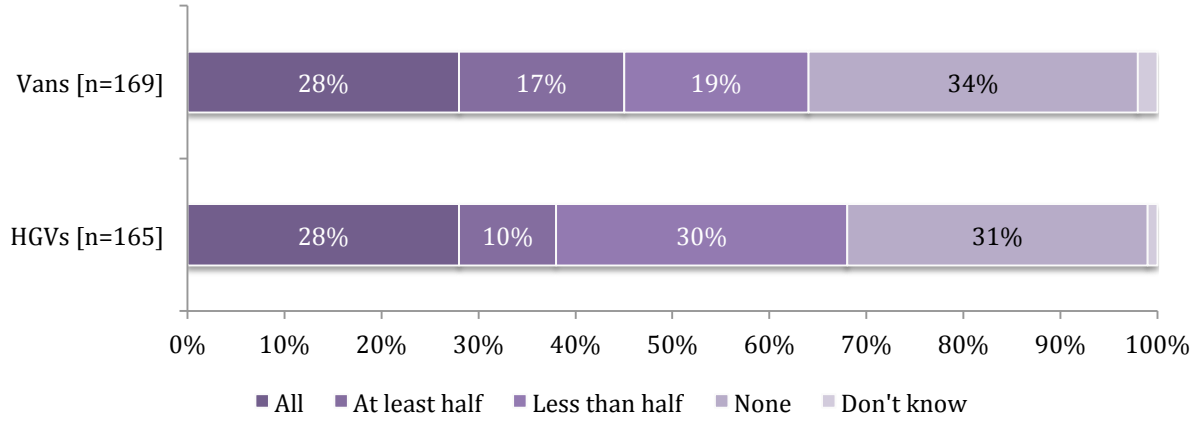
2.3 Fleet composition

All respondents were also asked to describe the makes and models their organisation operates and the breakdown of their vans / HGVs in terms of fuel type:

	Makes and models	Fuel types
Vans	The most commonly cited vans were Mercedes Sprinters and Ford Transits. However, a wide range of other makes and models were cited; those mentioned by at least three respondents were Citroen Berlingo, Ford Connect, Iveco Daily, Renault Trafic, and Volkswagen Caddy.	98% of van operators use diesel vans and in most of these cases only diesel vans. Only 8% of van operators reported using any hybrid or non-diesel vans, and even in these cases the majority were diesel.
HGVs	A range of models were cited depending upon the HGV size, but the most commonly cited makes were DAF, Iveco, Mercedes, Scania and Volvo.	All the HGVs were assumed to be diesel unless they were run on bio-fuel blends (explored in section 3).

Respondents were also asked what proportion of their van or HGV fleet was EURO6/VI compliant. Where respondents did not seem to know what EURO6/VI was (16% of van operators and 7% of HGV operators) or were not sure what proportion of their fleet EURO6/VI compliant vehicles comprised, they were asked what proportion of their van or HGV fleet was less than two years old. This was treated as a proxy for being compliant on the basis that most vehicles manufactured and purchased within the last two years should in principle be compliant with EURO6/VI[9]. The results were as follows:

Figure 1: Proportions of vans/HGVs in each fleet that are EURO6/VI compliant



[9] There was a risk of respondents misinterpreting this question to mean how long they had had the vehicles; as per section 4, a substantial proportion of – particularly smaller – operators are buying second hand vehicles and therefore even if they have only owned them for <2 years, it is unlikely the vehicle itself is <2 years.

Van operators in the public sector, logistics sector and retail sector were the most likely to have at least some EURO6 vans, whilst those in the waste sector were the least likely. For HGVs the converse was true, with the waste sector being most likely to be operating EUROVI compliant HGVs.

2.4 How the fleet operates

To ascertain how the vans and HGVs are used, all respondents were asked about their fleets' duty cycles – journeys (length and frequency), loads and approach to refuelling.

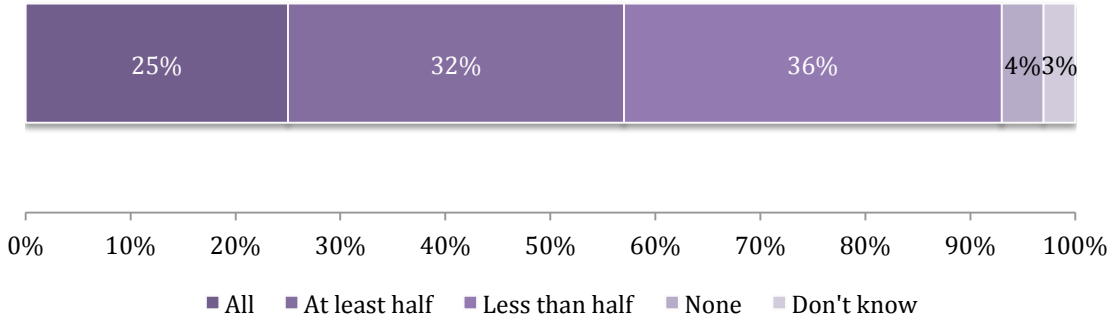
2.4.1 Journeys through London and the Congestion Charging Zone (CCZ)

With regards to journeys, respondents were asked what proportions of both their journeys and their vehicles travelled into or through London:

Figure 2: Proportions of fleet journeys and vehicles that go into London [n=200]

Respondents were then asked what proportion of their fleets' journeys go specifically into the Congestion Charging Zone (CCZ):

Figure 3: Proportions of fleet journeys that through the CCZ [n=200]



There were no clear differences in likelihood of entering the CCZ in terms of fleet size, though those in the waste and public sector were least likely to do so (likely because certain of these vehicles are specifically restricted to a geographical scope – e.g. borough area - that is within London but does not include the CCZ).

2.4.2 Mileages

All respondents were asked about the average mileage of journeys made by their fleet, and for the minimum and maximum ranges. For each figure only a minority of respondents felt able to estimate; based upon these the mileages of the survey sample were as follows:

Table 2: Averages, minimums and maximums of per journey mileages amongst those operators able to estimate

Averages [n=117]	The mean average mileage per journey across fleets where the respondent was able to quantify was 130 miles per journey (the range of average mileages quoted was 10 to 600 miles).
Minimums [n=58]	The mean minimum mileage per journey across the fleets where the respondent was able to quantify was 54 miles per journey (the range of minimum mileages quoted was 1 mile to 200 miles).
Maximums [n=65]	The mean maximum mileage per journey across the fleets where the respondent was able to quantify was 195 miles per journey (the range of maximum mileages quoted was 7 miles[10] to 1200 miles).

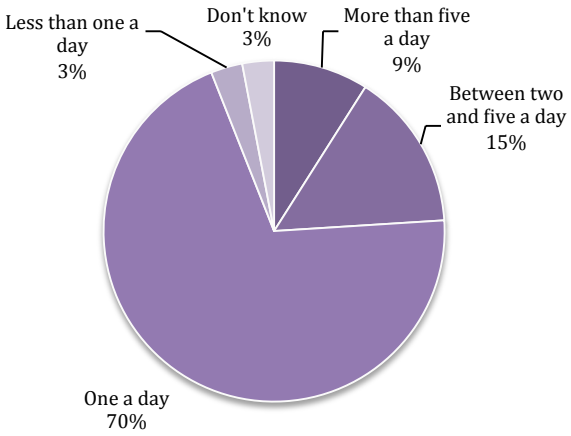
10 The bottom range of the maximum mileages is lower than the bottom range of the average mileages due to the different samples able to provide an estimate for each.

In general, larger fleets tended to have larger mileages – the mean average mileage amongst those with 10 or more vans was 230 vs. 128 for those with less than 10 vans, whilst the mean average mileage amongst those with 10 or more HGVs was 150 vs. 127 for those with less than 10 HGVs. Fleets in the waste sector had significantly lower average mileages than those in the other key sectors.

2.4.3 Frequency

All respondents were asked to describe the frequency with which a typical commercial vehicle in their fleet would be making journeys:

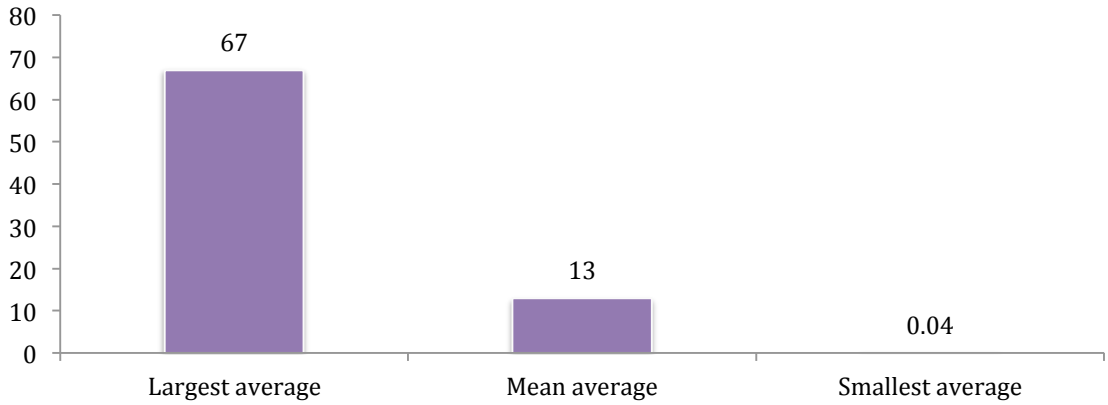
Figure 4: Breakdown of journey frequencies for typical vehicles across the fleets [n=200]



2.4.4 Load profiles

All respondents were asked to describe the load profiles of their vehicles; in terms of items, the loads varied according to sector, with contents including food and drink, car parts, waste and recycling, and large equipment (e.g. cement mixers). In terms of average load per vehicle in tonnes, around three quarters of respondents were able to provide an estimate:

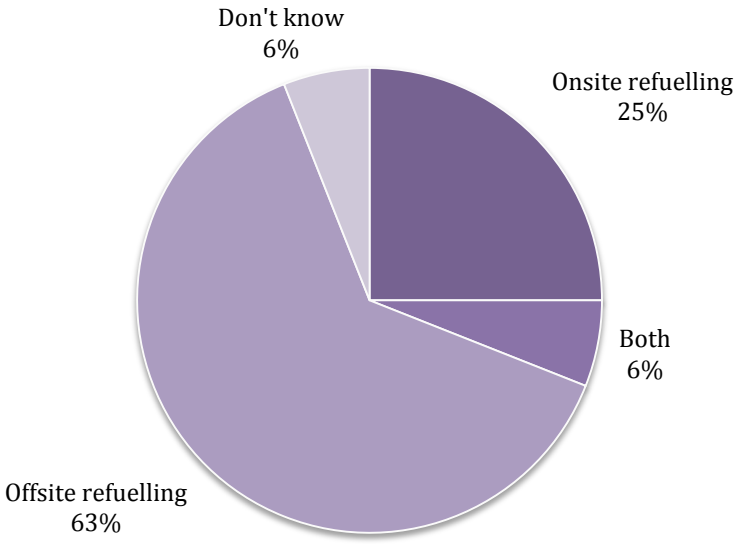
Figure 5: Average loads across the fleets [n=157]



2.4.5 Refuelling

Respondents were asked to describe two aspects of their fleet refuelling – location and frequency. Regarding the former, respondents were asked whether refuelling took place on site or off site:

Figure 6: Breakdown of refuelling location [n=200]



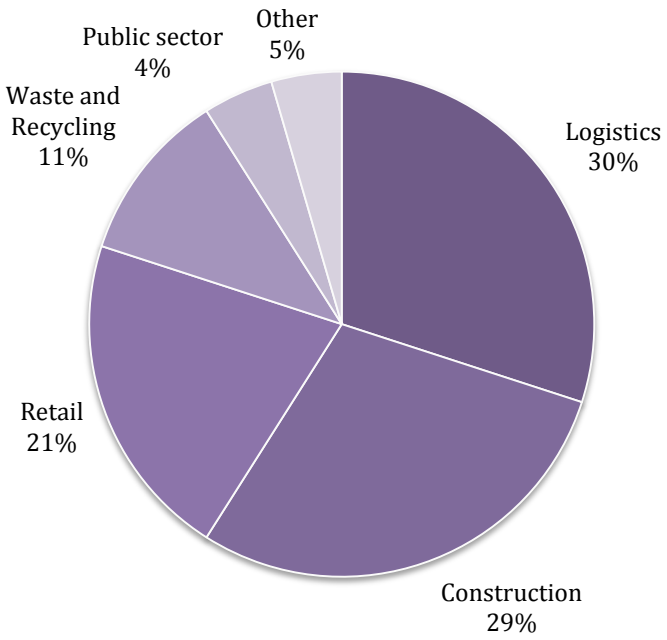
Larger fleets – likely operating from larger premises – were more likely to conduct on site refuelling than smaller fleets. Similarly, construction firms (without a 'base' / depot from which to operate) were most likely to conduct off site refuelling.

Refuelling frequency would be affected by models, mileage and loads; respondents were asked whether this was generally done ad hoc or at fixed times. Overall, 26% of respondents reported that their organisation refuels vehicles at specific times, whilst 68% reported that this was ad hoc (6% did not know). There was a strong correlation between those that have on site refuelling and those that refuel at fixed times.

2.5 Operator sector / activity

All respondents to the survey were asked to describe their organisation's primary activity; the breakdown of responses is as follows:

Figure 7: Sector breakdown of survey respondents [n=200]



In addition to the five key sectors of interest, interviews were conducted with a contract cleaning company, several manufacturers, several consultancies and a debt recovery company.

3 ULEVs: take up and propensity to take up

This section explores take up of ULEVs amongst the surveyed operator population, along with propensity for future take up amongst those yet to do so, and what organisational / fleet conditions seem to be prevalent amongst those taking up or planning to do so. The section then outlines the motivations and barriers to take up discussed by operators. Collation of these findings enabled a segmentation of operators based upon take up and propensity to take up.

3.1 Defining a ULEV

The definition of an Ultra-Low Emission Vehicle (ULEV) for this research was agreed with TfL to be as follows: a vehicle that emits extremely low levels of CO_2 compared to conventional vehicles fuelled by petrol / diesel, with typically much lower (or virtually nil) emissions of air pollutants and lower noise levels.

Evidence on the emissions performance of various technologies is still emerging, as those technologies evolve. At the outset of the survey work, a list of technologies [see Figure 8] was produced that have at least the potential to meet the above ULEV definition, and thus may well be thought of by users as ULEVs. However, not all of these will actually deliver extremely low levels of CO_2 compared to conventional vehicles. In particular, vehicles using other fossil fuels - such as LNG, CNG or LPG - may well only generate marginal overall greenhouse gas (CO_2, Methane and Nitrous Oxide) savings. DfT are currently funding research into this subject, and the results are expected to be published in the second half of 2016.

Furthermore, the climate impacts of plug-in hybrid and range-extended vehicles will depend heavily on how much of their usage is driven by electricity, and how much by their conventional engines. Even pure electric vehicles will only be genuinely ultra low carbon if they use low carbon electricity. The supply chain for hydrogen can also be energy and carbon intensive, affecting the overall climate change credentials of such vehicles.

For vans, the term ULEV is used across several categories but is generally accepted as the definition for cars and vans eligible for the Government's Plug-in Car or Van Grant, (https://www.gov.uk/plug-in-car-van-grants/eligibility). The definition for this has however recently changed (in March 2016) so care should be used applying the label ULEV. For vans the current eligibility for PIVG is for vehicles emitting below 75g/km CO_2 (on NEDC cycle) and with a zero emission range of more than 10 miles. Also the grant is only applicable to OEM vehicles with full EU-type approval and extensive manufacturer's warranty, hence excludes conversions and small series vehicle approvals.

There is no common definition of a ULEV HGV truck (over 3.5t), though fully electric vehicles are universally regarded as ULEV. The London Mayor's proposals for an Ultra

Low Emission Zone focus only on pollutant emissions, not CO_2 or other greenhouse gases, specifying Euro VI or 6 compliances as being the minimum acceptable standard. DfT and DEFRA, on the other hand, are considering retrofit technologies that can "clean up" a Euro IV or V vehicle to near Euro VI performance.

There is thus potential for considerable confusion about exactly what a ULEV is, or should in future be. Further thought and discussion is needed amongst stakeholders, but LowCVP has suggested definitions along the following lines could be appropriate, *albeit this is not the basis upon which respondents assessed their level of ULEV operation:*

Term	Definition
An Ultra Low Carbon Vehicle	One that emits a minimum of X% less greenhouse gases per km (calculated as CO_2e) than a conventional petrol or diesel equivalent, in representative test cycles, calculated on a well to wheel basis. X should be at least 30%.
A Clean Vehicle	One that emits at least Y% less NOx per km than a Euro 5/V conventional equivalent vehicle, in representative test cycles. Y should be at least 60%.
An Ultra Clean Vehicle	One that complies with Euro VI or 6c or equivalent.
An Ultra Low Emission Vehicle	One that is both Ultra Low Carbon and Ultra Clean.

LoCITY's currently stated focus is on vehicles and technologies that go beyond Euro VI/6 compliance and are Ultra Low Carbon. In practice, to go beyond these already very low limit levels ("Ultra Clean") implies zero pollutant capability; on this basis LowCVP argue a fifth categorisation may be useful – an "Ultra Low Carbon, Zero Pollution Vehicle".

The key context for findings in the remainder of section 3 is that with key stakeholders still debating a clear definition of ULEV, it is likely that respondents will have been trying to assess their organisation's level of operation of ULEVs with insufficient knowledge / understanding – around half of operators claiming to operate ULEVs rated their understanding of the ULEV definition at a 1,2, or 3 out of 5.

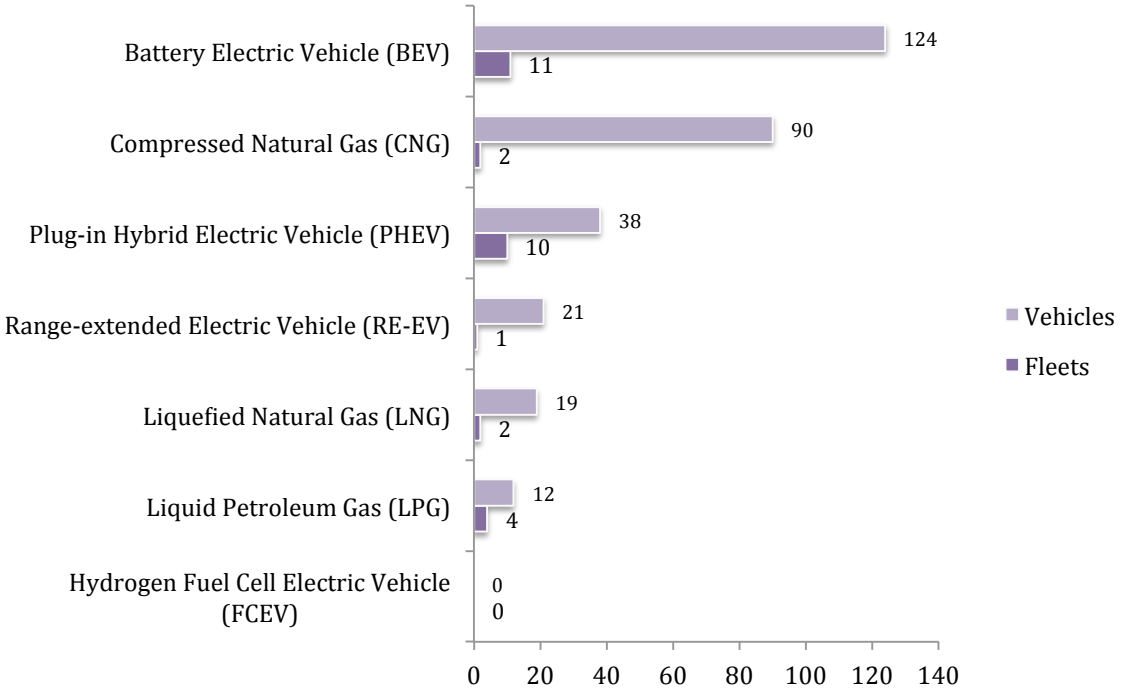
3.2 Take up

3.2.1 Extent

All operators [n=200] were asked whether or not their organisation operates any ULEVs; 14% [27 operators] reported that they did. 89% reported that these were fully integrated into the fleet, whilst the remaining 11% [3 operators] reported that these were pilot/demonstration vehicles only.

Where they operated at least one ULEV, operators were then prompted as to the numbers and types of different ULEVs operated; the results were as follows:

Figure 8: Uptake of different types of ULEV by number of vehicles and number of fleets=27]

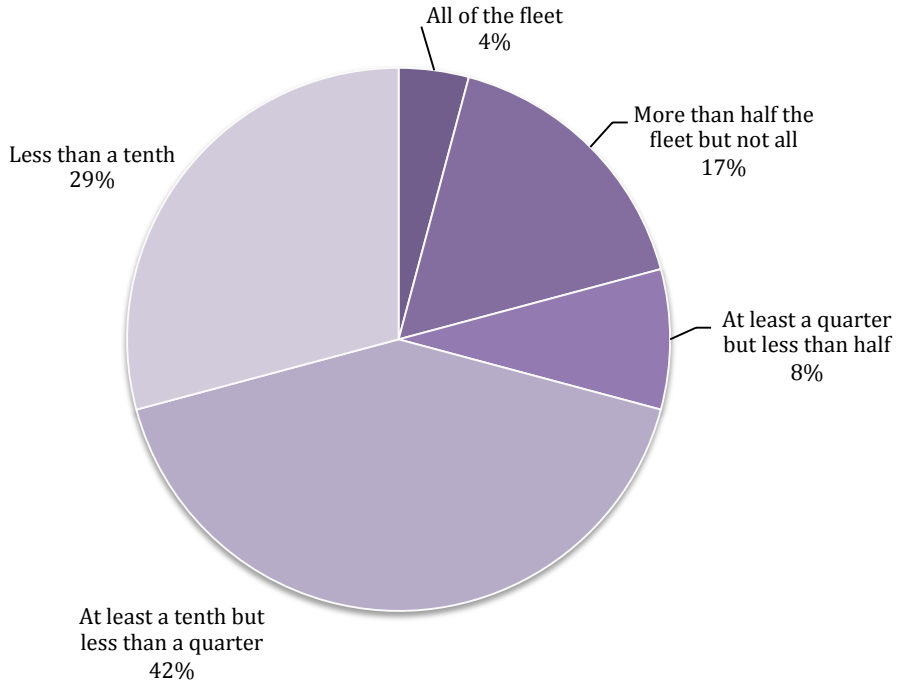


In addition to these numbers, six fleets reported that they operated biodiesel blend vehicles, which are low emission – and EURO6/VI/VI compliant - but not necessarily ULEVs. These six fleets reported operating a total of 431 of these vehicles. Further to this, one operator was certain that their organisation did operate ULEVs but they could not be certain as to which type, whilst another operator was certain that their organisation operates ULEVs but they could not confirm how many.

The phase 1 literature review found no comprehensive statistics to sense check the figures above. The Natural and Bio-gas Vehicle Association (NGVA) estimates 496 medium and heavy duty post-registration converted gas trucks in use in the UK. The Society of Motor Manufacturers and Traders' (SMMT) 2014 Motorparc statistics show 300 gas vehicles, though this is thought not to include post-registration conversions.

All those operating at least one ULEV [n=27] were operating a multi-vehicle fleet, the uptake of these as a proportion of the organisation's total commercial vehicle fleet was measured. This found a wide variance:

Figure 9: For those operating at least one ULEV, the proportion of their commercial vehicle fleet that the ULEVs comprise [n=27]



This demonstrates that even amongst those organisations taking up ULEVs to at least some degree, there remains a substantial opportunity for further take up[11]. Where they were operating either ULEV vans or HGVs, there was no significant difference between van or HGV operators in terms of the proportions of their fleets that these ULEVs comprised.

[11] There was no clear link between fleet size and the proportion group as per the chart above e.g. it wasn't the case that all those with a high proportion of ULEVs were simply operating one ULEV in a very small fleet.

Whether or not operators had taken up ULEVs – and to what extent – was explored further across a range of organisational and fleet profile data to identify potential correlations; whilst it should be noted that in some cases the samples being compared were very small, key findings from this analysis were as follows:

- In terms of FORS membership, established members were slightly more likely than newer members to be operating ULEVs (15% vs. 10%) and for these to comprise at least half of their commercial vehicle fleet (28% vs. 0%). Gold and Silver FORS members responding to the survey were no more likely than Bronze members to be operating ULEVs.

- Larger fleets (categorised in this study as those with at least ten vans / HGVs) were almost twice as likely to be operating ULEVs as smaller fleets (those with less than ten). Regarding van operators, 25% of larger fleets reported operating at least one ULEV, compared to 13% of smaller fleets; the respective figures for HGV operators were 20% and 11%. Even comparing only those operating ULEVs, larger fleets were slightly more likely to have rolled these out across the whole fleet.

- Those operators with fleet specialists were more likely to be operating ULEVs (19% vs. 13% for those without a specialist); this may reflect the importance of specialist expertise in organisations taking up ULEVs, or simply reflect that larger fleets are more likely to take up (specialists being more common amongst larger fleets).

- When measuring size by FTEs, larger organisations were again more likely to be operating ULEVs (39% of large organisations operating at least one, compared to 15% of medium-sized businesses, 6% of small businesses and 5% of micro businesses).

- There were no clear differences in proportions operating ULEVs between those organisations that own vehicles and those that lease, though those that lease tended to have a larger proportion of their fleet comprising ULEVs.

- Organisations in the public sector were much more likely than those in the other key sectors explored to be operating ULEVs (33% vs. the next highest of 17% for logistics firms). No organisations in the waste sector responding to the survey operated ULEVs; this likely reflects the availability of low emission options for the specific types of vehicle operated by waste and recycling collection / disposal businesses.

- In terms of fleet replacement practices, those with fixed vehicle replacement cycles (as opposed to those replacing vehicles ad hoc) were twice as likely to be operating ULEVs – 17% vs. 9% - and much more likely to have rolled these out across the whole fleet where they did operate ULEVs. As with fleet specialists, it is not clear

whether likelihood of ULEV operation reflects that fixed replacement better enables this, or simply that fixed replacement is more likely in larger fleets.

- As theorised in phase 1, several aspects of duty cycles seemed to have a bearing on likelihood of ULEV operation, in particular mileage (average journey mileage amongst fleets including ULEVs was 116 vs. 170 for those without) and refuelling (33% of those that refuel on site operate at least one ULEV compared to 8% of those solely refuelling off site) though this may be correlation rather than causation i.e. owning ULEVs often necessitates some on site refuelling infrastructure. Although average loads in tonnes were actually slightly larger for those operating at least one ULEV (average of 15 tonnes vs. 13 for those not operating a ULEV), this is likely to reflect that ULEV operators tended to be larger, as opposed to refuting the theory that load restrictions are a barrier to take up.

- 19% of those operators aware of the Ultra Low Emission Zone (ULEZ) proposals operate ULEVs compared to 9% of those not aware.

3.2.2 Drivers to take up

The phase 1 review did not find quantitative survey data on motivations, but through case studies indicated that financial and sustainability considerations were prominent.

When asked what their key drivers had been for their organisation to take up ULEVs in the phase 2 survey, the reasons given were as follows:

Table 3: Breakdown of key drivers for operators to have taken up ULEVs to at least some degree [n=27] [back coded from open end responses]

Driver	Number of operators citing[12]	Sample of responses (including from the in depth interviews)
Potential reduction in fleet operating costs	9	*"Colleagues use them for cheaper taxes and they reduce emissions by 2% per year, which helps towards our targets."* "*Supports the company ethos: our mission is to take diesel and petrol out of city centres."* *"It's the benefit of not having to pay the congestion charge in London."* *"It was just to see if [the ULEV] was fit for purpose and if there was potential to roll it out further in our fleet."* *"We saw a gap in the inner London courier market for electric vehicles that could be charged up within the small radius they would need to travel, with no tax, fuel costs and enabling clients to reduce fuel emissions."* *"The company was set up as a carbon neutral courier business. Being green is our modus operandi."*
Reduce environmental impact	9	
Adherence to CSR / targets	8	
Reputational: seeking market differentiation / niche	6	
Perceived customer demand	3	
Trialling for potentially wider integration into the fleet	2	
Compliance; see this as the way legislation is going	2	

The table demonstrates the range of motivations for organisations to be taking up ULEVs; although one of the most commonly cited motivations, 'reducing environmental impact' tended to be cited along with another motivation, indicating potentially limited salience as a factor in isolation.

[12] Some cited more than one motivation.

3.3 Propensity to take up

3.3.1 Summary of plans

Where they had not yet taken up ULEVs, operators were asked whether or not their organisation had any plans to take these up. 39% of these organisations – 33% of the total sample - reported that they did, meaning that in total 47% of all organisations responding to the survey have either taken up ULEVs to some degree or have plans to do so[13].

Whether or not operators had plans to take up ULEVs was explored further across a range of organisational and fleet profile data to identify potential correlations; whilst it should be noted that in some cases the samples being compared were very small, key findings from this analysis were as follows:

- In terms of FORS membership, established members (43%) were more likely than new members (31%) to be planning to take up ULEVs. Gold (48%) and Silver (44%) members were also more likely than Bronze (35%) members to be planning to take up.
- As well as being more likely to operate ULEVs, larger fleets – for both vans (54%) and HGVs (48%) – were more likely than smaller fleets (35% for vans and 37% for HGVs) to be planning take up. Variables correlating with large fleet size – such as large organisational size and presence of a specialist fleet manager – also indicated greater likelihood to be planning ULEV take up.
- In contrast to the split on operating ULEVs, there was very little difference in propensity to take up between operators replacing vehicles on a fixed cycle (40%) and those replacing ad hoc (37%).
- Where respondents acknowledged external influences upon fleet procurement decisions, 46% were planning ULEV take up, compared to 33% who reported no external influences upon decision making.
- In contrast to operators already having take up ULEVs, it was those with larger mileages that were more likely to be planning take up.
- Those with on-site refuelling infrastructure were more likely to be planning to take up ULEVs, indicating that this is an important factor, not simply a correlation as hypothesised in section 3.2.
- 48% of those aware of the ULEZ are planning take up of ULEVs, compared to 25% of those not aware.

[13] It should be noted that the strength of these plans were not explored in the quantitative survey. In the qualitative interviews, where respondents mentioned plans to take up ULEVs, these were medium – long term intentions to iteratively replace their existing fleet as opposed to immediate plans to replace.

Where they reported intentions to take up ULEVs, operators were asked about the motivations for this:

Table 4: Breakdown of key drivers for operators with intentions to take up ULEVs [n=66] [back coded from open end responses]

Driver	Number of operators citing[14]	Sample of responses (including from the in depth interviews)
Compliance; see this as the way legislation is going	34	*"In London there is a lot of focus on low emission vehicles, and regulations that we need to adhere to."* *"Because otherwise we will get charged a lot for operating within the M25."* *"We're looking in to it, as legislative environmental issues do keep cropping up."* *"London is going that way; also it is good for my business rep."* *"I need to or I will have to sell my business or set up elsewhere. Otherwise I will not be able to work in London and make enough money."* *"We have to have plans because of the ULEZ in 2020."* *"Firstly tax benefits, and secondarily, carbon image."* *"We are a recycling company trying to be as green as possible."*
Reduce emissions / environmental impact	15	
Potential reduction in fleet operating costs	14	
Reputational: seeking market differentiation / niche	11	
Adherence to CSR / targets	9	
Perceived customer demand	6	

The motivations for those planning to take up ULEVs for the first time differ substantially from the motivations of those who have already done so, in particular the extent to which compliance becomes a driver (from the least commonly cited amongst those already operating ULEVs, to the most commonly cited for those planning to); this was also the motivation anticipated to be most significant by the influencers interviewed in phase 2. On the other hand, motivations for operators that already have ULEVs to purchase *more ULEVs/ LECVs* are potentially similar.

There was relatively high awareness of the prospect / concept of ULEZ, even though few organisations specifically named it[15]. Responses from some organisations contained ambiguity as to their understanding of future legislative requirements. A number of organisations talked about *needing* ULEVs to travel in London in future; it was not clear whether for these organisations:

[14] Some cited more than one motivation.

[15] These responses were provided prior to the ULEZ being described and prompted later in the survey. The fact that the sample predominantly comprised FORS members may explain good awareness levels, though it is reasonable to suppose that many organisations operating fleets in London would have some awareness of this significant change.

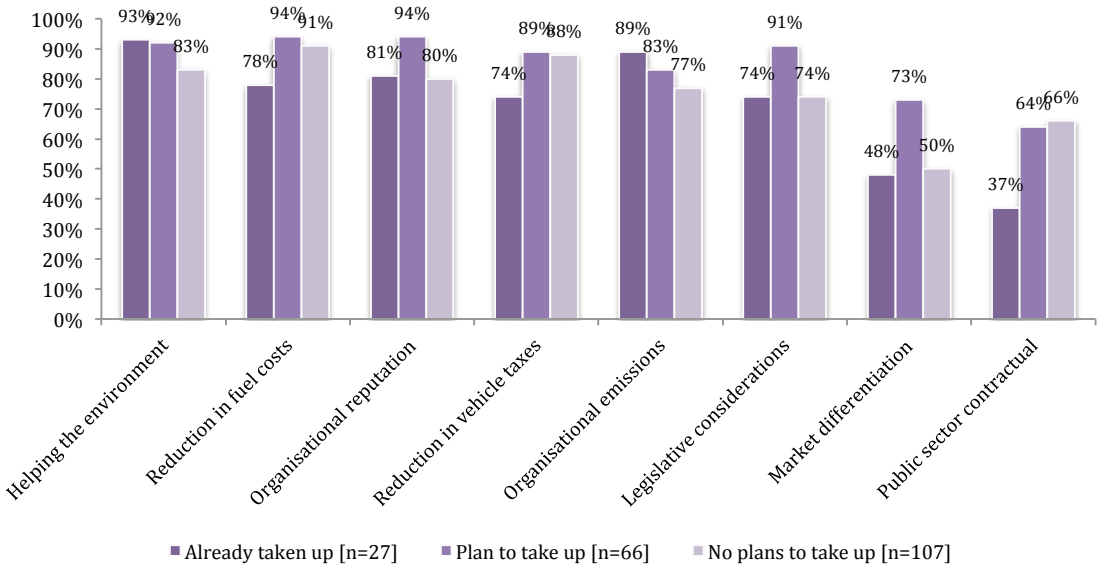
a. They (mis)understood the ULEZ as only allowing compliant vehicles to travel in the area.
b. They understood that ULEZ was a charging scheme, but expect the charges to be of a level that in effect forces them to purchase compliant vehicles.
c. They were conflating the ULEZ with wider EURO6/VI legislation. This would be important in that the type of vehicle they would need to purchase to comply with EURO6/VI would not have to be what TfL would consider to be a ULEV.

3.4 General motivations

Drivers evidenced in phase 1 included reduced fuel costs, customer or corporate sustainability interests, government encouragement (Plug-In Van Grants, Plugged in Places, the Low Carbon Vehicle Procurement Program, the Low Emission Heavy Goods Vehicle (HGV) Task Force, funding for bio methane refuelling infrastructure etc.), long-term policy cooperation and general business 'risk mitigation'. Previous research has shown that reduction of carbon emissions is an influential factor in the public sector, but this factor's impact on decisions made in the private sector is under-researched.

In the phase 2 survey, regardless of current ULEV take up – or plans – operators were prompted with a list of possible motivations for them to take up ULEVs in the future; the results – broken down by current ULEV status – are as follows:

Figure 10: Extent to which different motivations could be relevant to operators in deciding to take up ULEVs in future [n=200] [multiple choice]



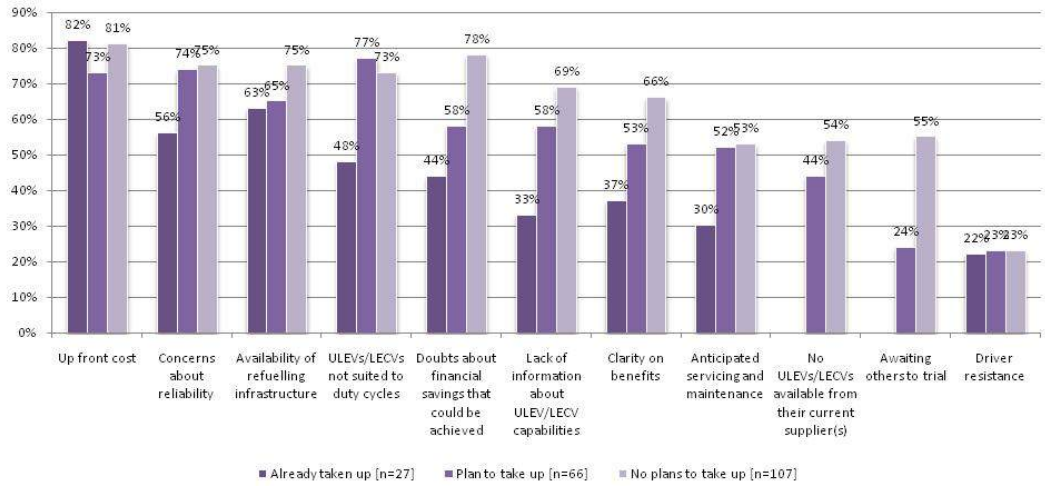
The chart shows that the prompted motivations would apply for at least half of all operators. In terms of comparison between the three groups, sustainability considerations seemed to be most prominent for those who already operate ULEVs, indicating again that these were the basis for these organisations first taking up or trialling ULEVs. Other considerations (financial, reputational, or legislative) tended to be more prominent for those yet to purchase a ULEV, usually strongest for those planning to do so, in particular around legislation and differentiation. The variance – and extent of endorsement – of the majority of motivations provides TfL with abundant angles that could be taken in successfully promoting take up. Some of these motivations – in particular the influence of ULEZ and customer influence – are explored in sections 4-6.

3.5 Potential barriers

The phase 1 literature review identified several barriers in relation to the uptake of low-emission vehicles. These barriers include technical barriers (limitations on aerodynamic feature dimensions on HGVs, refuelling infrastructure in particular for certain technologies, limited vehicle range, and small fleet sizes) and commercial barriers (perceived decreased payload due to the increased vehicle weight, high up front costs, lengthy payback periods, general difficulty in calculating cost benefits, and general uncertainty with regards to the future direction of ULEV technology / possible technology redundancy.

In the phase 2 survey, all operators were also prompted with a list of possible barriers to take up of ULEVs in the future; the results – again broken down by current ULEV status – are as follows:

Figure 11: Extent to which different barriers could be relevant to operators in deciding to take up ULEVs in future [n=200] [multiple choice]



Concerns about up-front cost were the most prominent barrier, along with concerns about reliability and refuelling infrastructure; these three are generally well cited and understood barriers across most previous research on alternatively fuelled vehicles. Up front cost was the most common barrier to further take up for those who have already taken up ULEVs; an important finding as this barrier is not likely to be only perception for these organisations – they already know the costs.

Anticipated maintenance and reliability concerns often overlapped; in the qualitative interviews it was noted (by organisations that cited this issue) that whilst servicing and maintenance costs are of immediate concern, there are also the knock-on effects to the service they provide (some operate their vehicles every day of the week and for most of the day) and reputation with customers.

The differences between those that operate ULEVs and those that do not on the existence and extent of some barriers – e.g. non-alignment with duty cycles and servicing / maintenance costs – might indicate that some barriers are more perception than the result of significant investigation. However, the fact that even some of those who have taken up ULEVs have cited such issues indicates that these are likely to be real – and potentially insuperable – barriers for a proportion of those yet to take up. The qualitative interviews found several cases of organisations that had trialled ULEVs and found them to be costlier and less reliable than their existing fleet. It is not clear whether those claiming that their suppliers do not offer a ULEV are correct or have simply not fully investigated / asked suppliers about this. Key barriers above – in particular duty cycles, supplier influence and refuelling - are explored in greater detail in sections 3-5. Operator descriptions of barriers included the following:

- *“It’s not practical with HGVs because of the distance that we need to cover.”*
- *“The weight of batteries would reduce loads.”*
- *“We currently meet EURO6 specifications so we do not need to upgrade at this time.”*
- *“There is nothing out there at the minute suitable for what we use. There is not a ULEV that has the ability to tow big vehicles. ULEV's do not have the power, and there is also a lot of cost to obtain one.”*
- *“We would be changing from a product we know to a product we don't know. We don't know how it would work.”*
- *“There is no ULEV that would be the weight and size that we need.”*
- *“I maybe will in the next two or three years but not at the moment because they are too expensive.”*
- *“It’s too expensive and I’m not interested at 68 years of age.”*
- *“The incentives have to be greater to compensate for additional costs.”*
- *“We always look at it but it has got to be something that works. You can't run a business and suddenly stop to plug it in at a charge point and wait an hour.”*
- *“It’s just the cost of buying and maintaining a ULEV is the issue.”*

Influencer respondents generally focused around four key barriers in their interviews:

1. Operators having limited accurate information about ULEVs, or hearing negative experiences; one influencer noted that *"whilst there is a lot of misinformation out there, some of it is actually true – early adopters did have bad experiences."*
2. Limited suitable vehicle models available.
3. What is available is too expensive.
4. Insufficient infrastructure to enable available ULEVs to operate efficiently.

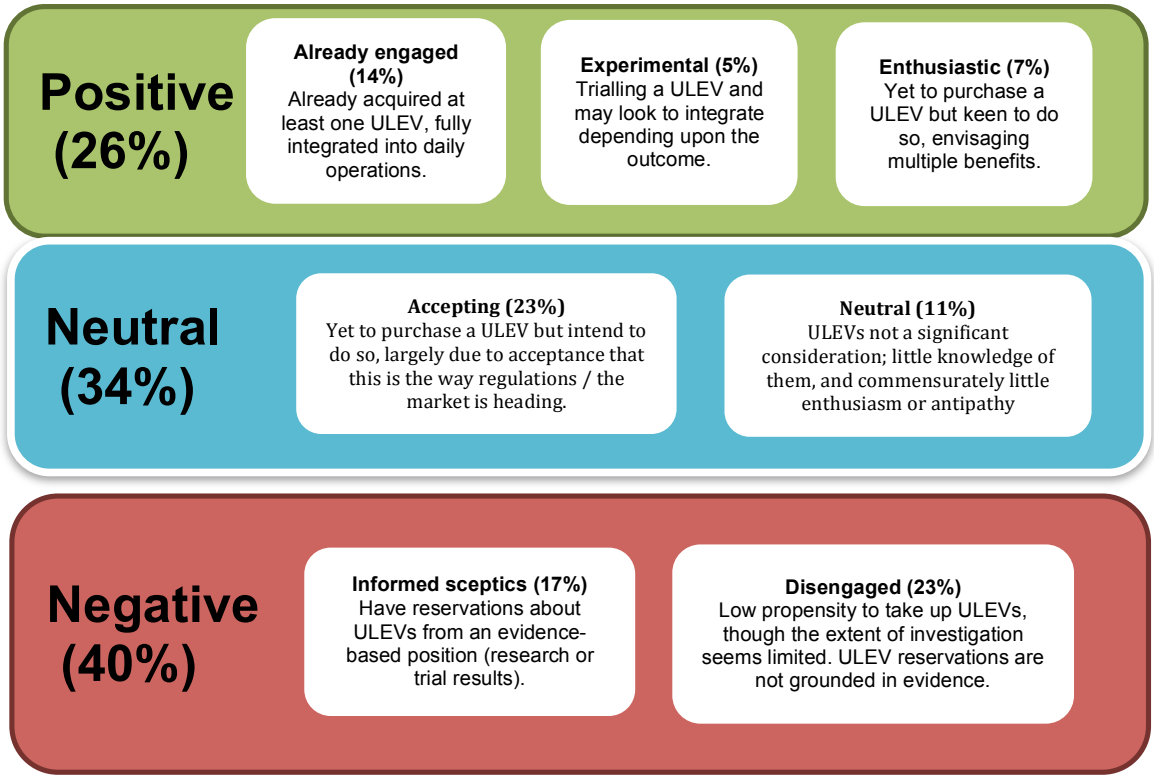
3.6 Segmentation

The responses around take up, motivations and barriers enabled a segmentation of operators into seven broad groups.

The key implication of the segmentation – and the profiles of different groups within it - for LoCITY is that there are a range of groups with different support needs in terms of information but broadly similar needs in terms of overcoming key practical barriers around cost, alignment with duty cycles and infrastructure. There are some obvious 'quick wins' for LoCITY in terms of organisations that are reconciled to idea of taking up ULEVs and simply require specific support to help them to do this.

These segments and groups, the approximate proportion of the sample that they comprised, their description, and some of the key attributes that seem to define them, are as follows:

Figure 12: Segmentation of operators and grouping of these segments



The breakdown of these seven segments translates into three broad positive-neutral-negative groups.

Whilst sample sizes and overlapping characteristics limited the extent to which each group could be analysed and a clear operator profile distinguished for each, apparent distinctions in profiles, and implications for TfL (discussed further in section 6), are as follows:

'Positive' group

Around a quarter of operators are already operating ULEVs or are enthusiastic to do so. These organisations tended to operate[16] larger fleets (and be larger in general e.g. measured by FTEs), were more likely to have fixed vehicle replacement procedures, averaged slightly lower mileages per vehicle (potentially making ULEVs more practical for them) though more frequent journeys, were more likely to have procedures that meant refuelling at fixed times, were the most likely to be aware of the ULEZ, and were most likely to be in the public sector.

In terms of LoCITY support, what links this group is less the need for ULEV benefits to be 'sold' to them, but more support in overcoming specific organisational barriers to take up or further[17] take up e.g. up front cost and refuelling infrastructure.

'Neutral' group

A further third of operators have strong potential to take up ULEVs leading up to the introduction of ULEZ. These organisations also tended towards having larger fleets and towards operating HGVs rather than vans (perhaps highlighting potential limitations in ULEV choice).

In terms of LoCITY support, this group largely accept the in-principle case for ULEV take up, but require not only support for the same types of barriers as the first group, but also greater levels of information on ULEV performance, cost-benefit analysis, and supplier information.

'Negative' group

A substantial minority of operators have strong reservations about ULEV take up for their organisations. As identified in the literature review, these operators tended to be smaller in terms of fleet and FTEs. They tended to have the highest average mileages and were the

[16] Ownership – however - did not seem to be a critical factor.
[17] Despite some having already taken up ULEVs, they still require support to further roll these out – for most, ULEVs comprised less than a quarter of their fleet.

most likely group to only refuel off site. They were the least likely to have CSR goals around emissions reductions and the most likely to be unaware of ULEZ.

Overall, the group can be characterised as one that sees multiple and substantial barriers to take up, whilst also being the least likely to see / be in a position to realise potential benefits to overcome reservations. This is a group that would likely require substantial resource and effort from LoCITY to turn around propensity; it remains a question for TfL as to whether they view this as being an effective use of resources, or whether these organisations can be 'caught in the net' anyway by the increasing emissions standards in EURO6/VI etc.

Analysis of these segments and broader groups against key potential motivations and barriers provided limited distinctions as most motivations / barriers were acknowledged by most groups. Even where there were distinctions, they did not always point to a clear strategy for LoCITY; for example, of all the segments, achieving reductions in fuel costs was of least motivation to the 'already engaged', yet still 78% of this segment said that achieving reductions would be a motivator, therefore any approach to them that ignored this would likely be of limited effectiveness. However, the following were generalisations from the data:

- Those already operating ULEVs *tended to be slightly more likely* than others to be motivated by sustainability and environmental concerns (93% acknowledged this as a motivation) and less likely to be motivated by financial considerations: *"we are looking to reduce our emissions and improve air quality"* (78% for fuel cost reductions and 71% for tax reductions). Those trialling or enthused about ULEVs seemed to be more motivated by financial (fuel and tax reduction) considerations – more than 90% acknowledged both - at levels identical to the segments in the 'neutral' and 'negative' groups.

- Those in the two 'negative' segments were less likely to be motivated by organisational CSR or emissions reductions targets. They were also least likely to see the potential of ULEVs in terms of reputational benefits / market differentiation. For both, around 75% acknowledged these as a motivation.

- In most segments, a majority reported a key barrier as the need for greater clarity on ULEV benefits (truest of those in the 'negative' group) whilst the types of barrier such as up-front cost and concerns about refuelling infrastructure and reliability were similar across most segments.

- Those in the three least positive segments were clearly more likely to want to see others in their sector / competitors successfully trialling vehicles before they would consider take up.

- Those in the ‘neutral’ and ‘negative’ groups were more likely to report that their current suppliers do not offer ULEVs, though the extent that this was due to lack of enquiry on their part was not ascertained.

4 The process of purchasing vehicles

This section provides a summary of operator responses around how they purchase vehicles; the quantitative survey explored a small number of key questions and these were explored in greater depth in the qualitative research.

The section follows a broadly chronological path from how the need for new vehicles is first identified, how the requirement (number, make / model, capabilities) is defined and how that is then progressed, as well as which stakeholders (both internal and external) are involved at each stage and to what extent.

The literature review found that the extent of centralisation and formalisation in vehicle purchasing were key features determining the extent of uptake of cleaner technologies.

High formalisation: Only solutions to problems that disrupt standard procedure are typically sought. Associated solutions seek only incremental change, if any, and rely heavily on previous processes/solutions.	**Low formalisation**: Decisions are guided by intuition, judgement, political bargaining etc.
High centralisation: Multiple people across multiple teams/departments are involved in the decision-making process. Fleet decisions are often a team decision vs. the decision of a single fleet manager.	**Low centralisation**: One or two individuals are able to make a fleet decision without further authorisation

The primary research found these reflected at each stage but also a wider more nuanced range i.e. there were few clear typologies in terms of groups of operators who all approach each stage similarly with the same internal and external actors involved at the same time and in the same way.

Overall however, the difficulty in accessing what is usually a non-transparent procurement process – indicate that LoCITY influence upon procurement will likely comprise:

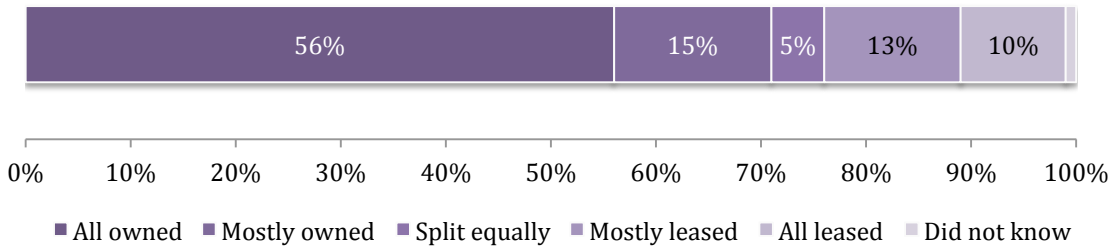
- Provision of information to operators to ensure that (a) seeds are planted as to ULEVs as a prospect; (b) that reservations / gaps in knowledge on ULEVs (such as cost-benefit and reliability) have already been addressed.
- Awareness raising and advocacy work with wider stakeholders (suppliers, leasing companies, manufacturers etc.) to encourage these organisations to in turn encourage ULEV uptake.

4.1 Identifying the need for new vehicles

4.1.1 Ownership

All operators who participated in the survey were asked whether their organisation owned or leased their commercial vehicle fleet; the results were as follows:

Figure 13: How operators acquire their commercial vehicles [n=200]



Where they part owned and part leased their vehicles, operators were asked upon what basis they decided which. Aside from the small number of operators who were not clear on the basis for this, the reasoning was largely financial. There was usually presumption in favour of owning, though some organisations felt that servicing and maintenance were better managed through leasing and some will default lease in the absence of external funding. The decision depended upon the cost of the vehicle(s) in question, how many the organisation already own (i.e. more likely to buy outright a make and model they have experience of and trust), and / or existing budgets. One operator discussed leasing and then purchasing the vehicle outright (at much lower cost) upon the expiry of that lease. Another said that leasing is done due to only temporarily needing a specific specialist vehicle for a specific task. Several organisations have switched from leasing to owning (or vice versa) and so have a mix because the decision was a fairly recent one: *"we only lease now, but we have some vehicles from a while ago when we used to purchase."*

As noted in section 2, there seemed little correlation between the extent to which operators own/lease and which operator segment they seemed to occupy, though one operator reported that they preferred to lease but could not find a supplier willing to lease the LNG they wished to trial. Conversely, another reported leasing low emission vehicles in order to trial them at lower risk.

4.1.2 Replacement frequency

From phase 1 review, a 2014 study of utility companies in the US showed that 81% had a formal vehicle replacement policy. Replacement age varied across companies, but more

predominantly across vehicle types. Light vans replaced at an average age of ¬7 years, and most HGVs at ¬11 years. The most common responses were for replacement at 8 years for small vans and 10 years for most trucks, with target mileages ranging from ¬122,000 to ¬154,000, with 150,000 miles being the most common response for all vehicle classes. Anecdotal information from leasing websites on how long leased vehicles are retained by operators indicated that:

- Options for van leasing tend to vary between 2 and 4 years;
- The default setting for HGVs is 5 years.

In phase 2, 78% of operators said that their organisation replaces vehicles at fixed times (though that fixed point may vary by vehicle type). This was more common for larger fleets and those in the 'positive' group described in section 3. Where they do so, the average length is around 5.5 years, though the range was between 2 years (cited by two operators) and 15 years (cited by one). Almost half of these organisations replaced their vehicles between 3 and 5 years.

As well as the length of replacement cycle, the key triggers for these organisations varied; the triggers cited in the qualitative research tended to comprise vehicle age or mileage, but these fixed arbitrary milestones are informed by belief (whether evidence-based or otherwise) of vehicle performance and condition after that time / mileage. In some organisations there are exceptions to the fixed replacement rule whereby a vehicle may be retained for longer if in good condition, or may be replaced before the usual point if servicing and maintenance costs are adjudged to be excessive. For these organisations it is more accurate to say age/mileage is a trigger to assess vehicle roadworthiness than an automatic trigger to replace.

The remainder of operators described their purchase process as ad hoc. Whilst these organisations sometimes take into account maintenance costs, performance, vehicle age or mileage in their assessment of whether to replace, they rarely seemed to have clear milestones / limits. A number of operators to the qualitative research discussed the importance of avoiding unused capacity i.e. they will investigate whether needs can be met by re-balancing existing fleet use without having to purchase a new vehicle.

Some operators use a mixed approach to renewing their fleet. For example, they might renew certain types of vehicle at a fixed point. This tends to be for standard vehicles that an organisation will always need on an ongoing basis. These organisations then take a more ad hoc approach to procuring more specialised vehicles as the organisation grows and has differing needs.

4.2 Who?

Regardless of the trigger for replacement, this is usually activated by the fleet manager / individual with the fleet in their remit, albeit agreement on the need to replace was sometimes tested with colleagues (and senior decision makers) prior to progressing exploration of what the replacement vehicle(s) could be.

Overall, just over half of operators to the survey (57%) said that multiple internal representatives were involved in vehicle procurement decisions, though a substantial proportion of the remaining 43% were those organisations where the owner is in effect responsible for all fleet decisions (usually a small fleet). Amongst organisations with multiple internal actors that responded to the qualitative research, the roles described included a combination of the following:

- A fleet manager or equivalent; even where multiple actors are involved at initial stages, respondents reported this individual (often themselves) as doing most of the 'leg work' in terms of identifying the need for replacement vehicles, producing a specification and contacting suppliers. They present the business case to the MD / owner (sometimes not a very formal process). They then source quotes (where the operator does not simply renew and existing order) and have some autonomy over the selection. *"The National Fleet Manager would identify the need for new vehicles and would manage the whole procurement process including writing the spec, evaluating the tenders and doing the number crunching and then looking after the vehicles once purchased."*

- Operations managers – where organisations have both this role and that of a specialist fleet manager, the former may become involved through providing a steer on requirements, driver feedback and in future capacity needs. *"I [ops manager] will spec out what we need and make the business case and take the costs and recommendations to the owners, who will then sign off on the finance."*

- Owners / directors – responses varied as to whether they become actively involved at the scoping stage or simply assess a presented business case and sign off the purchase; in small operators the owner might be the individual fulfilling all roles in the process.
    - *"I do 95% of the work. Then pass quotes and info to the finance director, who will sign off the purchase, unlock funds etc."*
    - *"It's all me; I'm basically a one-man operation and just pay a few drivers."*

- Procurement teams – only really in place for larger organisations, they might be involved in producing the specification (or making sure it meets organisational standards / legalities) and then sorting out the paperwork. They will also tend to manage the administration of a tender process where there is one. *"There is a*

tendering exercise…managed by the Fleet Manager and the procurement team are also involved."

- Accounts / finance departments will input on budget available, and how vehicles can be paid for. They may also help to assess whole life costs. *"The accounts department get involved in terms of raising a purchase order and transferring the money etc."*

4.3 Selecting vehicles

4.3.1 Key considerations

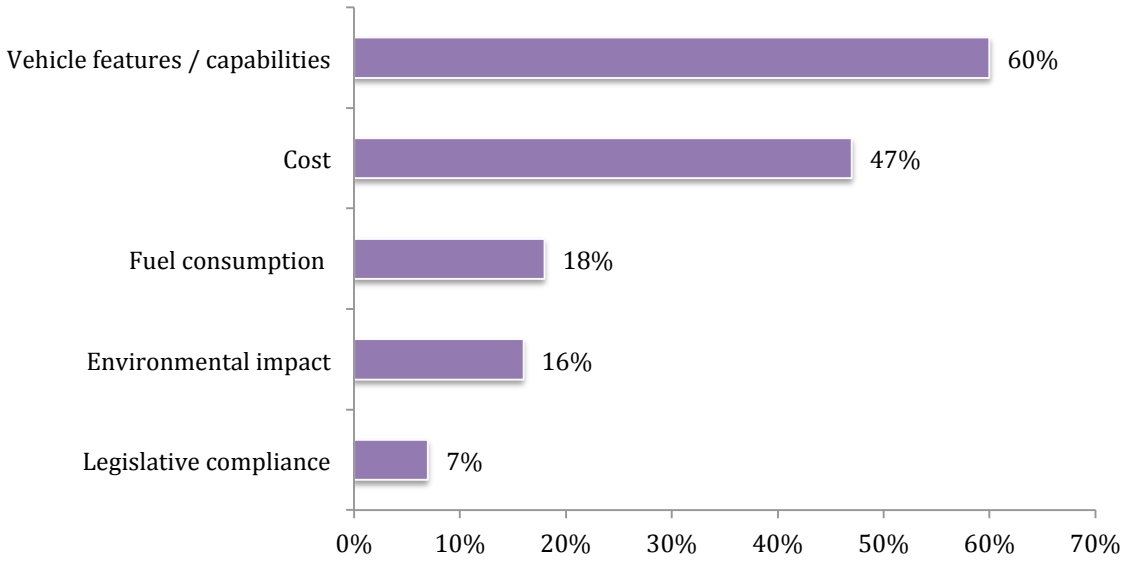
The phase 1 review indicated that considerations of fleet turnover intersected with those on payback periods, which often became more relevant in relation to low-emission vehicle technology. Fleet operators were looking for typical pay-back period of ¬4 years- even if electric vehicles make financial sense over a longer time period. A LowCVP market background study[18] found that for HGVs, operators prefer that any upfront investment generally has a payback of at most around two years, with less preferred.

The phase 1 review found that maintenance costs, resale value, infrastructure cost and lifespan are factored in to all vehicle purchasing decisions. Due to current low uptake, maintenance costs, repair, infrastructure and upfront vehicle costs can all be quite high for ULEVs without various financial or non-financial incentives (such as allowances for battery mass, exclusive access to certain loading bays in cities, extended delivery hours, use of bus lanes, longer term financing options etc.). The phase 1 review found that complicating accurate financial calculations, as noted in section 3, fleet managers of car and van fleets often have poor access to data (including baseline operational spend and potential electric vehicle costs and benefits) due to the low priority given (within many organisations) to vehicle fleet monitoring.

All operators who participated in the survey were asked to describe – unprompted – the key factors influencing vehicle procurement decisions in their organisation; the results are as follows:

[18] Low Carbon HGVs - Market Background Study (2010): AEA for LowCVP / DfT.

Figure 14: Coding of responses to an unprompted question of key factors influencing vehicle procurement decisions [n=200]



Whilst the chart should not be assumed to reflect the actual extent to which these different factors apply in vehicle purchase decisions (the question being unprompted makes it unreliable in this regard), it does help to understand both which factors are to the forefront of operators' minds and perhaps the relative importance of each.

Where cost was cited, this tended to be in relation to capital expenditure as opposed to operating cost, though the qualitative interviews indicated that most operators do consider whole-life cost, albeit within the parameter of vehicles being affordable up front.

Selected responses to the question included the following:

- *"What customers require. We need vehicles with certain specs and we need to make sure that they are compliant with regulations for travelling around London."*
- *"We tend to buy [x brand] because of their reliability. We look at cost of ownership and costs in the long run."*
- *"We need specific vehicles for jobs. We have requirements such as a certain weight limits and space. Vehicles need to perform a certain function."*
- *"We look at value for money as well as reliability. Most vehicles have to be EURO6 standards."*
- *"We look at emissions and costs and maintenance. We also look at comfort for drivers because they do 7 days a week operation."*

- *"We have a pot of money and we want to get the most out of that pot so primarily we want to get the vehicle at the lowest cost. Safety is also a factor, making sure the vehicle is right."*
- *"The vehicle has to be suited to the duty cycle. We also look at the age of the vehicles."*
- *"The relationship with the dealership. We have a very good one with our dealership which results in us being able to get good, cheap vehicles, in a quicker period of time."*
- *"The key factor is the cost of the van and the space at the back. We need space to make sure we can carry tools and machinery."*
- *"The cost is a big factor, as well as the size of the vehicle. There are also environmental factors."*
- *"Reliability of the vehicle, maintenance costs, upfront cost and level of fuel consumption."*
- *"Price. We are concerned about the environment but we are mainly focused on price."*

4.3.2 Supplier selection

From the qualitative interviews, three broad groups emerged in terms of the specific process for vehicle supplier selection:

1. Operators – usually larger and disproportionately in the public sector – that have a formalised tender process (whether open or limited invitation). Only four of the 30 operators in the qualitative survey ran this type of process. In addition, even for these, tendering processes were sometimes of limited rigour ("not very scientific" as one operator described) and factors such as existing relationship and previous experience with a supplier are important.

2. Operators across a range of profile variables who have fixed supplier agreements (sometimes with Key Account Managers[19] depending upon size) and so renew existing orders or seek supplier support in refining an existing order / specification. This often suits larger fleets that have rolling requirements, especially where fixed agreements enable discounts, can guarantee build slots (continuity of supply being paramount), and include maintenance clauses in the package.

3. Operators – usually most applicable to smaller fleets - that take a more ad hoc approach to purchasing. This can vary from organisations that will research a number of potential suppliers and approach each / the one deemed to best match requirements, or will simply return to a supplier they have historically used / have

[19] Where organisations had KAMs, it seemed even these tended to respond to specifications rather than seek to lead the operator to new solutions.

an existing relationship with (albeit nothing as formal as the situation in the second group). Within this group are a significant proportion of the qualitative sample that are only purchasing second-hand vehicles (sometimes from e-bay or similar); for these operators, the primary consideration is cost – they are often operating only a handful of vehicles – and tend to run vehicles 'into the ground' before replacing.

What connects these three groups is that the operator leads with a specification and reports that in most cases suppliers / brokers simply respond to this rather than 'up sell'; albeit there will be an impetus upon brokers / suppliers to secure a good deal and maximise revenue, there was little suggestion that suppliers are pushing ULEVs or incentivising trials etc. This may come from a reticence to 'rock the boat' with long term and lucrative customers, but may also highlight an opportunity for a more proactive role. From their extensive experience, LowCVP perceive a few factors at play:

1. Vehicle availability – suppliers do not have mature, readily accessible ULEVs to up-sell.
2. Risk – suppliers won't want to risk up-selling a technology which they cannot be certain will be appropriate for the client, so they stick to what they know will work, which is the conventional vehicle type.
3. Infrastructure provision – suppliers know that operators need more than just the ULEV in many cases; they also need access to charging or alternative fuel facilities.

Some operators reported being contacted periodically by their suppliers with information on new vehicles or new features that can be built into a vehicle (mostly safety or driver comfort features); although even this doesn't tend to prompt immediate action, most recipients reported holding onto the information and bearing it in mind at vehicle renewal points. In most cases, fleet managers have established relationships with a handful of suppliers, and often organisations just keep going back to the same people as they trust them and tend to get the best prices.

Several operators – both operator and influencer – reported operators tended to be "very loyal" and "know what they like"[20], often one or two manufacturers at most. The implication was that it might be difficult to weaken these relationships where the supplier offers no ULEVs. Even where operators do not to have fixed supplier agreements, most have 'favourite' or 'preferred' vehicles and / or supplier.

Those leasing vehicles tended to have the more formalised arrangements in terms of both supplier relationship and fixed replacement cycles.

[20] One fleet publication representative said that they will often run a story on an operator who has switched manufacturer of vehicle, as this qualifies as a newsworthy event.

In terms of budget for vehicle purchase, these are pre-planned for those with larger requirements and / or fixed replacement cycles, but can fluctuate greatly for other operators. Many operators in the qualitative interviews talked about the importance of a business case as there was no guarantee of funding for any vehicle replacement in some years i.e. unless it could be shown to be a necessity.

4.3.3 Other external actors

As well as suppliers, the influence of other external actors – or the potential for influence – was explored in the qualitative interviews. The key influences cited tended to be statutory – Government due to the introduction of legislative requirements, and DVSA due to driver requirements. Trade bodies were hypothetically felt to be an important audience – at least in terms of messages being listened to – though no specific bodies were cited. It was noted by operators that smaller organisations and fleets that are less likely to be members will be missed, though they may still pay attention to content disseminated by associations.

Whilst operators did not cite competitors directly as an external influencer, a couple of operators mentioned that they were keeping an eye on competitors who were trialling ULEVs, and were interested in whether they found the trial successful. Linked to this, word of mouth between drivers of different organisations was sometimes seen as a powerful influence in terms of broadening consideration of options / planting seeds.

Few operators cited trade press – or the press more widely - as an influence. Publications mentioned as being read by respondents included Commercial Motor, Road Trader, and Road Transport, along with various unnamed sector specific publications.

The ten influencers interviewed as part of the research were asked for their own perspective on the extent to which they influence decisions. All felt in some way able to influence fleets – whether through advice, research, standards, quotes / suggested models, features / editorials. Some felt they have more direct ability to influence e.g. leasing companies feel they can influence, FORS feel their influence is more indirect. Regarding low carbon vehicles specifically, there was a mixture of views closely linked to the type of organisation:

- **Indirect influence** included FORS, the trade publications (who might carry adverts or features about low carbon options, consultancies reporting that their influence is through the research they do. One influencer noted that *“I haven’t really seen anything to indicate that other (wider) organisations really do have much influence, at least not directly. Organisations such as the FTA and LowCVP do influence policy and incentive/support mechanisms for ULEVs, but individual purchase decisions are more driven by what the suppliers/leasers have available and have knowledge of.”*

- **Active influence** included trade bodies and consultancies providing advice to their members / clients around vehicle choices, including discussion of low carbon options.

4.3.4 Purchase process vs. operator segments

There is insufficient evidence to suggest that vehicle purchase process is clearly different for / more conducive to specific segments. The purchase process and who is involved is more down to the size of the company and the size of the fleet – larger organisations tend to have more formalised processes - though this means a correlation with those who have already taken up ULEVs to some degree. The only clear distinction was organisations with ULEVs including sustainability as a stipulation in some or all requests to suppliers.

5 Examination of specific internal influences on vehicle consideration

This section focuses in on two key internal influences hypothesised in the ITT for the research and from the literature review. The first – duty cycle – tends to at best have a neutral influence upon ULEV take up (i.e. duty cycles do not prohibit / create obvious practical difficulties); CSR tends to have a positive effect where it genuinely influences selection, but the extent to which it does influence – when in place - varies.

5.1 Duty cycles

The phase 1 literature review indicated that the need for fleet infrastructure meant that duty cycles, site location and distance between depots are crucial to the decision to pursue new technologies. The phase 2 survey sample covered a wide range of duty cycles in terms of business activity, frequency of vehicle use, loads, mileage, and refuelling approach. The only clear correlation with ULEV take up – or propensity to take up – seemed to be around mileage (the lower the more likely to be operating a ULEV). However, in more open ended responses there were a number of hurdles for organisations to overcome in terms of ULEVs being appropriate for their fleet operations:

- Options for low emission vehicles – and ULEVs in particular – become increasingly limited as vehicle weight bands go up; where organisations are operating predominantly HGVs, this limits selection even prior to consideration of more specific duty cycle issues. Linked to this, a number of organisations with specialist vehicle requirements (e.g. waste trucks) were not aware of any ULEV that delivered such a function. *"The key limiting factor at the moment is that as far as we are aware there are no ULEV waste trucks available on the market at present."*

- ULEVs tend to weigh more due to batteries etc. and so have to carry reduced loads vs. a conventional van or HGV. This would adversely affect load carried and so operational speed / efficiency.
    - *"I've been shown the electric vehicles and the weight of the batteries would reduce the payload of the vehicles."*
    - *"I need to know the effect that having a large battery in a van would have on the space in the back."*

- Where vehicles travel long distances per day (as opposed to covering a lot of miles in a small area) there are perceived to be increased risks relating to reliability, both of the vehicle and availability of refuelling infrastructure. This was especially the case for those operators that talked about 'driving vehicles into the ground'. *"Can these things be charged if they're doing long haul jobs, what is their range etc., where are the charge points?"* The literature review in phase 1 indicated that there were a number of operators in or around London returning vehicles to a base or

depot at least once per day, indicating potential for adoption of ULEVs; however, even where vehicles are only travelling smaller distances, it was felt by operators that there may be limitations around when and at which locations refuelling might take place. *"The charging infrastructure in London needs to be better."*

- Linked to this, operators with 24/7 vehicle operations (where drivers simply switch) would not have the time for the lengthy refuelling required by some ULEVs, or would have to re-work schedules and become less efficient / productive.

- Even for cycles where returning to depot would be feasible, there were concerns about infrastructure cost. Yet as found in the literature review, some organisations allow drivers to take vehicles home which could lead to tension if ULEVs are introduced: *"Some diesel vans go home with staff at the end of the day. If we moved to electric, we would get electric pool vehicles that are used as needed and if we do this we are worried that some staff might leave because they don't have a vehicle they can take home anymore."*

Overall, where ULEVs would seem to be most immediately viable are operators with localised routes, schedules with some flexibility around loads and time for vehicles to undergo refuelling, central depots that vehicles return to with charging infrastructure (or clearly planned publicly accessible charging infrastructure).

5.2 CSR

As already noted in section 3, reducing environmental impact and meeting organisational emissions targets were often cited by operators and seemed to be most prominent for those organisations in the 'already engaged' group. Seven out of the 30 qualitative research operators stated that reducing emissions is an important priority for their organisation.

- *"We are doing our bit for the community in helping the environment. ULEVs also help us to hit our CO_2 targets."*
- *"We are looking to be greenest fleet in UK."*
- *"Our mission is to take diesel and petrol out of city centres."*

CSR had in some cases instigated action on things like driver behaviour and route planning in order to reduce emissions.

6 Examination of specific external influences on vehicle consideration

This section focuses on two key influences. The first – the ULEZ – seems to have the potential to be a crucial factor in operator considerations; customer requirements are already important to most operators, but in most cases (depending upon the customer base) these tend to lead away from – rather than towards – ULEVs.

6.1 ULEZ

The phase 1 review found little information on operator awareness of or response to the ULEZ. From the phase 2 surveys there were two key findings with regards to the ULEZ and its potential influence upon ULEV take up. The first is that there is good awareness of the concept and in principle recognition of the effect it could have. 65% of operators to the survey said that they were aware of ULEZ and – following an outline description for those not aware – 63% of operators felt that it would have a substantial impact upon their organisation. In addition, section 3 has already highlighted the extent to which compliance with future regulation is featuring in operator considerations, though how far ULEZ is being conflated with EURO6/VI requirements was not always clear.

Example quotes from those envisaging a substantial impact; these show the range of ways in which different operators are envisaging responding to the ULEZ.	• *"We will be looking to upgrade the fleet so we may bring it forward a little bit so it comes in time for the ULEZ."* • *"We would put a message out to sub-contractors, making them aware, and discuss increase in cost of freight."* • *"We would have to upgrade our fleet, which would have huge cost implications. We would be looking to minimise travel."* • *"We would be looking to upgrade our fleet. We can't minimise travel in t ULEZ so would pay the charges if we have to."* • *"Obviously we would have to be very sure which vehicles can go in it the zone, managing which ones go in so we don't get fined etc."* • *"It will affect us being able to supply a service to our customers in that zone."* • *"We must go where the clients are so we won't have a choice to a certain degree. We will likely have to upgrade the fleet, and try and minimise travel within ULEZ."*
Example quotes from those envisaging no / minimal impact; some indicate the differing perspectives of operators i.e. some see ULEZ increasing costs to their customers as a substantial effect, others see this as	• *"We would have the correct vehicles so I cannot see it having major implications on our company."* • *"We will not lose anything; it will only result in charging our customers more* • *"We will have upgraded by this time and at this moment in time we believe it will not affect us unless they change the goal posts again."* • *"I don't think it will affect us too much as we don't go into the zone often. We generally get a congestion charge once a week."*

However, there was a general lack of operator knowledge on the specifics of the policy e.g. charges and precise area it will cover, which limited the extent to which they could discern precisely to what extent the Zone would affect them, and therefore what mitigating steps to take.

Depending upon the Zone boundaries and charges for different vehicle types, operators said that they may choose to: (a) purchase ULEVs; (b) pay the charges (c) re-route and avoid the Zone altogether; (d) combinations of the above to varying degrees. One influencer postulated that some operators may be sceptical as to whether the ULEZ will actually be implemented, and are waiting for confirmation before making any firm moves.

Several operators voiced concerns about the ULEZ, especially where they were currently unable to find any suitable vehicles that would likely escape charges, yet could also ill-afford to reorganise routes i.e. situations where operators believe themselves to be unfairly penalised when unable to take action: *"It would cost £2.5m to replace the current fleet so this or the ULEZ charges would most likely finish off the business."*

6.2 Customers

A small number of operators – in particular those with public sector clients – reported that their customers are starting to demand greater sustainability: *"Customers buying from us want zero emissions."* Albeit potentially skewed by the sample source, operators talked about FORS accreditation as becoming an important accreditation required by their customers. There was interest in maintaining the accreditation even in organisations that outwardly seemed less interested in sustainability / environmental impact: *"some customers ask for sustainability information in their tender process"; "customers enquire about our carbon emissions."*

Most operators reported that customers were theoretically a very important influence on their vehicle choices. However, overall many seemed to feel that either (a) their customers were not particularly interested in their vehicle choices: *"we don't really have any CSR goals - customers aren't fussed."* (b) Even where they were, this tended to be around ensuring the best vehicle to get the job done / minimising costs, as opposed to driving increased sustainability or ULEV take up: *"Our customers don't care what vehicles we use as long as they comply with regulations."* Even where sustainability was an issue for customers, operators did not feel that their customers were pushing them to have ULEVs, merely that the vehicles were compliant e.g. with EURO6/VI. This was even the case despite most of the sample comprising FORS members, many of whom had in principle signed up due to theoretical customer contract requirements.

6.3 Testing phase 1 hypotheses

Based upon both pre-existing expert understanding from the evaluation team, and phase 1 findings, a number of hypotheses were built around conditions important in the vehicle purchase process. The primary research conducted in phase 2 enabled testing and verification of these hypotheses; these are rated below using a Red (refuted) – Amber (partly true / insufficient information to assess) – Green (supported by phase 2 evidence):

Hypothesis from phase 1	Phase 2 findings and whether these tend to support or refute the hypothesis
Fleet characteristics	
Larger fleets are more likely to have predictable and regular journeys than smaller fleets, whose vehicle use is likely to be more variable and less predictable. The former should lend itself more to ULEV take up.	*Amber:* Phase 2 research did find increased ULEV take up – and propensity to take up – in larger fleets, but did not find evidence that duty cycles for larger operators were necessarily more fixed / predictable on a per vehicle basis.
Fleets primarily comprising vans will have shorter, more localised daily mileages. This again should make ULEV take up less challenging.	*Amber:* Phase 2 research did find van operators reporting a lower average mileage for the average fleet vehicle than HGV operators, and the former were more likely to have taken up and be planning to take up ULEVs, though the difference could equally relate to availability of ULEV HGVs.
Smaller fleets are more likely to be leased; the effect of this on ULEV take up was unclear.	*Red:* The phase 2 research found no greater likelihood for smaller fleets to be leasing their vehicles, with breakdown between owned and leased being similar for both smaller and larger fleets.
Larger HGV operators are more likely to be purchasing vehicles in bulk whilst other groups are more likely to be purchasing on a rolling basis.	*Green:* Phase 2 research confirmed that larger fleets were more likely than smaller fleets to replace a number of vehicles at fixed points rather than replace ad hoc.
HGVs will tend to be replaced after a longer cycle (5-10 years) than vans (<5 years).	*Red:* Phase 2 research found that the average replacement cycle for HGVs was barely larger than that for vans (less than one year on average).
ULEV opportunities for HGV operators like with technology such as bio-methane, LNG and CNG; ULEV opportunities for van operators are more likely to be around electric (either full or range extended).	*Amber:* Even where operators were planning ULEV uptake, they were not yet clear on the technology they would likely uptake, though certainly electric is restricted as an option to HGV operators.

Actors involved: how and in which circumstances	
Large fleet will operate with a dedicated fleet manager or with a site-specific manager with responsibility for the fleet. Smaller fleets will tend towards the latter (one individual with a broader remit).	*Green:* Phase 2 research confirmed that specialists are much more likely to be found in larger fleets / organisations where this role can be 'justified'.
Fleet consultants will often be engaged by larger fleets depending upon internal resources / skills.	*Amber:* Albeit limited to the qualitative interviews, only one operator reported using consultants in their process.
Senior management in larger fleets will be involved at a strategic level and key decision points only; in smaller fleets they may be performing the main fleet manager role.	*Green:* Albeit limited to the qualitative interviews, this was generally the case, though sometimes the fleet specialist was also a senior manager within the business.
For larger fleets, sales / leasing rep would be involved throughout in a KAM role; often both informing specifications and responding to them.	*Amber:* Albeit limited to the qualitative interviews, very little evidence of supplier involvement throughout the process was found.
Actors involved: how and in which circumstances	
Formalisation of the process is high for larger fleets and low for smaller fleets.	*Green:* Phase 2 research indicates a greater likelihood of ad hoc purchase and smaller fleets following a less fixed / defined process.
In determining the vehicles needed, larger fleets will have a specific business case reviewed and signed off by senior managers, along with discussions with suppliers. Smaller fleets have a less formal approach though suppliers may still be involved.	*Amber:* Phase 2 found that larger fleets were generally more likely to have a formal business case for the vehicles that underpinned the specification and purchase requirement, though there was little suggestion that suppliers are closely involved in this process *when it is likely to go out to tender*.
Larger fleets conduct rigorous analysis of supplier responses to their specification and whole life costs more likely to be considered.	*Red:* Not all fleets seek multiple responses to a specification and there are not always fixed evaluation criteria with scoring against key criteria.
Whether or not the fleet is a significant aspect of the organisation's operations – those for whom it is will focus more closely on the fleet.	*Amber:* Phase 2 did not explore the significance of the fleet to operators in terms of the proportion of total business costs it represents (or its strategic importance more widely). However, the research did indicate that larger fleets were more likely to invest more time and resource in the fleet renewal process.

7 Scoping a LoCITY offer

This final section draws upon the findings above – as well as responses in the qualitative research to specific offerings being tested by LoCITY – to form suggestions as to key opportunities for the programme. There are three sub-sections:

1. Operator response to tested ideas, as well as any further suggestions for support from research operators.
2. Conclusions as to the key information operators might require and how this would be best delivered.
3. Conclusions as to the wider channels / partners through which LoCITY could look to work and how.

As noted in section 3, the research and segmentation indicates that more than half of operators – those in the 'positive' and 'neutral' segments - in London would seem to be a fruitful target for the programme i.e. there are hooks – such as compliance or financial benefits - for engaging these operators in ULEVs, and it is upon these organisations that this section focuses, as opposed to those who are more entrenched in their reservations about ULEVs (in particular where these are based upon first-hand experience).

Finally, whilst many operators enjoy longstanding relations with their suppliers, some operators were / would be sceptical about information from manufacturers / suppliers *("are the vehicles as good as they say they are?")* especially in the context of recent national news in this regard. They felt there was a need for impartial, trusted information about vehicle options.

7.1 Case studies

The key idea tested in the qualitative research was operator appetite for case studies of organisations that have taken up ULEVs.

16 of the 30 operators were broadly positive about using case studies. Most of these had accessed case studies in the past and found them useful. Responses included:

- *"I would be interested in case studies of logistics businesses using / planning to use electric cars as they would be in competition with us."*
- *"If someone else can share information on their experiences then that saves us the time / money of trialling something."*
- *"We have looked at case studies in the past and taken some influence from them. They are most useful when they clearly set out the costs and benefits so we can relate them to our business."*
- *"I think case studies would be useful, as long as they cover the same kind of industry, same size, similar profile etc., and be fully transparent on the financials."*

The remaining operators were disinterested in case studies and did not think they would use them in the future. These respondents had no strong objections to case studies, more a lack of time to find these or acceptance that the situation of the subject would match their own. Responses included:

- *"I don't use them; just tends to use snippets of information from colleagues and in the general media."*
- *"Statistics can be written in a way to misguide people. I'm unlikely to trust written information; I would want to speak to someone and therefore site visits might be useful."*

For those open to case studies, responses indicated that the case study would need to clearly set out the costs and benefits of ULEVs - focusing on detailed financial and operational facts - and that the subject financials would have to be transparent; this raises a challenge for LoCITY around balancing case study subjects likely wish to protect commercial confidentiality with these organisations' wish to see the full quantified costs and benefits. Those who might access studies felt that these should be based around:

- Certain types of vehicle
- Certain industries (especially those that might operate particular vehicles)
- Size of fleet

Another basis for the studies could be the seven segments outlined in section 3, as organisations may better affiliate with an organisation in a similar situation to them (regardless of profile).

Whilst some saw video case studies as useful (potentially more engaging and shorter, and can therefore be shown to time-poor senior managers), others equally felt a written study was important in order to have written information to include in business cases.

7.2 Information required

Beyond specific ideas from respondents, the research highlighted a number of key gaps in operator information and understanding and therefore varied opportunities for LoCITY:

- Clear information as to what defines a ULEV and the range of examples (makes and models) of them. More than half of survey operators (rated their understanding of ULEVs at a 3/5 or lower. One operator suggested that LoCITY could replicate the list that TfL already generate for cars, simultaneously providing an incentive for manufacturers / suppliers to get on the list to promote their vehicles.

- More specifically, organisations felt they would benefit from tailored information as to if and how ULEVs could be integrated into their fleet. Several emphasised that they want clarity if ULEVs are simply not feasible for their organisation: *"we don't*

want advice like 'take up could save you money', with a long list of conditions" that essentially necessitate doing their own research to find out if it's likely to deliver. Linked to this, operators require information on ULEV performance and capabilities so operators can make an informed decision as to their ability to "get the job done" e.g. distances and weight loads. ULEV capability to deliver certain duty cycles was often cited as a barrier, but it was not clear how far these operators had fully investigated options and their capabilities.

- A campaign on ULEZ details, in terms of boundary and charges [see section 6.1]: "*We need more information on how much a ULEV would cost. We also need to know what the ULEZ charges will be."* Whilst for some organisations this may lead to confirmation for them that they will change routes or simply accept the charges, for the majority it seems it would enable currently vague compliance plans to be better defined and actioned. One possibility – though not suggested by operators – would be an online calculator whereby operators could enter key information on fleet profile and routes/duty cycles, and then receive an approximation of costs per week / month / year to their organisation of the ULEZ in a BAU scenario.

- Linked to greater understanding of both ULEVs and ULEZ, based upon the seemingly lack of understanding highlighted in section 2, clarity on Euro 6 and VI would be useful to some operators.

- As indicated in responses on the value of LoCITY case studies [section 7.1] and based upon the proportion of respondents citing 'lack of clarity on benefits' as a barrier [section 3], any information that could be fed into whole-life cost-benefit analysis of ULEVs would be valued by operators to ensure the accuracy and authority of business cases for investment. These data include capital outlay (including refuelling infrastructure cost), refuelling costs, typical servicing and maintenance costs, efficiency etc.

- Linked to this, LowCVP emphasised that there is scepticism around manufacturers' data and therefore need for independent assessment/accreditation which confirms earlier LowCVP/Ricardo research. Some operators lack the resources to conduct their own properly managed trials, so would benefit from an independent, robust and representative source to provide such evidence for them, in a form they can readily understand, believe and make use of.

- The current and planned extent of publicly accessible infrastructure; this was frequently cited as a concern and barrier to take up. LoCITY should share information on the location of infrastructure in London, and could even consider establishing a forum for fleets to share their own refuelling capacity with others at cost.

- Signposting sources of funding for ULEV trials or full take up.

As well as website, email and case studies, another potential method is through delivering – or partnering on – the type of audits delivered by the Energy Saving Trust on programmes like the Green Fleet Review. These tailored consultant reviews of fleet opportunities for greater efficiency could include a focus upon ULEV potential.

LoCITY could also consider facilitating peer-to-peer visits for operators so they can see ULEVs in operation at another, similar organisation: *"with site visits I could talk to a business owner and see and hear how they work using low emission vehicles and have a Q&A session about operations and costings."*

7.3 Who LoCITY could work with and how

Other key opportunities to address operator barriers to ULEVs may lie in working with other organisations and influencers:

- One of the key barriers for operators is access to reliable and authoritative quantified data to inform a business case assessment for ULEV take up. As noted in section 7.2, potential partnering with organisations like EST – or other consultants – who deliver fleet audits in order to investigate ULEV potential and produce authoritative findings for use in businesses cases seeking internal (or external) funding.

- Up front cost continues to be the principal barrier for many operators in taking up ULEVs. In helping to overcome the initial cost of vehicles, LoCITY could work with suppliers to secure discounts for trials. For small fleets that struggle with up-front cost, LoCITY could play the role of an aggregator of demand – or encourage brokers to do so - to encourage a supplier to offer discounts.

- The research found several barriers in relation to supply, in particular lack of ULEVs in certain vehicle categories and lack of awareness of options. LoCITY could deliver advocacy to manufacturers and suppliers, emphasising operator types where there is latent demand or where further technological breakthroughs are needed e.g. for the largest HGVs and vehicles performing specialist roles.

- The widespread need for 24/7 operation and rapid refuelling would point to liquid fuels being key for some operators for the foreseeable future. LoCITY could consider bringing bio-diesel within programme scope. This is also pertinent to larger HGVs where genuinely low carbon alternatives are not widely available.

- Encouraging suppliers (including leasing companies and brokers) to be more proactive in promoting ULEV uptake to customers. This may necessitate some

training from LoCITY to these organisations, but could be couched as helping them to provide a more comprehensive and informative service to customers, in particular in the context of legislative changes that are likely to see customer operators making more enquiries about these changes, their impacts, and potential solutions.

Overall, the research has highlighted a potentially useful segmentation in terms of thinking about differing support needs, and has highlighted a large number of potential ways in which LoCITY can address information gaps and leverage partners to support further ULEV uptake.

8 Conclusions: answering the overall research objectives

This final section of the report collates the findings in sections 2 – 7 to provide a summary of findings against each of the original key research objectives. Following phase 1, key remaining gaps included awareness of ULEZ, in-depth information on duty cycles, uptake of ULEVs, the decision-making process in relation to low-emission vehicles, and whether vehicle sellers are being pro-active in promoting cleaner technologies.

The table shows the phase 1 primary research findings and the phase 2 findings, for the latter explaining how they enhanced understanding above and beyond the existing literature in a number of areas, and challenged some of the phase 1 findings:

Research objective	Key findings in phase 1	Key findings in phase 2
Identify how many organisations are aware of ULEZ and what this may mean for their fleet. Provide details of duty cycles.	Duty cycles of London operators seem to fit with the adoption of low-emission vehicles. Operators in or around London are likely to return to a base or depot at least once per day, though light goods vehicles such as vans, which are more common than HGVs in London, may return to the driver's home overnight. This is especially true for owner-drivers, potentially reducing the effectiveness of refuelling or recharging stations at depots. There was no information on awareness of ULEZ or responses to it.	The primary research found good awareness of ULEZ as a concept and found that the majority of operators feel it will have a substantial effect upon their fleet operation. The research identified a wide range of duty cycles, some of which – lower mileages, on site refuelling etc. – did seem more suited to ULEV take up. However, there were equally duty cycle characteristics proving to be a specific barrier to take up – big mileages, frequent vehicle use, lack of infrastructure – which somewhat refutes the phase 1 overview

Determine what influences an organisation's purchasing decisi process for new vehicles in eacl industry sector, who is involved, their role is, and who makes the decision. Identify the most effec communication channels to influ those individuals who are makin new vehicle purchasing decisior	There are various decision-making processes; centralisation and formalisation are key features of those processes and can determine the extent of uptake of cleaner technologies. Centralised processes are typical of departmentalised organisations, whereby multiple individuals may be involved in decisions about new vehicles. Smaller organisations tend to have a de-centralised process, whereby decisions are made by one or two individuals. Smaller businesses are already less likely to trial new technologies based on the high upfront capital required, and competing priorities for time and finances. Formalised processes tend to rely more on established knowledge, and these organisations tend to be more reluctant to uptake cleaner technologies for which previous experience is limited. Communication channels depend on the decision-making process of each individual organisation.	The primary research confirmed a number of the hypotheses around operator purchasing procedures and the distinctions between smaller and larger fleets on aspects such as formality and centralisation. For most operators there is a fixed point – usually based upon age or mileage - at which a vehicle will be at least assessed for replacement, if not automatically replaced. This is more fixed for larger fleets; smaller fleets tend to replace vehicles on an ad hoc basis as the need arises. In terms of influencing key decision makers, plugging directly into operator vehicle procurement processes seems to be challenging; the key influence would be through embedding the idea to consider ULEVs in advance. Certain organisations such as Trade Associations and accreditation bodies (e.g. FORS) are effective in encouraging ULEV take up and disseminating information, though the research did not find any particular trade press very influential in this regard.
Identify the commercial and technical barriers to purchasing each alternative fuel technology option for operational vehicles and why such barriers exist.	Several barriers to uptake were identified; key barriers, applying across different technologies, include uncertainty in the business case, which relates to availability of refuelling infrastructure, government policies, payback periods and uptake of cleaner technologies by other operators. High upfront costs are also a significant barrier. Additionally, due to the need for fleet infrastructure, duty cycles, the location and geographical distance between depots or bases and average mileages are crucial to the decision to pursue new technologies.	The primary research emphasised the importance of those barriers found in the literature review, in particular on four key areas – financial considerations (up-front cost and maintenance), information gaps (on ULEV capabilities and costs / benefits), operational concerns (fitting with duty cycles and required refuelling infrastructure) and ULEV availability in certain vehicle categories.

Establish how long organisations retain leased and/or purchased vehicles	There is some information about the US, but no information on London or the UK. Anecdotal information from leasing websites indicates that options for van leasing tend to vary between 2 and 4 years, whereas the default setting for HGVs is 5 years.	Most operators said that their organisation replaces vehicles at fixed times (though that fixed point may vary by vehicle type). Where they do so, the average length is around 5.5 years, though the range was between 2 years (cited by two operators) and 15 years (cited by one). Almost half of these organisations replaced their vehicles between 3 and 5 years.
Identify what the motivators are to purchasing each alternative fuel technology option for operational vehicles and why such motivators exist.	Aside from anticipated motivators, such as financial and reputational ones, policy changes that would motivate operators to take up cleaner technologies were also identified.	The primary research emphasised the importance of the motivations found in the literature review, and identified drivers across four key areas – financial considerations (reducing operating costs inc. fuel and tax), ensuring compliance with current / forthcoming legislation, environmental, and reputational (both meeting customer demand and seeking out market differentiation).