Evaluation of the Longer Semi-Trailer Trial: Annual Report 2015

A report for the Department for Transport

August 2016

Issue 1

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LST TRIAL EVALUATION : 2015 HEADLINES

At 31 Dec 2015	Latest figures	
Trial Take Up		Trial target total: 1,800 LSTs
1,747 (97%)	**1,764** (98%)	LSTs registered on Vehicle Special Orders (VSO)s (% of trial target of 1,800 trailers)
1,511 (84%)	**1,674** (93%)	LSTs on the road and submitted trial data (% of trial target of 1,800 trailers)
151	**163**	Number of operators with trailers on the road (this report based on accepted data to 31 Dec 15)
Utilisation and km saved		
1.7m	**2.0m**	Journey legs travelled by LSTs during the trial
202m	**236m**	km travelled by LSTs during the trial
8.7 – 10.6m		Vehicle km 'saved' by LST operations (end 2015) Lower - Upper bound (includes some return legs)
Journeys saved		Estimates of equivalent 'standard trailer' journeys saved across whole trial period and all operators
75 - 90,000		Journeys by 13.6m trailers saved by using LSTs Lower - Upper bound (includes some return legs)
1 in 19 (5%)		Average saving across all operators 1 in 'n' journeys (x% distance saved)
1 in 9 (11.5%)		Highest saving achieved by individual operators
Safety incidents involving LSTs		
Collisions	**Casualties**	*Collisions / Casualties **on public highways or public access areas** (2012-2015) resulting in injury*
11	**16**	**Personal injury incidents involving an LST.**
2	**2**	**Personal injury incidents judged 'LST Related'** (The trailer being an LST was part of the cause)

On a per kilometre basis, nationally, LSTs have been involved in around 70% fewer personal injury collisions and casualties, in comparison to the average for standard articulated HGVs.

Executive summary

Background and key facts

The Department for Transport (DfT) is evaluating the impact of the operation of longer semi-trailers (LSTs) on Great Britain's (GB) roads. These trailers are up to 2.05m longer than the standard 13.6m units commonly seen on the roads in this country. DfT launched the 10-year trial in 2012, permitting up to 1,800 to operate under Vehicle Special Orders (VSOs) granted by the Vehicle Certification Agency (VCA). The trial is designed to evaluate the impact of LST operations on efficiency, emissions and safety. A reduction in emissions may be expected because the increased trailer length should allow the same quantity of goods to be transported in fewer journeys. Evaluation of the trial will determine whether this potential reduction in emissions is realised. This report contains a full analysis of the data to the end of 2015.

At the end of 2015, more than **1,511 LSTs were on the road** (and appearing in the data), with **1,764 LSTs on a VSO** as of July 2016. With 98% of the original aspiration of 1,800 LSTs on the trial, DfT now consider the LST fleet to be complete once the final trailers are built and brought into service. The results presented include **data from 151 operators,** and represent the results from **1.7 million LST journey legs** covering a distance of **202 million km**.

Summary of findings

There is good evidence that LST operations are realising significant savings in the number of trailer vehicle kilometres driven on GB roads, with consequential environmental benefits.

There is no evidence to date that the safety risk from LSTs is worse than that of normal HGV trailers. Looking at all operations, there may be evidence that they are performing better, but data collection should be continued till the end of 2017 in order to confirm this with statistical confidence. We do not yet have sufficient data regarding the safety risk performance of LSTs specifically in urban operations. Further work is needed to determine the relative proportion of LST operations on urban roads in comparison to that of normal HGV trailer operations.

Key analysis results

Safety related incidents.

The following table shows the total number of safety related incidents (and resulting casualties) involving LSTs to the end of 2015, and the severity of the injuries to those people affected. The figures in brackets are the numbers to the end of 2014.

There have been no reported incidents involving an LST resulting in a fatality

During 2015 we saw,

- **one multiple injury incident, but not related to the trailer being an LST**
- **one slight injury to a pedestrian on a public road that may have been LST related.**

Casualties from the 15 incidents involving LSTs (2012-15)

Injury Collisions from Trial Logs	Total Collisions	Total Casualties	Fatal	Serious	Slight
All Injuries	**15 (10)**	**20 (10)**	0	4 (3)	16 (7)
All Injuries in public place	**11 (7)**	**16 (7)**	0	4 (3)	12 (4)
All Injuries judged LST related (any location)	**1-2 (1)**	**4-5 (3)**	0	0	4-5 (3)
All injuries – LST-related AND in public place	**2 (1)**	**2 (1)**	0	0	2 (1)

Source: LST Trial data - figures in brackets are those to the end of the preceding year

During 2015 the number of reported incidents involving a serious injury increased by one. Similarly, the number of incidents involving a slight injury increased by nine. Only one or perhaps two of these incidents (both slight injury incident) were been judged to be potentially LST-related by the operators concerned.

Of the total number of 15 personal injury incidents on the trial to the end of 2015, only four or five have been found to be related to the fact that the trailer was an LST. Of these, only two occurred on the public highway or private land with public access.

Comparison to injury rates for all UK articulated HGVs

We compare the incident rate for LSTs to that for the overall UK articulated HGV fleet using a method described in earlier Annual Reports. This involves consideration of road traffic collision data involving personal injuries (STATS19), and DfT's traffic flow statistics for the trial years where data is available (2012-14).

Comparison of LST public road collision and casualty rates (to end Dec 2015) vs. GB general articulated fleet (2012-14)

Injury incidents Public access locations	LST Rate (per billion vkm)	GB Artic HGV Rate (per billion vkm)	Ratio LST/GB-HGV
Collisions	**54.5** (64.8)	**170.0** (187.4)	**32%** (38%)
Casualties	**79.2** (64.8)	**241.3** (262.5)	**33%** (27%)

Sources: LST from trial data. GB from STATS19 and TRA3105 – all 2012-2014. Annual Report 2014 result parentheses. Both ratios shown to be statistically significant at the 5% confidence level.).

At the national level, there is no evidence that LSTs are experiencing a higher rate of road traffic collisions than that experienced by the national fleet of articulated HGVs. To date, the experience from LSTs in the trial is that, on a per kilometre basis, they have been involved in around 70% fewer injury collisions and 70% fewer casualties, in comparison to the average for standard articulated HGVs.

During 2015, we continued to examine whether or not, for urban operations, LSTs present a higher risk than standard trailers, but which is hidden by the dominance of long distance motorway travel in the LST dataset. We have reviewed the 15 injury incidents to date and analysed the data using classical statistical tests as well as a Bayesian approach. We find that:

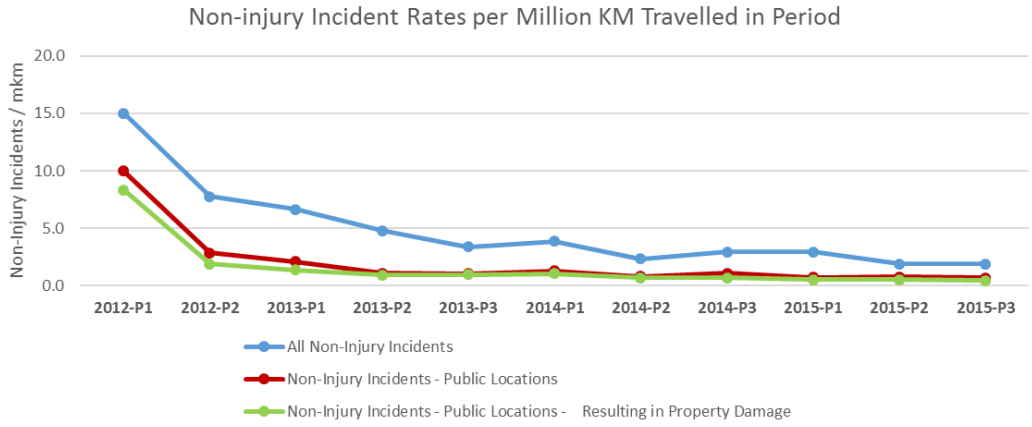
- **The number of urban LST injury incident events to date is too few for any statistically significant inference to be made with the current data.**
- A projection based on classical statistical tests shows that **if the rate of urban incidents observed to date (2 in 4 years) continued at the same rate, then after six years (data to end 2017) we would be confident in a conclusion that the LST urban incident rate was significantly lower than the background population urban incident rate.**
- A Bayesian analysis of the data indicates that **there is a high probability that the LST incident rate is equal to or lower than that for all articulated HGVs**. However, this conclusion is sensitive of the relative proportion of urban/rural operation vehicle kilometres for LSTs, compared to the value of around 6% Urban operations for articulated HGVs in general. Therefore, further work to determine the actual LST urban/rural proportion is required.

Damage only (non-injury) incidents

We have analysed 540 events reported that resulted in some damage, but no personal injury.

Of these, only 161 occurred on the public highway and only 81 of those, were judged to have been related, or partially related, to the trailer being an LST. **This equates to 1 damage only event for every 2.5 million km travelled by the LSTs.**

We note that the rate of incidents declined significantly after the first few periods of the trial.



The key challenge in using damage only data is the lack of a single robust dataset on damage events for the national standard trailer fleet, comparable to STATS19 for the injury data.

During 2015, we worked with a limited number of operators who run large LST fleets and have high quality in-house incident reporting systems to test whether we can merge data from several large operators into a common data format to compare

damage only data for LSTs and non-LSTs. This only involved four operators and must therefore be treated cautiously.

Sample data from two operators running mainly To/From Retail sites appear to have experienced a higher incident rate for their LSTs than their regular fleet. This was not the case for sample data from two operators running primarily DC to DC.

We are continuing to discuss the results with the operators involved and are reviewing options with DfT for further analysis that would verify, or otherwise, these sample results.

Incident outcomes summary for LSTs vs. GB articulated HGV fleet

The table below shows how the incident outcomes for LSTs compare to that for all large articulated HGVs in Great Britain, in the summary form "1 event in every x km" to convey a sense of the scale of the incidents being observed with LSTs, compared to existing semi-trailers in common use in the country.

Summary of LST-related incident outcomes after 202 million km travelled, compared to those for all GB Articulated HGVs (>7.5T)

Casualties / Damage resulting from LST related incidents in all public locations* 2012-15	GB Artic HGVs 1 in every …	LST Involved 1 in every …	LST Related 1 in every …
Fatality	**116** million km	**No Incidents**	**No Incidents**
Serious injury	**33** million km	**51** million km	**No Incidents**
Slight injury	**5** million km	**17** million km	**101** million km
Property damage only	*No national figures*	**1.2** million km	**2.5** million km

Notes to Table

- 'All public locations' covers all public roads and also private land where there is public access. These figures are national averages. They do not consider any special subsets of the data, such as 'urban operations only'.
- LST Involved: Any injury event in which an LST was involved, even if the trailer being an LST was not relevant.
- LST Related: Events involving an LST where the fact that the trailer was an LST rather than a standard length was considered to be at least part of the cause – two such injury incidents have occurred in public locations during the trial.
- GB Articulated HGVs: Based on DfT National data for all articulated HGVs > 7.5T. Total distance 3 years of data 2012-2014 (TRA3105) = 39.9bn km. Injury incidents – STATS19 data 2012-14, casualty totals = 344 fatalities, 1208 serious and 8075 slight injuries.

HGV vehicle kilometres (vkm) saved

We have estimated the number of vehicle km saved by LST operations. Savings are expressed in vehicle km travelled and include a small loss factor to reflect a marginal increase in fuel consumption (and hence environmental impact) by LSTs over standard length trailers.

We estimate that between 8.7 and 10.6 million vehicle km of HGV journeys have been removed from the road during the operation of LSTs since September 2012. This equates to removing 75 – 90,000 journeys by the 13.6 metre trailers which are our longest standard articulated HGVs currently permitted in GB.

Cumulative Vehicle km saved by using LSTs

Distance saved (million vehicle km)	At end 2015	At end 2014	At end 2013
Lower bound	8.7	4.2	1.4
Upper bound	10.6	5.2	1.7

Source: LST Trial data

The upper bound estimate represents a saving of around 4.9% on the distance that would have been travelled by standard 13.6m trailers to move the same cargo.

Alternatively, assuming average journey distances, this is equivalent to a saving of one journey in 19 across the whole trial to date, a small improvement on the 1 in 22 figure at the end of 2014.

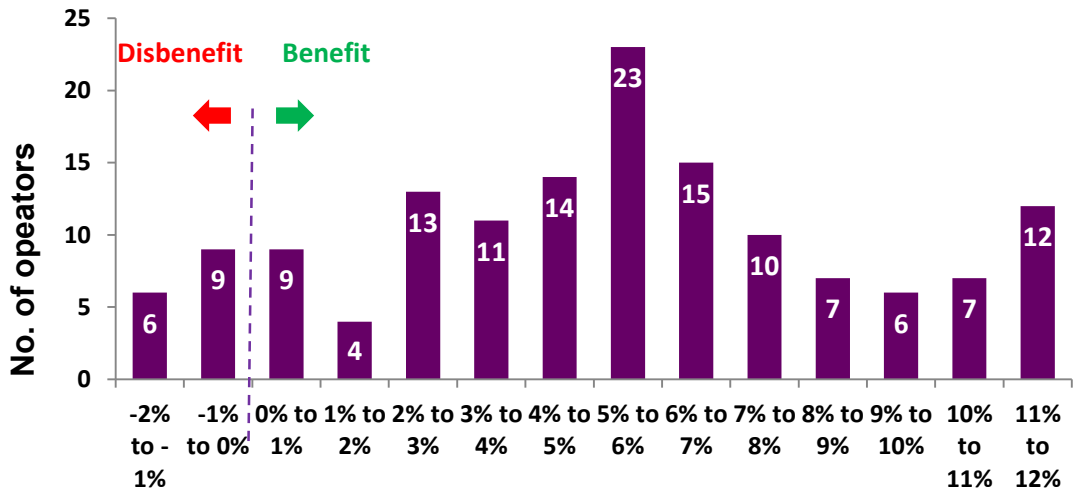
Journeys saved by individual operator

We analysed the range of savings estimated for individual operators.

Estimated vehicle km savings by individual operators range from a maximum of 11.5% to a minimum of -1.8%.

At the top of this range, operators are saving **up to 1 in 9 journeys** in the way they are operating the LSTs in the trial. This is the maximum that might be anticipated. There are 19 operators with estimated savings over 10%. They have 204 LSTs between them.

Distribution of % distance saved using LSTs - by operator



% Saving - average for operator since joining the trial (upper bound method) *(Source: LST Trial Data)*

We continue to review reasons for why some operators are not realising benefits from exploitation of LSTs and will monitor whether or not this changes with operational experience.

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1 INTRODUCTION AND EVALUATION FRAMEWORK

1.1 The Department for Transport (DfT) wants to evaluate a trial of the operation of longer semi-trailers (LSTs) on roads in Great Britain (GB). These trailers are permitted to be up to 2.05m longer than the standard 13.6m units commonly seen on the roads in this country.

1.2 A trial has been created to gather evidence about the operational performance of LSTs in terms of safety, environmental impact and economics. The trial is proposed to last for 10 years from its launch in 2012. The first semi-trailers were granted Vehicle Special Orders (VSOs) early in 2012 and data collection began on 1 May 2012.

1.3 The outputs from the trial will feed into a decision about whether to permit an increase in the length of semi-trailers authorised for operation on roads in GB. More broadly, the trial will contribute to DfT's work to:

- identify de-regulatory measures to reduce burdens on business; and
- identify measures to reduce carbon emissions from HGVs.

1.4 In December 2011, the Freight, Operator Licensing and Roadworthiness Division (FOLR) of the DfT commissioned Risk Solutions to:

- Design a process to collect data to support the evaluation of LST operational performance.
- Set up the initial systems for data collection.
- Initiate the process and support participants during the first year of the trial (2012).
- Report on progress achieved during the year.

1.5 Risk Solutions has been commissioned to continue in the role of independent evaluation consultant for the trial through to March 2017.

1.6 Results from the LST operations have been reported annually for the first three years of the trial, 2012-14[1]. Terminology used in the trial and data collation, is also defined in those earlier reports.

1.7 This fourth annual report follows the same structure as previous years. Previous reports described the trial data collection and analysis methodology in detail. The core processes have not changed significantly since 2013, so this information will not be repeated and can be referenced in last year's report.

Evaluation framework

1.8 The primary objective of the entire trial is to provide evidence to DfT to support long term policy decisions on **"…. the most socially beneficial length of Heavy Goods Vehicle semi-trailers"**[2]. The specification of the trial to allow trailers of the two length categories (up to 14.6m and up to 15.65m), and otherwise matching all existing regulatory standards, flowed out of the impact assessment and the analyses done to support it.

1.9 The evaluation process needs to operate at two levels:

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1 Evaluation of the high volume semi-trailer trial: annual reports for 2012, 2013 and 2014 https://www.gov.uk/government/collections/longer-semi-trailer-trial.

2 'Impact Assessment of Longer Semi-Trailers', DFT00062 15/12/2010.

- Primary evaluation of outcomes – analysis that can inform the response to core questions:
  - Do longer trailers carry at full capacity?
  - Do longer trailers result in fewer vehicle trips or vehicle kilometres?
  - Do longer trailers result in more or different types of accidents? Is there potential for using extra safety devices on longer trailers?
  - What kind of operations are longer trailers used for? For example, what routes, trips, commodities and roads are they used on?
  - Does the pattern of usage differ significantly from the assumptions made in the original Departmental Impact Assessment[2]?
  - Can the existing infrastructure (including roads, delivery depots and parking) cope with longer trailers? Does existing infrastructure limit their potential use?
  - Do real world operations identify any additional operational issues, risks, costs or benefits not identified in the Department's original research?
- Secondary evaluation – analysis to assess the extent to which the trial process and the resulting data have produced a robust data source, and the applicability of any results.

1.10 The HM Treasury Magenta Book ('Guidance for Evaluation')[3] recommends use of a programme logic model (PLM), for all policy evaluation. The PLM provides a structure for evidence gathering, collation and analysis, mapping how the inputs, key activities and outputs are used to deliver the desired outcomes.[4]

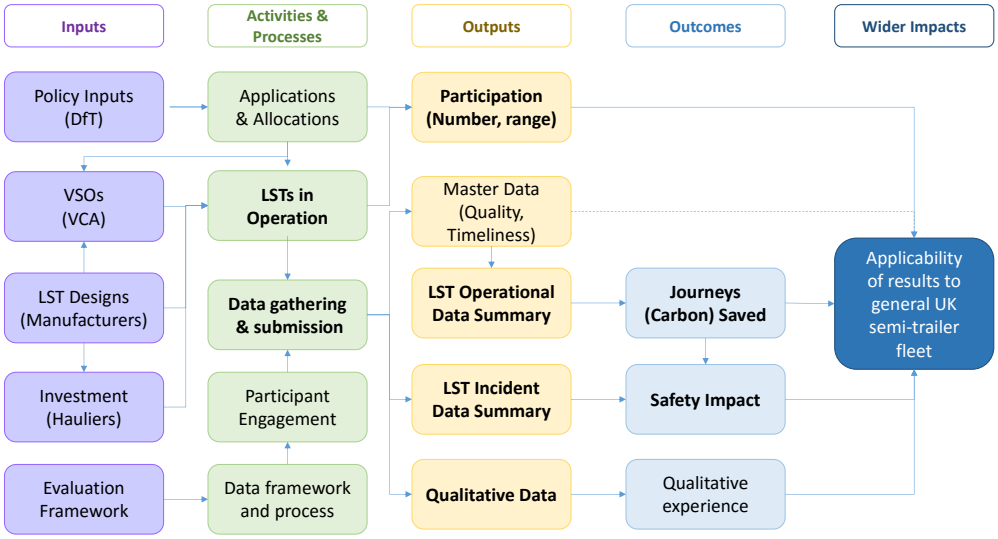


Figure 1: LST Trial Evaluation Programme Logic Model

1.11 Figure 1 shows the PLM for the LST trial evaluation. Some elements of the model, and the progress being made on them, can be expressed as metrics (e.g. How many operators have been signed up? How many LSTs are operating compared with the planned total?). Others may only be expressed qualitatively as no numeric target was

3 'The Magenta Book: Guidance for Evaluation' HM Treasury April 2011 (available from .GOV) See also 'Logic Mapping: hints and tips for better transport evaluations' Tavistock Institute for DfT October 2010.

4 An expanded explanation of PLMs as outlined in the HMT guidance is given in Appendix B of the 2014 Annual Report.

set at the start of the trial (e.g. Has the trial attracted a broad range of operator types and sizes as was hoped?).

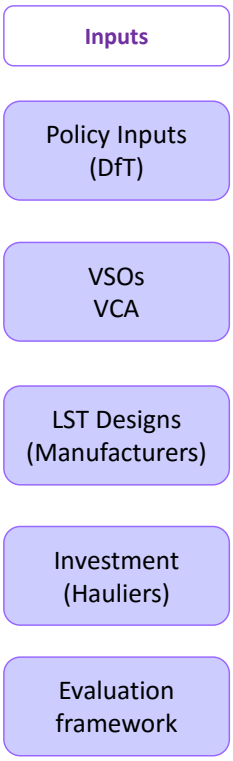
1.12 Where metrics were explicit in the original formation of the trial (e.g. 1,800 LSTs on the road), they are clearly identified in this report and progress against them will be evaluated as the trial continues. Where no quantitative measure can be established, progress is reported qualitatively.

1.13 The report has been structured to align with the PLM evaluation stages as follows:

- Section 2 Inputs
- Section 3 Activities and Processes
- Section 4 Outputs
- Sections 5 and 6 Outcomes
- Section 7 Wider Impacts

1.14 Section 8 brings together the key conclusions from the work to date and recommendations for the next stages of the evaluation.

2 TRIAL INPUTS



Policy inputs

2.1 The framework for the trial was established by DfT at the end of 2011 has remained largely unchanged. Full details are on the DfT website[5].

The allocation process has been completed

2.2 The final round of LST allocations held in the autumn of 2014 shared out the remaining places on the trial between a mixture of existing trial participants and new applicants. The successful applicants were required to provide a proof of order, even if there was likely to be a delay before manufacture began.

We expect all the LSTs to be in service during 2016

2.3 A steady flow of new trailers has entered service during 2015. While DfT cannot see the actual order and production programmes, the flow of new trailers appearing on VSOs suggests that all allocated trailers will be operational during 2016. The number of LSTs on the road or on VSOs is described in Section 3 (paragraph 3.1).

A few trailers have been transferred between participants

2.4 Operators have transferred a few LSTs between companies on the trial. The main movements have been between companies where there was already a relationship, for example between subsidiaries of a parent company, or between a client company and their contract haulier who was already running the trailers. There have also been a small number of sales of manufacturer's demonstration trailers to hauliers.

The system of Vehicle Special Orders (VSOs) is largely robust

2.5 The Vehicle Certification Agency (VCA) issues the Vehicle Special Orders (VSOs) under which the LSTs are permitted to run on GB roads. For new designs, this involves rigorous testing by VCA at Millbrook Proving Ground, or at the manufacturer's site. This results in production of a 'Model Report' that records the design parameters of the design being approved, and its performance in the tests. For further builds of an existing design, each new trailer is subject to a simple conformance test.

2.6 The VCA provides advice to DfT, operators and Risk Solutions on matters relating to LST operations under VSOs and on errors found in the recording of vehicle identification numbers (VINs) in the data.

2.7 There have been a small number of cases where the operator has not obtained a VSO, usually because they believed the manufacturer did this. These errors have been picked up when they start to submit data, or when they have initiated contact about doing so.

2.8 In 2014, we reported that Risk Solutions and VCA were working together to codify key data from the VCA model reports[6] so that we will be able to match operational data back to design features, such as tail-swing distance. VCA's work on this is now complete.

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5 https://www.gov.uk/government/collections/longer-semi-trailer-trial

6 Each LST design is tested by VCA to ensure it conforms to the requirements laid down for the trial by DfT. This includes a practical test of the turning circle requirements, on-the-road tests of performance and stability, and

2.9 At the time of writing, 14 manufacturers have constructed LSTs – see Figure 2.

2.10 LST designs have emerged from manufacturers or bespoke requirements of users.

2.11 The numbers of each design has been driven by market demand.

2.12 The main UK manufacturers have been responsible for construction of most LSTs. 34 LSTs have been sourced from producers who have built fewer than ten LSTs each.

2.13 Most LSTs are single deck box/curtain sided designs. More detail is given in Section 3

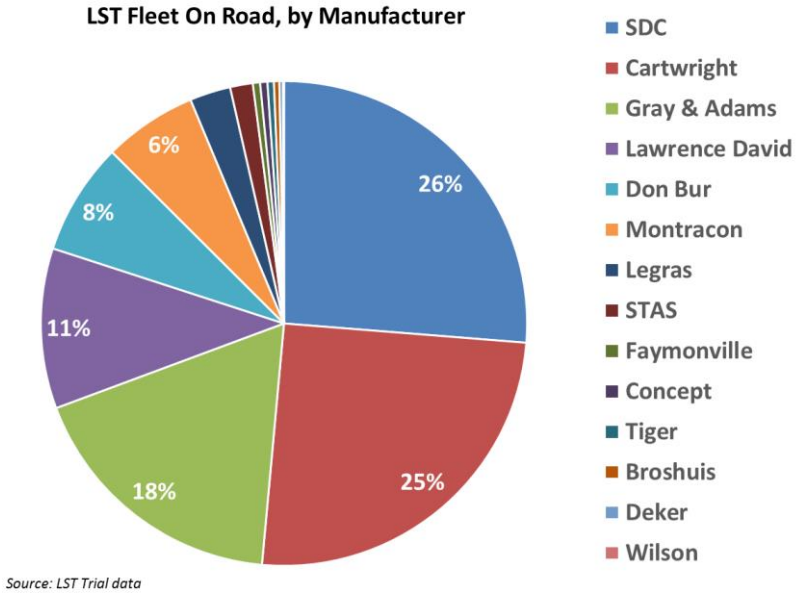


Figure 2: LST fleet by manufacturer

Both DfT and operators continue to invest in the LST trial

2.14 DfT's financial commitment under the trial covers: project management of the trial; the time required by VCA for the testing of LST designs prior to issue of a VSO; and the contract with Risk Solutions for independent evaluation support.

2.15 The decision that the trailers would be funded by the market, without any subsidy from public money, was one of the drivers for setting the trial up as a ten-year programme.

2.16 While the take up of allocations was initially slower than DfT anticipated, take up during 2012-13, and the oversubscription of the later allocation processes, suggest that many operators see a good business case to justify investing in the trailers. Efficiency gains are discussed in Section 6.

The core data requirement and evaluation framework has been stable since 2013

2.17 A major policy input by DfT was definition of the original data requirement, which was first drafted in December 2011. Risk Solutions and DfT rationalised the data requirements to just a few data elements for which DfT could see value in later analysis[7]. This formed the first version of the data submissions to be completed by operators and, with two minor changes, remains the basis for data collection today. The key submission files and processes are summarised in Figure 3.

measurements such as the cut-in and kick-out (tail swing) of each design under a pre-defined set of turning and speed conditions.

7 DfT's rationale and justification for each data item is described in Appendix A1 of the 2014 Annual Report.

2.18 Risk Solutions developed MS Excel templates and user instructions for use by operators to collate the data. The latest versions are available on the DfT website[8].

2.19 The data gathering processes provide for basic reporting of trial statistics after each four month data collection period. This annual report, and any special topic analyses during any year, provides more in depth analysis of the data.

LST data submissions and process

Company Information File (CIF)

This is submitted once only, when the operator enters the trial (when their first VSO is granted). The CIF includes information about the size and nature of the operator's business and their non-LST semi-trailer fleet.

Qualitative Survey File (QSF)

This is submitted when the operator enters the trial and then optionally at later times. The QSF contains open questions about the experience of the company, its staff and clients in operating the new trailers.

LST Data Submission File (DSF)

This is submitted every data period and covers their LST operations in that period, including:

- An aggregated journey log of all LST journeys on the public road network in the period. The log includes details of locations and times, the nature of the journey, load and mode of appearance (MOA) types, load weight and two measures of utilisation.
- A set of trailer reference information relating trailer IDs to their vehicle identification number (VIN), basic design details and numbers of days 'off the road' in the period.
- An incident log covering all LST incidents on the public highway and certain types of incident on private property (e.g. in depots, at client sites).

Data checking and compliance management

All files submitted are checked for basic errors and inconsistencies by Risk Solutions:

- comments and requests for revisions are sent back to the operator, **OR**
- an 'Accepted' email is sent, signifying the completion of the process.

All three sets of data are collected using MS Excel templates provided by Risk Solutions.

The submission process and all communication with operators is managed using a CRM (Customer Relationship Management) system called 'Gold-Vision', installed and tailored to the needs of the trial by Risk Solutions in 2015. The Gold-Vision system is only accessible to the project team members in Risk Solutions. The company contact data and some summary submission progress charts are accessible to the DfT trial project team.

A full description of the data requirements and framework, including DfT's original rationale for each data field is available in past annual reports published on the DfT website. The website also contains the current version of the data templates and the user instructions.

https://www.gov.uk/government/collections/longer-semi-trailer-trial

Figure 3: LST Trial - data submission framework and process summary

[8] The latest trial data process templates, user guide and management summary are available on the DfT website at https://www.gov.uk/government/publications/longer-semi-trailers-trial-data-guidance-and-documentation.

3 TRIAL ACTIVITY AND PROCESSES

98% of the anticipated 1,800 LSTs are now on the road or a VSO.

3.1 We track the growth of the fleet in two ways:

- the number of LSTs known to be **on the road** by the date on which they appear in the journey logs submitted by the operators.
- the number of LSTs on VSOs. VSOs are granted before or during manufacture, some time before they appear on the road.

3.2 Table 1 shows the size of the fleet at the end of December 2015 (the trailers in the data analysed by this report) and aat the time of writing.

Table 1: LSTs on the road/VSO

	On the road	On VSO
At end Dec 2015	1,511	1,747
Latest Figures	April '16 1,674	July '16 1,764
Source	*LST Trial Data*	*DfT/VCA Data*

3.3 Note that the figure of 1,511 'on the road' is an underestimate as it counts only those trailers for which we had data submitted. A substantial number of additional trailers were issued with VSOs late in 2015 but were not on the road by 1st December – the cut-off point after which they are not expected to submit data until the subsequent period.

The projected LST fleet is now large enough to meet the data analysis requirements of the trial

3.4 When the trial was launched, DfT set a goal of 1,800 LSTs – around 2% of the UK semi-trailer fleet at the time - based on an estimate of the number of trailers that would be needed to generate data to ensure the findings were sufficiently robust to inform policy.

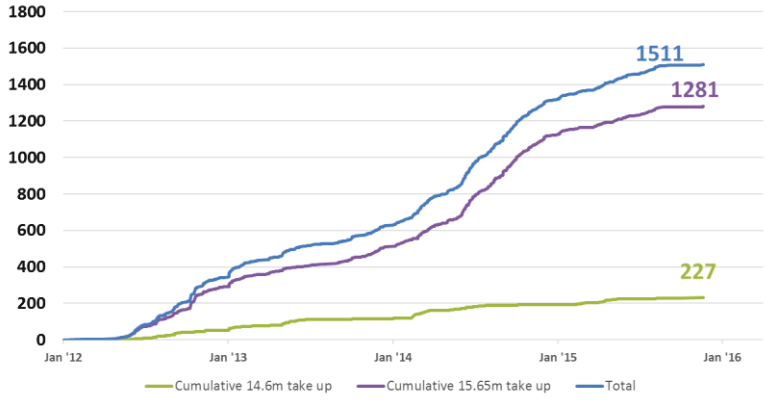
3.5 Risk Solutions have performed some bounding calculations to confirm that even if no further LSTs were to be granted VSOs during 2016, the trial should still generate sufficient data to give statistically significant results, especially for the safety analysis, by the planned end of the trial in 2022. (See Section 5, paragraph 0 onwards)

The most common LST design is 15.65m box or curtain sider.

3.6 Figure 4 shows the growth of the LST fleet from the start of the trial to the end of 2015.

Figure 4: Growth of the LST fleet 'On the Road' (from journey logs)

Source: DfT trial data



3.7 Figure 5 to Figure 8 show a summary of the LST fleet mix by major design features[9].

Figure 5: LST body design mix

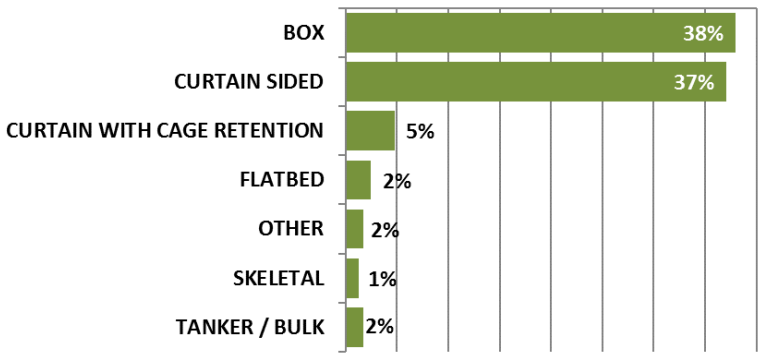


Figure 6: LST deck layout mix

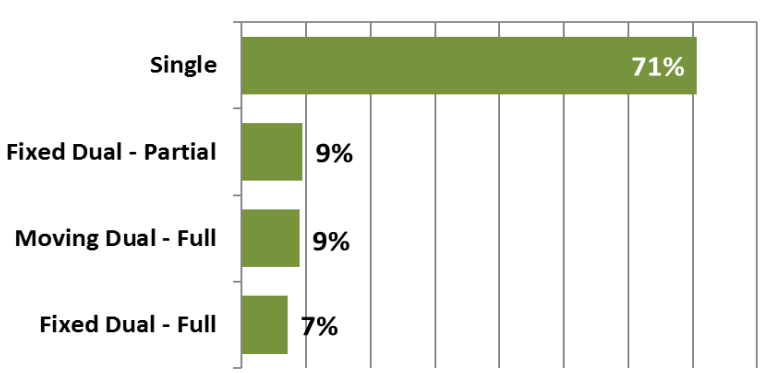


Figure 7: LST steering design mix

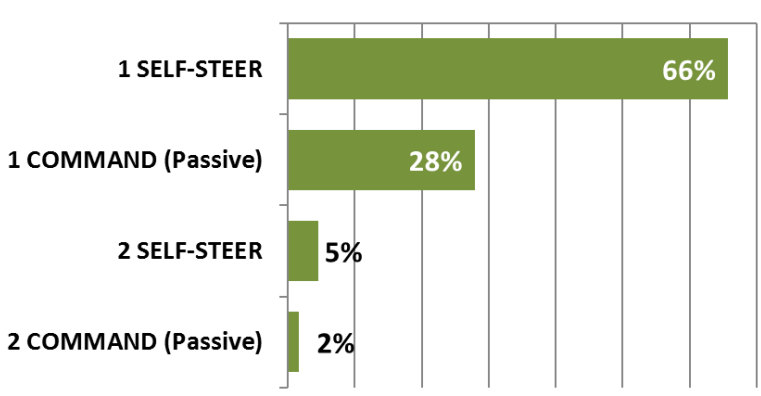
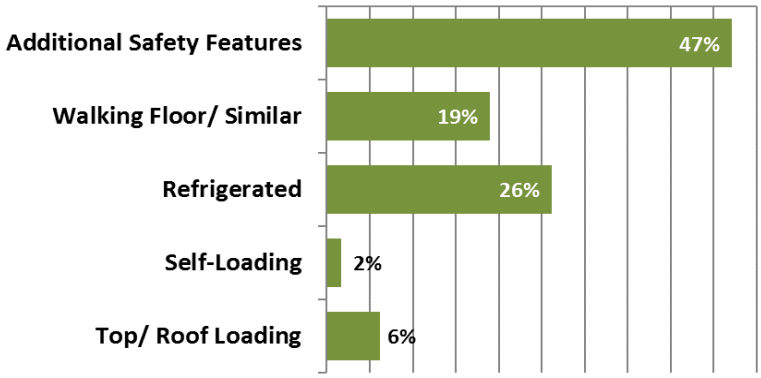


Figure 8: LST other features mix



Source: LST Trial data

[9] Further details of the design mix categorisation and the history around the choices of steering arrangement can be found in earlier trial annual reports – see footnote 1.

The most common steering arrangement is a single moving axle (93%)

3.8 When the trial was first launched, some designers suggested that in order to pass the required turning circle test, two steering axles might be required. Early in the trial, manufacturers demonstrated that this was not the case and most of the trailers produced have either a single self-steer or command steer axle. The LSTs with more than one steering axle are just a few produced right at the start of the trial, or are flatbed designs used for 'heavy haulage'.

The fleet includes some dual deck, flatbed & ISO container carrier designs

3.9 Just under 30% of the LST fleet have more specialised designs. The dual-deck trailers are mostly carrying low-density goods that cannot be stacked without damaging them, such as parcels or FMCG pallets. The flatbeds are largely being used for specialist heavy haulage or vehicle transport. In most cases they are telescopic and so only appear on the trial when extended to a length within the trial limit of 15.65m. The ISO carriers belong to a single operator and have been discussed in the trade press[10].

3.10 While the results from the dual deck trailers might give a usable sub-set of data for analysis, the numbers of flatbed and ISO carriers mean that we can only elicit qualitative insights into the potential for such vehicles, as the numbers of journeys will not yield statistically meaningful insights for these specific designs.

We are working to link the trial data to the detailed design details held by VCA

3.11 The detailed design of each LST (dimensions, detailed axle data etc.) is contained in the vehicle model report held by VCA. During 2015, VCA have been working to clean that data and verify the link from each model report to the relevant VIN numbers. Risk Solutions will then link this into the wider trial database to perform cross-cutting analysis. For example, it should be possible to analyse turning accidents in relation to different steering designs or rear end out-swing. The VCA work is almost complete so we are hoping to consider this analysis during 2016.

More than 25% of the LSTs have GPS tracking

3.12 We collect information on whether the LSTs have GPS tracking units fitted as part of the initial Company Information Form (CIF) submitted by each operator early in their participation in the trial. According to that data, around 20-25% of the LSTs have GPS fitted. However, we are confident that this is an underestimate for two reasons:

- Some operators have tracking on their tractor units and also have the ability to identify the trailer being pulled on each leg. They are therefore effectively able to track their trailers.
- As the cost of telematics services has fallen since 2012, many operators are back-fitting GPS tracking to trailers for the first time, expanding existing telematics systems to include their LSTs or are purchasing new tractors with tracking fitted

3.13 We have no plans to expand the data framework at this stage to add a field to require all operators to identify exactly which LSTs are tracked, directly or via their tractor units.

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[10] The skeletal trailers built to carry a 50 foot ISO container have been reported on several times by Commercial Motor and Motor Transport during the past

Data submission process and compliance management

The majority of operators are submitting journey data of reasonable quality and on time

3.14 Throughout 2015, we have found that the majority of operators are now able to collate, clean and submit their Data Submission File (DSF) in good time. Around a third of operators submit files that pass all of our completeness and consistency checks without any further intervention. Another third pass once they have addressed minor errors or problems found in the tests. Of the remaining third, the majority are cases where the operator needs to improve their process in order to generate cleaner and more consistent data. Risk Solutions spends additional support time with these operators until their data collation process becomes more mature.

The compliance management of 'missing/late' submissions is effective

3.15 In each period, around 10% of operators fail to submit or to correct their draft data by the 'freeze' date when Risk Solutions close the period to new submissions. These are followed up in a 'missing/late' process and the data is incorporated into the dataset in subsequent periods.

3.16 A ranked list of these missing/late operators is submitted to DfT each period. The ranking determines whether the issue is minor and Risk Solutions can resolve it, or that the issue is more serious and DfT action is required. The initial DFT action is simply a warning call or email.

3.17 Where an operator has failed to submit or has been late over several periods, DfT will request urgent action by company directors to rectify the situation in a timely manner, or to face suspension of their VSO, effectively putting their LSTs out of service. Since the start of this 'Missing/Late' process in 2013, only 4 such 'Cat 1 DfT warnings' have been issued and in each case the company has responded with appropriate action before further action was required.

3.18 **As the trial progresses, Risk Solutions and DfT will consider challenging non-compliance earlier, especially for operators who have already been on the trial for several periods, in order to reduce the support resource being taken up with missing/late cases**

The data checking process now includes an automated 'sequence' validation

3.19 Risk Solutions is continually improving our in-house tools to check data submissions for consistency and completeness. Robust checking as the data arrives, allows us to go back to the operator for corrections while the data is still current and fresh in their minds.

3.20 During 2015 we have added a fairly complex test that examines the sequence of journey legs for each trailer in the submission. It checks for missing legs or errors in the date, time or origin / destination data. The test cannot be perfect, due to the multiple data entry errors that could lead to an apparent sequence problem[11]. However, it does allow us to highlight possible errors that the operator can correct using local operational knowledge. The test was introduced in 2015-P2 and operators are now asked to review

[11] For example, if a leg appears not to fit the sequence of the legs before or after it, the error could be that the trailer ID is wrong, or the date, rather than the data stating the original and destination.

the file if the sequencer flags up a significant proportion of issues associated with journey legs recorded in the file[12].

Trial communications and submissions are now tracked using a CRM system

3.21 During 2015 we implemented a Customer Relationship Management (CRM) system to manage the increased scale and complexity of communications with operators and reporting to DfT.

Raw data submitted by operators remains confidential

3.22 All datasets submitted by trial participants contain commercially sensitive data and are held securely on Risk Solutions servers or the encrypted personal computers of the project team. The data files are only accessible by members of the team who have a project-related reason to do so. Risk Solutions does not make raw data available to DfT or any third parties.

Participant engagement remains high

3.23 Risk Solutions continues to support trial participants in setting up efficient data processes and advising on possible improvements, based on good practice across the trial.

3.24 In general, engagement with operators continues to be positive with both managers and direct data contacts demonstrating good intent and a conscientious approach to data gathering. Where problems have arisen and more senior staff have become involved, this has also been done efficiently and without loss of relationships in almost all cases.

3.25 The Freight Transport Association (FTA) has generously organised three LST trial industry forums since 2012, with 30-40 operators attending each event. The events have been open to all companies participating in the trial (not just FTA members) and include input from DfT, VCA and Risk Solutions. DfT and FTA are currently discussing a further event in Autumn 2016.

[12] We have not set a fixed % criteria on how much of the sequence needs to appear to be wrong for us to reject the file. We may consider doing this but we currently take other factors into consideration, such as the size of the submission, the likelihood that the operator will be capable of fixing the issue and whether the errors appear to be random or systemic.

4 TRIAL OUTPUTS: LST FACTS AND FIGURES 2015

4.1 This chapter provides an overview of the key statistics for:

- The number and range of participating companies
- The extent and nature of LST operations
- The number and nature of incidents involving LSTs.

4.2 This is followed by a summary of the Qualitative Survey Files.

Outputs

Participation (Number, range)

Master Data (Quality, Timeliness)

LST Operational Data Summary

LST Incident Data Summary

Qualitative Data

Participants – number and range

4.3 The data on who is participating in the trial and the nature and size of their operations is drawn from the company information file (CIF) completed by each trial participant, usually in their first data period.

4.4 The CIF data provides background information used to group companies for analysis. It also provides a data source for later comparison of the operational patterns of LSTs to those of the existing fleet of an operator.

Table 2: Company Information File (CIF) Status

CIF Status	Finalised	Draft/Missing
At end Dec 2015	119	32
Source	*LST Trial Data*	

4.5 The status of CIF submissions is shown in Table 2. Many of the draft/missing CIFs are recent joiners, but some have been in the trial for some time. We have a process in place to follow up on the missing CIFs during the 2016-P1/P2 data submissions so that the CIF dataset is completed as the final LSTs enter service.

There is a good range of company types on the trial

3.26 One of DfT's stated intentions was that the trial should be accessible to operators of all sizes – not just large operators. Figure 9 summarises the range of companies (based on their CIFs[13]) by size, Figure 10 by the nature of their primary operations. The figures show the balance between a small number of own operation fleets (retailers, parcel companies) with larger numbers of LSTs, in comparison to a large number of general hauliers with fewer LSTs each.

4.6 We note that while a large portion of the companies are general hauliers, some of their operations are associated with long term contracts for major retailers.

4.7 The 'Other' category includes cases with very few data points or specialist trailers.:

Many operators applied special LST operational measures to LST operations

4.8 One of the earliest questions to be considered by all participants is the extent to which they would constrain the use of LSTs within their operation, at least during early use.

4.9 Figure 11 shows operator responses to a series of possible special arrangements that could have been put in place, with operators selecting as many as applied.

[13] Further details of the categorisation of companies and all other data gathering in the CIFs can be found in earlier trial annual reports – see footnote 1.

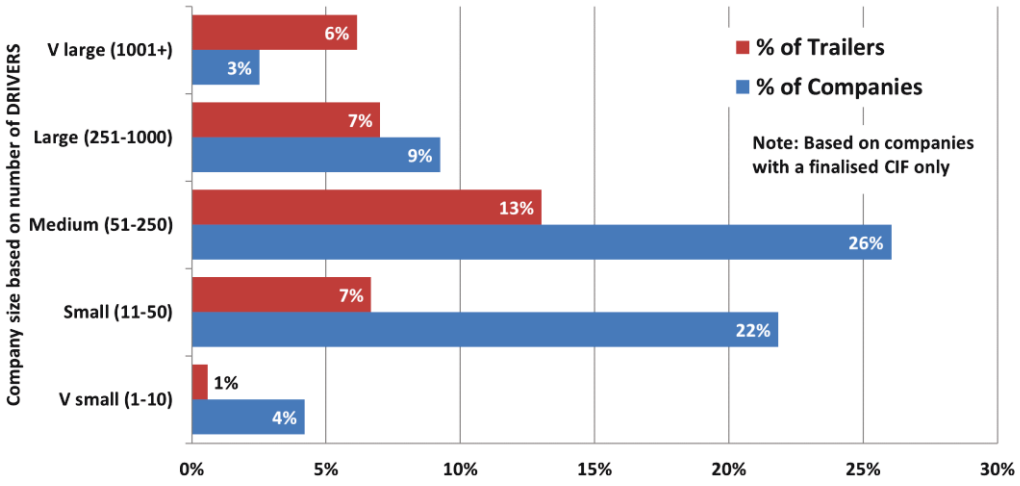

Figure 9: LST trial participants and fleet by company size

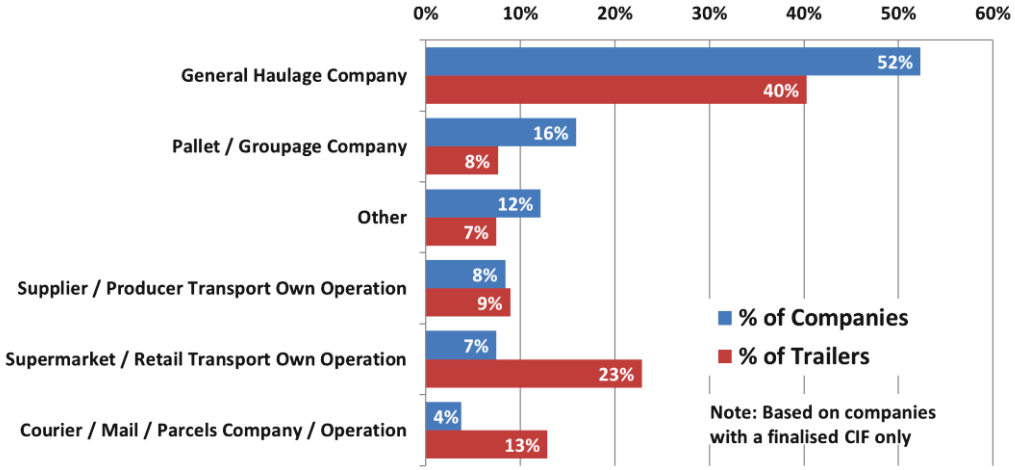

Figure 10: LST trial participants by nature of operation

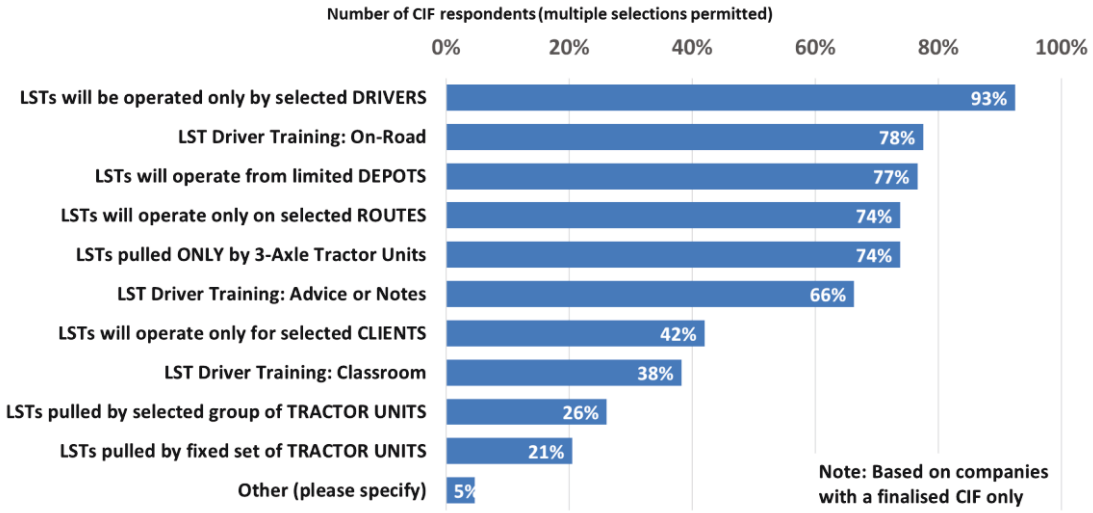

Figure 11: Special arrangements made for LST operations

Source for all charts- LST Trial data

Operational data summary

4.10 The outputs below give an overview of the operations of LSTs from the start of the trial to the end of 2015 based on the journey leg data submitted by operators.

4.11 Journeys are expressed as legs in the data, meaning a single point-to-point trip without loading or unloading stops en-route. Any multi-drop journeys with fewer than five loading/unloading points are recorded as individual legs for each part of the trip. Where there were five or more drops, the journey is recorded as a single record in the data, with the number of drops noted.[14]

Distance covered

LSTs had travelled over 200 million km by the end of 2015

4.12 The summary figures for LST operations to the end of 2015 are shown in Table 3.

4.13 The equivalent figures to the end of 2014 show that during 2015, with around 300 more LSTs on the road than at the end of 2014 (1,194[1]) the LST fleet covered a distance almost as great as the entire trial up to that point.

Table 3: LST total km and legs

LST distance & leg count totals	To end 2015	To end 2014
Total vkm recorded	202 million	108 million
Number of recorded legs	1,727,559	928,134
Average leg distance	117 km	117 km

More than half of the distance covered by LSTs is between 'industrial', rather than 'public' locations

4.14 Figure 12 shows that the primary uses of the LSTs continue to be in the areas anticipated in the DfT Impact Assessment[15].

4.15 The categories '3) Supplier to Distribution Centre (DC)', '4) DC to DC', '6) To/from industrial site' and '7) Palletised trunking' all relate to journeys between sites that might be considered 'industrial' rather than 'public' - based on site access and the location of such sites in areas with lower public movement or limited public access. These legs represent 62% of all loaded distance covered and, we can assume, a proportion of all the empty distance.

4.16 In contrast, '5) To/from Retail Site' is the only leg type where we might expect operations in areas of high public movement and potential public access (on entry routes to the site). This leg type represents only 17% of the loaded distance, but by the nature of retail delivery operations, the majority of the return legs will be empty. From this we can infer that **around 30% of all distance covered will include a portion which is going to or coming back from retail sites, which might be in urbanised areas**.

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14 This approach is the same as that used in the DfT Continuing Survey of Road Goods Transport.

15 Op Cit. Page 31 and Page 40 Table 5 of the impact assessment lists the categories of journeys which were assumed to see transfer of loads from regular 13.6m trailers to LSTs were the longer trailers to be generally available. This is a direct comparison of the percentage swaps since the table relates to assumed transfers of loads across the entire market.

4.17 The nature of the transported goods is shown in Figure 13 and the mode of appearance (MOA) is shown in Figure 14. These are dominated by FMCG goods and other goods moved in cages or on pallets.

4.18 Mail and parcels work represents 8% of all vehicle km, similar to the figure in 2014. As has been noted earlier, this is the sector running the most dual-deck LSTs and we believe that in most cases the LSTs are being used alongside 13.6m dual-deck trailers. The potential percentage saving from using the LSTs is therefore the same as when comparing single deck regular and LST units, when based solely on available deck space.

Figure 12: LST km by journey type

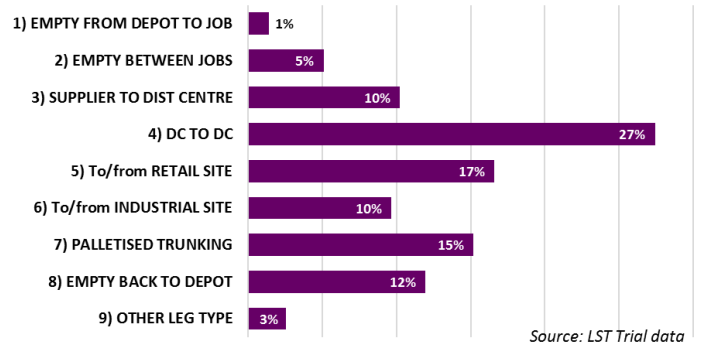


Figure 13: LST km by goods type

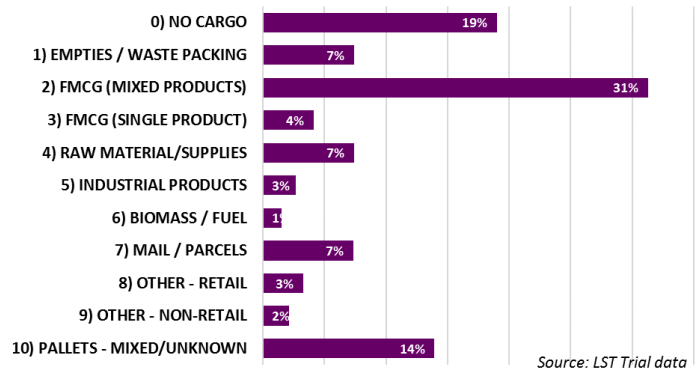
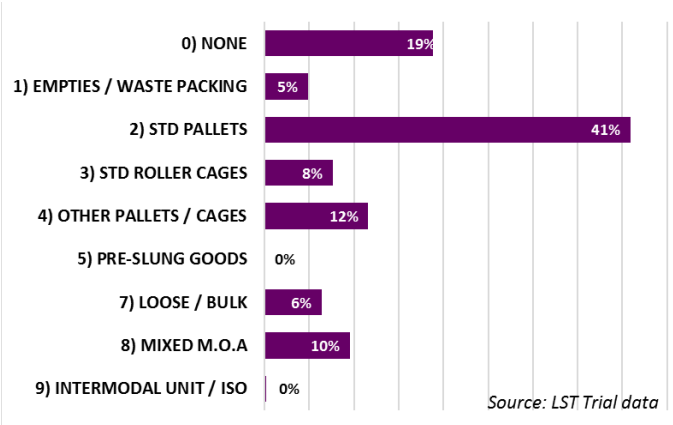


Figure 14: LST km by M.O.A.



Source: LST Trial data

4.19 There is a special case in which the **percentage** deck space gained by adding the additional length is greater than that for a single decker. Some of the dual deck trailers (both regular and LST lengths) have a profiled front edge to their roof, to offset the drag from the increased height required to make use of the dual decks. This reduces the loading space at the front of the upper deck, meaning that the total usable deck space is not double that of an equivalent single deck trailer. This means that as a **percentage**,

the gain resulting from extending a trailer with a profile front roof, is greater than for an equivalent square fronted trailer, since the whole additional length is at the rear where the load area is full height. This potential further gain is noted, but no special allowances have been claimed for such trailers in the utilisation calculations in Section 6

4.20 Some of the values reported on these charts differ from those reported for 2014, but in fact the underlying mix of leg types, goods types and MOA has not changed significantly in the past year. The difference arises because in 2015 we changed the reporting from 'number of legs' to 'distance covered' for all our main results, for two reasons:

- Expressing the results by 'number of legs' overstated the effect of a large number of very small legs, such as very small local movements to reposition trailers or even movements inside large sites with more than one telematics geo-fence.
- Expressing the results as 'distance covered' brings the reporting into line with the published DfT national data on HGV traffic, which is of interest for key comparisons.

Empty running of LSTs is only 2/3 that for regular semi-trailers in the same period

4.21 The LSTs ran empty for around 19% of the total distance they covered, considerably lower than the figure of around 29% for all articulated HGVs in 2012-2014[16].

4.22 As stated in earlier annual reports, this lower empty running figure for the LSTs needs to be interpreted correctly. There is no inherent reason to believe that LSTs would run empty less often than standard trailers across all operations. Rather, the difference is showing the extent to which the trial participants are placing the LSTs on operations where there is more limited empty running, such as trunking and depot to depot routes.

4.23 The reduced empty running is evidence that many of the trial operators have such work available on which they can deploy the LSTs efficiently, making use of the additional length on both outbound and return legs.

Utilisation

4.24 Utilisation data is gathered by both deck % and volume % to give both perspectives on how well the total load potential of the trailer is being used.

4.25 We also record whether the load was 'weight limited' so that we can identify cases where the deck or volume is not being used because no additional weight can be added, rather than because no further goods were available. However, only 2.9% of legs are noted as being weight limited, as may be anticipated with the LSTs being primarily of interest to those hauling lower density – higher volume goods. Indeed, if a significant proportion of a company's LST legs were to be weight limited and showed low deck % figures, it might call into question the value of using LSTs for that operation.

LSTs have been 100% full for 30% of their distance travelled

4.26 Figure 15 shows the utilisation by deck space covered.

4.27 The operators are instructed that they may record a trailer as 100% full if they could not load another 'unit' of goods (i.e. 1 more cage, 1 more pallet etc.)

4.28 The figures for 100% full journeys contain some conservatism as data for 2012-2013 did

[16] Source – Latest CSRGT Data for 2014 Table RFS0117 Percentage empty running and loading factors by type and weight of vehicle: annual 2000-2014.

not include a distinct 100% category.[17]

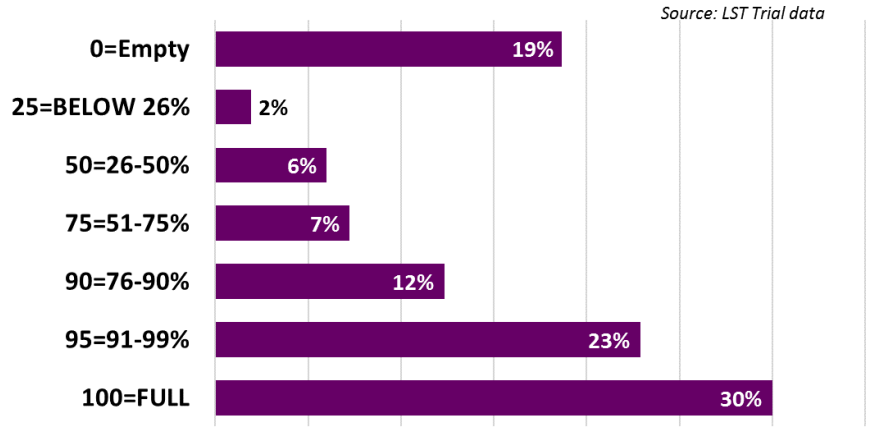


Figure 15: LST km by Deck% covered

4.29 Figure 16 show the utilisation by volume filled which although important, is not the primary focus of the analysis at this stage.

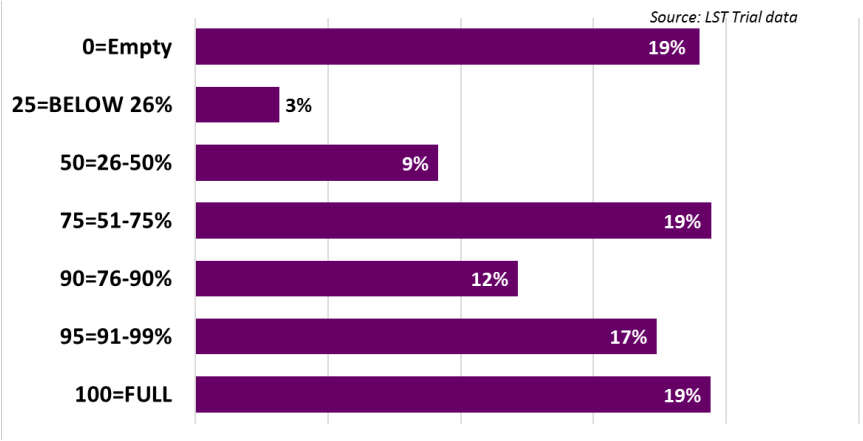


Figure 16: LST km by Volume% filled

The additional length of the LSTs was in use for around 53% of the total distance covered

4.30 As a rough measure, any journey with Deck % > 90% is making some use of the additional trailer length, i.e. the bottom two categories on Figure 15 giving a total of 53%.

4.31 Section 6 includes a detailed analysis of the deck % utilisation data and what it might mean in terms of a reduction in vehicle km compared to the same work being done on 13.6m trailers. That analysis takes into account the fact that where an LST makes outbound legs fully loaded, there will be fewer consequent empty return legs so these can also be counted as a saving, at least for some types of journey.

4.32 Any analysis by volume % will require a larger dataset so that it can be split out by different types of operation and trailer type. For example, an assessment by volume needs to take into account the trailer design.

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17 Annual Report 2014 (footnote 1) Appendix E, paras 22-30 for explanation of the changes made in 2014. Para 28 and 29 explain the conservative assumptions made in back-fitting the revised rules to earlier data for some operators.

- For refrigerated trailers, a free space of perhaps 20-30% of the volume may be required to permit circulation of the air and hence for such trailer designs, a figure of 70% may be regarded as 'full' by volume in analysis.
- For flatbed trailers, volume fill is not measureable in a meaningful way and so volume analysis will need to exclude these units.

Incident data summary

The analysis of incidents involving LSTs is a primary objective of the trial.

4.33 The low incidence of road traffic collisions involving LSTs on the public highway (both anticipated and actual) is one of the reasons the trial needs to collect data for an extended period of time before we are able to analyse trends or contributory factors to risk in a statistically meaningful way that can be used to inform future policy decisions.

4.34 The primary focus of analysis at this stage is to assess whether or not there is any emerging evidence from the trial about the relative safety risk performance of LST operations compared to standard sized trailers.

4.35 Figure 17 provides a summary of the incidents involving LSTs, reported by operators.

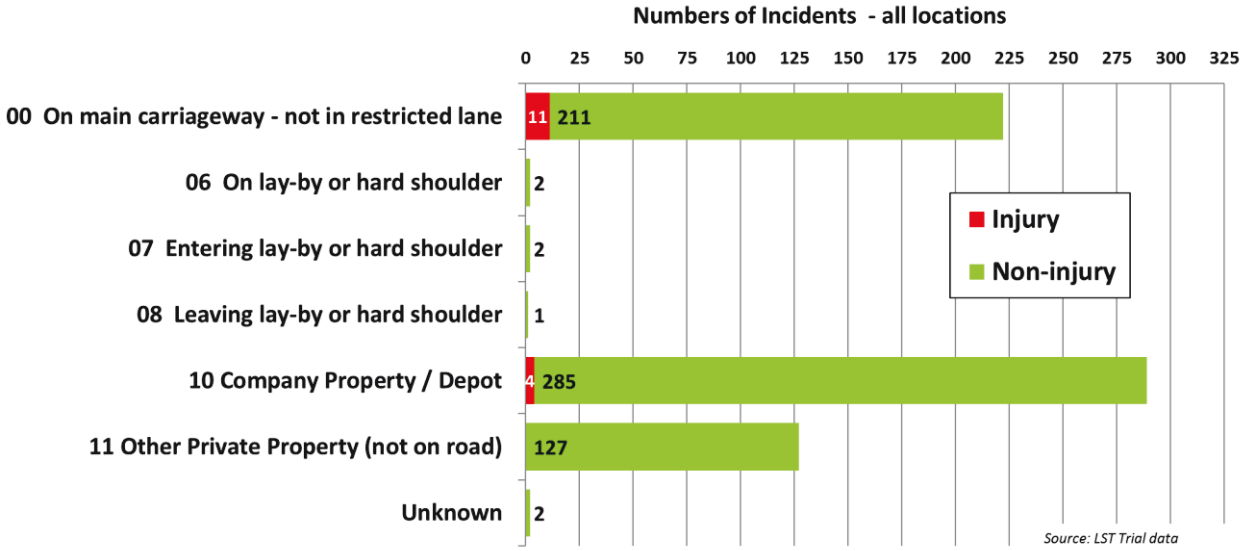


Figure 17: Incidents reported involving LSTs (Summary to end 2015)

There have been 15 injury incidents involving an LST reported of which 11 took place on the public highway

4.36 A detailed analysis of the incident data and resulting casualty figures is reported in Section 5. Values are compared to what would be expected for non-LSTs covering the same distances. For easy reference, details of the injury events and further charts showing more detail of the incident data are also provided.

4.37 The analysis includes an assessment of whether each incident was 'LST Related', i.e. was the fact the trailer was an LST a factor that influenced either the occurrence or outcome of the event.

There are have been 630 non-injury incidents reported of which only 161 were on the public highway and caused any damage

4.38 As in previous years, the quality of damage only incident reporting in depots and on other private land is highly variable. This is not surprising as it is not a requirement of trial participation. Some operators simply take the approach of reporting everything – others just the minimum required.

4.39 Of the 630 non-injury events reported, 216 were identified by the operator as occurring in 'Public' and even fewer, 161, were actually reported as resulting in any damage. These events are examined further in Section 5 (para 5.42 onwards), including an assessment of whether they were related to the trailer being an LST.

Qualitative Survey File (QSF) summary

4.40 The Qualitative Survey File (QSF) contains six open questions about the experiences of company participants in the trial, and of their staff in operating the new trailers or their clients.

4.41 The QSF provides an opportunity for operators to provide some narrative about their experience of operating the LSTs from the perspective of a range of staff and the business as a whole. It allows a space to record both the benefits they are realising from running the LSTs as well as any challenges and adjustments they have made. It therefore provides evidence that can contribute to 'lessons learned', which might benefit future companies who decide to operate LSTs. There is a small overlap between some of the areas covered in the QSF and those noted in the CIF.

4.42 In the 2014 annual report we presented analysis based on the first 100 QSFs received. We received 11 new QSFs during 2015. These new QSFs were very much in line with the earlier results, so what follows is a condensed version of the summary to date. The charts in Figure 18 indicate the range of response to each question.

4.43 The number of any particular type of narrative comment is not given, as the QSF part of the data gathering is not a quantitative analysis.

4.44 The commentary summarised here is based mainly on QSF returns one or two reporting periods after starting their LST operations. It may not reflect operator experience after a longer period. DfT and Risk Solutions are discussing the possibility of circulating a new version of the QSF to operators once they have been on the trial for more than an agreed number of periods, to capture the longer term experience.

Summary of Qualitative Survey Responses

Most operators reported no problems incorporating LSTs into the existing operation

4.45 *Question 1: Did you encounter any issues or problems with incorporating the LSTs into your operation?*

- Operators reported no significant issues in loading or driving. 10% of operators reported issues around negotiating **client** depots and a few noted 'other' issues.
- None of the 2015 QSF responses encountered any issues.

Most operators provided or insisted on LST specific driver training

4.46 *Question 2: Did you undertake any special training of staff in advance of operating the LSTs?*

Overall 98 operators have added narrative comment types falling into six categories:

- Classroom based learning (19)
- On-the-road training (3)
- In-house training with on-road practice (34)
- In-house training and assessment (6)
- Externally delivered training (11).

Other preparation before operating LSTs

4.47 *Question 3: Did you undertake any other special preparation in advance of operating the LSTs? (e.g. staff training, physical changes to loading areas or depots, changes to planning or operations processes etc.)*

- This has not changed from last year to this most recent year, with the majority of operators still stating that they did not make any special preparations (other than the driver training) in advance of operating the LSTs.
- Of the two who answered 'yes' in this previous year's submission of QSFs, the comments were related to use of LSTs at certain depots only.
- Outside the QSF analysis, we are aware of operators who have made adjustments once they have gained some initial experience of using the LSTs, in particular, arranging for them to be placed at the end of a line of loading bays at a depot (rather than the middle).

Feedback from user / stakeholder groups

4.48 *Question 4: Have you had any feedback (from key stakeholders)?*

- The main comments about the LSTs received were from the drivers.
- The comments still show that the feedback was either 'positive' or 'generally good' and the new comments received in 2015 were mainly about 'helping to save the company money' and that the 'trailer handled really well'.
- The neutral and negative comments have not changed since last year's report.

Self-imposed restrictions on LST operations

4.49 *Question 5: Have you chosen to operate the LSTs in a more restrictive way than your other semi-trailers?*

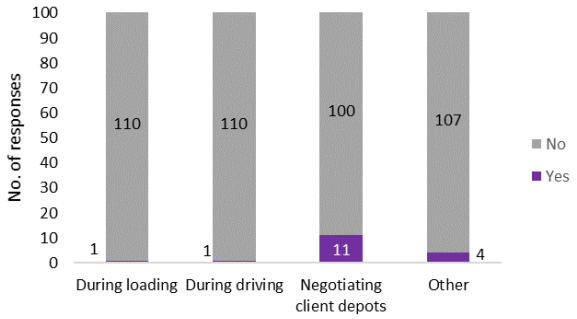
- 59% of respondents noted some self-imposed restrictions for LSTs, the most common being approved routes only and certain client depots.
- The other 41% said they would not have to impose additional constraints as the nature of their general operation (for example, palletised trunking) is already suited to LSTs.
- It is worth noting that some of the companies who did impose some restrictions, did not see their choices as negative, but simply a reflection of choosing to operate the LSTs in the most efficient or cost effective way.

Overall performance of LSTs for business (so far)

4.50 *Question 6: 94 operators have given comments to their QSF. Some of the latest responses include:*

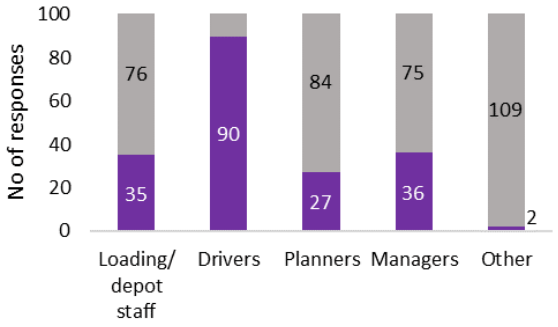
- Increased commercial returns
  "Excellent- an additional benefit to the operation and reduced costs and maintenance."
- No problems-excellent
  "Overall the new trailers are ideal for the trunking work we do on the pallet network"
  "Excellent, they drive like any other trailer and even better than a wagon and drag"
- Reduced carbon footprint
  "Extra revenue for carrying goods and lower CO_2"

Question 1



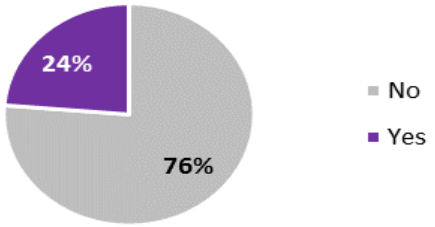
Did you encounter any issues or problems with incorporating the LSTs into your operation?

Question 2



Did you undertake any special training of staff in advance of operating the LSTs?

Question 3

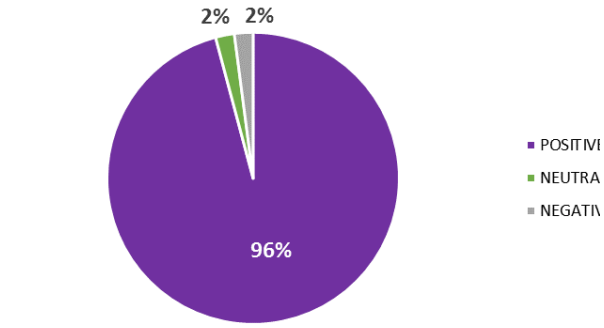


Did you undertake any other special preparation in advance of operating the LSTs?

Question 4

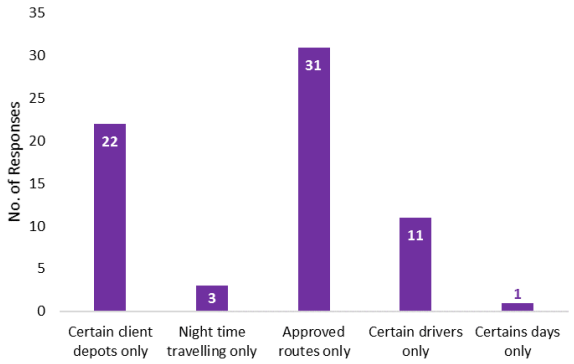
Have you had any feedback (from key stakeholders)?

Question 4



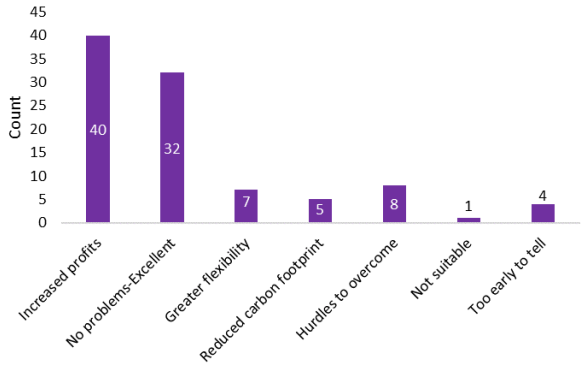
Nature of feedback (from key stakeholders)

Question 5



Have you chosen to operate the LSTs in a more restrictive way than your other semi-trailers?

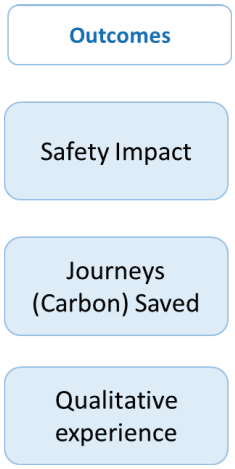
Question 6



General comments experience of operating LSTs in your business (grouped by themes found in responses)

Figure 18: Summary of Qualitative Survey Responses

5 TRIAL OUTCOMES 1: SAFETY IMPACT



5.1 The data sources, collection and analysis methods have been fully described in earlier annual reports[1]. In this report we have only included notes of any amended or new methods or processes.

5.2 The analysis targets the three anticipated outcomes of the trial:

1. The analysis of **personal injury incidents** is vital to establish whether there are any indications that LST operations are increasing safety risk (relative to other traditional trailers), particularly to other road users and vulnerable groups. (Section 5).
2. The analysis of **utilisation** is important as it reveals the extent to which the potential savings in journeys (and hence carbon emissions) are being realised in real operations. (Section 6).
3. The outcomes in qualitative experience, have been covered in the discussion in the previous section as we judged there was little value in separating them from their raw outputs (Section 4).

5.3 Our analyses will be expanded and refined as the trial dataset grows. This will permit finer segmentation and cross-referencing of findings. Where appropriate these deeper analyses will draw on experience from outside the project team or from special topic analyses involving selected volunteer companies from among the trial participants.

5.4 In last year's annual report, we noted two special studies that are now complete:

- An analysis looking at non-injury (damage only) incidents based on sampling the in-house incident databases of a selection of LST operators.
- Further statistical analysis to see if there is enough data yet to make any meaningful comment on whether LSTs have a higher or lower vehicle collision rate during **urban operations**, compared to the UK non-LST articulated fleet.

5.5 **The analysis of utilisation (journeys saved) is reported in Section 6.** The remainder of this section of the report deals with safety impact outcomes, covering:

- Injury incidents (trial outcomes, comparison to national statistics)
- Damage only incidents (trial outcomes, special topic analyses using operator in-house data)

Injury incidents - data

Injury incidents and casualties

5.6 Figure 17 noted 15 injury incidents involving LSTs. Table 4 shows detail for the 20 casualties associated with these events, classified by injury severity, where they were at the time and whether the event has been judged to be 'LST-related'[18].

5.7 From this table and the data that underpins it, we can note the following 'headlines'

[18] An incident is considered to be LST-related if it is judged that the incident occurred because the trailer was an LST and would not have occurred had the trailer been a standard length.

There have been no fatal accidents involving LSTs in 202 million km of operation.

Since the last annual report, there have been 5 additional personal injury incidents involving LSTs, resulting in 1 serious and 9 slight injuries. Only 1 of these has been LST-related.

5.8 There was a single incident in 2015 in which an LST was involved in a rear-end shunt in heavily congested traffic on a motorway. This resulted in injuries to the occupants of a car/taxi at the rear of the tailback. The incident was judged not to be LST-related.

Table 4: Casualties from 15 incidents involving LSTs (2012-15)

Injury Collisions from Trial Logs	Total Collisions	Total Casualties	Fatal	Serious	Slight
All Injuries	**15 (10)**	**20 (10)**	0	4 (3)	16 (7)
All Injuries in Public Road/Place	**11 (7)**	**16 (7)**	0	4 (3)	12 (4)
All Injuries judged LST-related (any location)	**1-2 (1)**	**4-5 (3)**	0	0	4-5 (3)
All injuries – LST-related AND in public place	**2 (1)**	**2 (1)**	0	0	2 (1)

Figures in (brackets) show the totals at the end of 2014

5.9 The personal injury incidents in public locations are summarised in Table 5. Note that:

- Identification of location, and assessment of whether or not the event was LST-related, is made by the operator.
- Casualty severity is determined by the operator, based on the STATS19 injury classes.
- Where appropriate (e.g. to clarify certain details), we have reviewed specific event records with the operator and, in the light of better information, adjusted the original classifications.
- The incident summary shown here is a simplified and cleansed version of events designed to convey the main points without identifying the operator.
- In some cases, the STATS19 record of the same event can be identified from the event details and has been used to further inform our understanding of the events.
- The national STATS19 data for 2015 has not yet been validated by DfT, so we cannot be sure that the 2015 LST events shown here will be included in that data.[19]

[19] The raw STATS19 data collected by police forces across the country are checked and validated centrally to ensure they meet a consistent set of criteria. Only the validated events are included in the national published statistics.

Table 5: Description of LST injury incidents in public locations

	Location:		Casualties				
Year	Public/ private	Urban?	Fatal	Serious	Slight	LST Related?	Incident summary
2012	Public	Yes	0	0	1	NO	LST driver turning left on mini-roundabout. A taxi entered the roundabout during the LST manoeuvre struck the trailer. Taxi driver slight injury. **Not LST related.**
2012	Public	No - Rural	0	0	1	MAYBE	Early in the trial, LST being delivered from manufacturer to MIRA for testing, before delivery to operator. Agency driver misjudged roundabout at motorway junction and overturned trailer. Driver slightly injured - no other vehicles involved. Agency drivers generally not used on the trial. **Classified as 'maybe' LST related.**
2013	Public	No - Motorway	0	1	0	NO	LST slowing down on motorway. Driver behind failed to brake and hit back of trailer and was injured. **Not LST related.**
2014	Public	No - Rural	0	0	1	NO	LST travelling on rural section of A-Road at night. Another road user ran into rear of the LST at high speed and was injured. **Not LST related.**
2014	Public	No - Motorway	0	1	0	NO	LST encountered previous incident on motorway that had resulted in a jack-knifed vehicle partially blocking lane 1. It was night, motorway section unlit and damaged vehicle was unlit. LST driver was unable to avoid hitting it and was injured. **Not LST related.**
2014	Public	No - Motorway	0	1	0	NO	LST travelling in lane 1 of motorway at night. Car driver approached from behind and hit the trailer. Car driver injured. **Not LST related.**
2014	Public	No - Rural	0	0	1	NO	LST travelling on rural section of A-Road when he lost control - vehicle left the road and overturned, injuring the driver. No other vehicles involved. Investigation attributed event to driver fatigue resulting from stress factors outside work. **Not LST related.**

	Location:		Casualties				
Year	Public/ private	Urban?	Fatal	Serious	Slight	LST Related?	Incident summary
2015	Public	Yes	**0**	**0**	**1**	**YES**	LST making a turning manoeuvre in an urban location reported to have hit a pedestrian with the tail end of the trailer. **See paras 5.12 to 5.18 and** Figure 19 **for further details**
2015	Public	No - Motorway	**0**	**0**	**1**	**NO**	LST travelling on motorway in middle of the day. Vehicle left the road on nearside but did not overturn. No other vehicle involved. Investigation attributed event to driver fatigue. **Not LST related.**
2015	Public	No - Motorway	**0**	**0**	**1**	**NO**	LST travelling on motorway mid-morning. Vehicle left the road on offside and overturned. No other vehicle involved. Investigation attributed event to driver fatigue. **Not LST related.**
2015	Public	No - Motorway	**0**	**1**	**5**	**NO**	LST travelling on motorway in middle of the day. Traffic congestion resulted in a stationary queue. LST driver failed to react quickly enough and collided with the rear stationary vehicle. 1 serious and 5 slight injuries. **Not LST related.**

Sources LST Data, Operator communications, STATS19 data (except 2015)

The injury incident analysis remains conservative since the events being included are not all definitely LST-related.

5.10 In the discussion that follows, we focus on the two events which occurred in a public location that was also 'urban'. However, this is conservative as, only one of these two events was judged to be **LST-related**. The other one would probably still have happened if the trailer had not been an LST.

5.11 STATS19 is the national record of road traffic collisions recorded by the Police, and provides the basis for recording national road safety statistics. It provides the primary data source for comparing road safety performance of articulated HGVs against LSTs. We have confirmed that the 2012 LST injury event is not in the STATS19 for that year. We believe the 2015 event will appear in the data when published. Without understating the importance of the events themselves, this highlights the fact that any equivalent events involving regular semi-trailers might not be in the background data. Therefore, including these two LST events in the comparison, is conservative.

There has been one reported slight injury to a pedestrian, involving an LST. However, circumstances mean it may not be representative of normal operations.

5.12 During 2015 an incident was reported that involved slight injury to a vulnerable road user (in this case a pedestrian) that resulted from being hit by the tail end of a LST as it was

making a turning manoeuvre in an urban location. This is the first and only incident of this type in the trial to date, and is therefore of special interest.

5.13 We have investigated this event in more detail and our findings are summarised in Figure 19.

5.14 So far as we are aware, the injured party did not attend hospital, nor have they made any direct complaint or claim against the operator.

5.15 The police did not attend the scene, but following a telephone report from the injured party, they collected details of the incident.

5.16 From our further investigations, we have conservatively counted it in our analysis as occurring in an urban area on the public highway. We have also counted it as LST related, on the basis that we know the vehicle was performing a high angle turn and the impact point was the rear corner of the trailer.

5.17 Operationally, the event is unusual, since it happened when the operator was deliberately putting the LST and driver into a situation at or even beyond the limits they would be expected to encounter on a real delivery route. Indeed, the communication we have had with a variety of operators around routing of LSTs suggests that they might exclude a route with such a turn from their route planning.

5.18 We have decided, for conservative reasons, to include it in our statistical analysis of LST related events, but this is done with the caveat that the event is not strongly representative of 'normal' LST operations.

Single LST urban turning event

In this incident, a member of the public contacted the police, claiming that they had received a slight injury on the arm/shoulder as result of being hit by the back end of an articulated HGV as it turned right at a traffic light controlled junction. The report from the injured party, supported by a witness, states that they were standing on the edge of the kerb when they were hit.

The party concerned did not attend hospital, nor have they made any contact with the operator. The injured party identified the operator from vehicle branding. The police did not attend the scene.

Police investigations determined that at the time of the incident, the vehicle was being used for LST driver training and assessment, rather than on a delivery run. Furthermore, it was not on a 'normal' delivery run route, but rather on one specially selected to include a range of challenging manoeuvres to test the driver's abilities - beyond what they might expect to encounter in regular operations.

The police interviewed both the driver and the driver assessor (in the cab during the assessment). Neither were aware that any incident had taken place.

The event occurred in a small/medium town that is bisected by a single carriageway B-Road. The LST was performing a 120 degree right turn from an unclassified road onto the B-road.

The operator confirmed that the route is not part of any regular delivery operation and it is no longer used for driver assessment.

Source: Police record, Operator report, Operator discussion.

Figure 19: LST urban turning event

Injury incidents – comparison to other semi-trailers

National comparison of LST incident rates vs all GB Articulated HGVs

5.19 As the LST trial progresses, we have been analysing incident data to assess whether or not LST operations pose an additional risk to other road users, when compared to the standard semi-trailer fleet. Our analysis focuses on the comparison of LST incidents in public locations (public highway, services areas etc.) as the best comparison to the background STATS19 data published for all personal injury road traffic collisions that take place on the public highway.

5.20 There have been **11 personal injury incidents involving an LST in public locations in 202 million km travelled over 1.7 million journey legs.** Of these, **only 2 incidents (resulting in 2 slight injuries) were determined to be LST-related**. This equates to:

- **1 injury event in a public place for every 18 million km travelled by the LSTs**
- **1 LST-related injury event in a public place, in every 101 million km travelled**.

5.21 For some of our analysis, we also report a 'conservative' case, where we include all the LST injuries that took place on **private land**, and add them to the number of LST-related events that have been reported to have occurred in a public place.

Overall incident rates for LSTs are substantially lower than those of the standard fleet.

5.22 The first statistical test we have performed is a 'Poisson rate ratio' test. This calculates the '**mean rate ratio**' of the LST incident rate (per billion vehicle km) to that for the background population of all GB articulated HGVs. If the mean rate ratio is equal to 1.0, then the rates are the same. If the ratio is not equal to 1.0, then the test tells us if the difference from 1.0 is statistically significant.

5.23 Table 6 shows that at a national level the incident and casualty rates for LSTs are substantially lower than those of the standard fleet. The ratios in the table are less than 100% (1.0) and proven to be statistically significant. **For the public access location comparison, LST incidents are occurring at a rate of only 32% of the general GB articulated HGV fleet, down from 38% to end 2014.**

5.24 The national level casualty rate for LSTs remains small compared to the GB fleet as a whole, but has risen since last year as a result of one event in which there was 1 serious and 5 slight injuries. The event, described later, was not LST related.

Table 6: Summary comparison of LST public road collision and casualty rates (2012-15) vs. GB articulated HGVs (2012-14)

Injury incidents Public access locations	LST Rate per billion vkm	GB Artic HGV Rate per billion vkm	Ratio LST/GB-HGV
Collisions	**54.5** (64.8)	**170.0** (187.4)	**32%** (38%)
Casualties	**79.2** (64.8)	**241.3** (262.5)	**33%** (27%)

Sources: LST from trial data. GB from STATS19 and TRA3105 – all 2012-2014. Annual Report 2014 results in parentheses. Both ratios shown to be statistically significant at the 5% confidence level.

'Urban' comparison of LST incident rates vs all GB Articulated HGVs

5.25 During 2015, we have been working to see whether the LST incident rate is dominated by LST operations on long distance, trunk roads which could mask an increased safety risk during the very limited operations on urban roads. Some stakeholders have expressed a concern that urban LST operations would be where LSTs perform most high angle turns which could pose a threat to vulnerable road users such as pedestrians, cyclists and powered two-wheeler users, as well as to other drivers.

5.26 To carry out the analysis we need to determine the number of 'urban' incidents and the urban/rural distance travelled ratio, for the background and LST populations.

5.27 **Background population - urban/rural distance and incident counts:** For the general GB articulated HGV fleet, traffic census data[20] published by DfT includes a breakdown by road type in rural or urban locations. We have refined this breakdown to eliminate urban motorways as these are not representative of the urban operations we are interested in. A similar approach is adopted for the STATS19 data – which is reported according to the same classifications of roads.

5.28 **LST population –urban/rural distance:** We do not currently have detailed data on LST journeys by road type nor for urban or rural environments. However, we can undertake statistical analysis if we make some assumptions about the proportion of LST journey legs in urban environments compared to the background HGV fleet. For this analysis we use a parameter 'M', where M=1 means that the proportion of vehicle miles driven on urban roads is the same for LSTs as it is for the background population. We then explore the impact of scenarios with reducing values of 'M' (i.e. reducing the relative proportion of LST vehicle kilometres driven in urban areas), and test for the statistical significance of any differences from the background HGV fleet results. Options for analysing the actual value of 'M' are noted in Section 7, para 7.12.

5.29 **LST population –incident count.** The detailed data for the injury incidents noted in Table 4 have been analysed and the incidents classified in Table 7 under the same 'tailored' definition of urban / rural or motorway described above.

Table 7: Number of personal injury collisions for LST trial population, 2012 to 2015 – urban/rural split

Number of collisions in each location type	Public and private	Public only
N_{LR}, Rural or motorway	9	9
All motorways	*6*	*6*
Rural and not on a motorway	*3*	*3*
N_{LU}, Urban and not on a motorway	6	2
Total	15	11

5.30 Using the urban data only, and the STATS19 equivalent case where there are only two LST events that are truly urban and on the public highway, the statistical analysis for a series of values of M are shown in Table 8.

There have been too few LST related personal injury incidents in urban operations to determine a statistically meaningful assessment of the relative safety of LSTs compared to the background HGV fleet for urban operations.

5.31 The results shown in Table 8 are based on the assumption that only two LST personal injury collisions have occurred to date in a genuinely urban public location. In this case, even with an M value of 0.05 (i.e. the ratio of LST urban operations is 5% of the ratio of the background HGV urban operations/ background HGV rural operations) we cannot force the rate ratio test to be statistically significant. The very low urban vehicle kilometres associated with an M value of 0.05 is not judged to be credible.

5.32 We repeated the calculations in Table 8 with a conservative assumption that includes the four injury events that happened in depots or other private land. We found that in this case, the ratio of LST urban collision rate to the background urban collision rate only

[20] DfT road transport statistics - table TRA3105

becomes significant with an M value somewhere between 0.35 and 0.30. This shows that because the number of incidents is so small there would have to be a very significant difference in urban vehicle kilometres driven for the collision rates to be considered significantly different. An M value of 0.30 means that the proportion of LST vehicle kilometres driven on urban roads would be less than a third of that for the background population. In other words, given that the background population drives about 6% of their total vehicle kilometres on urban roads, LSTs would have to drive about 1.8% or less of their vehicle kilometres on urban roads.

Table 8: Rate ratio significance test results assuming two LST urban incidents (public locations only), varying the M parameter to change the assumed LST urban vehicle kilometres

	M = 1.0	M = 0.10	M = 0.05
Background population of urban collisions in public places			
No. of collisions	1358	1358	1358
Billion vehicle km	2.4	2.4	2.4
Mean collision rate per billion veh km	566	566	566
LST population of urban collisions			
No. of collisions	2	2	2
Billion vehicle km	0.012	0.0012	0.0006
Mean collision rate per billion veh km	165	1646	3292
Rate ratio test results (ratio of LST urban collision rate to background urban collision rate)			
Mean rate ratio	0.29	2.91	5.82
95% confidence limit of rate ratio	0.04 – 1.05	0.35 – 10.53	0.70 – 21.06
p value that rate ratio equals 1.0.	0.07	0.30	0.09
Statistical interpretation	Not significant at the 5% level. Insufficient evidence to reject null hypothesis that the rates are the same	Not significant at the 5% level. Insufficient evidence to reject null hypothesis that the rates are the same	Not significant at the 5% level. Insufficient evidence to reject null hypothesis that the rates are the same

5.33 The second statistical analysis we have performed tests how long the trial will need to continue before the rate ratio test can be expected to yield a statistically significant results for the relative urban incident rate of LSTs compared to the background population.

A statistically robust conclusion on urban (excluding urban motorways) operational risk should be reached by year 6 of the trial (2017) if the incident rates experienced to date, and LST usage on urban operations continue.

5.34 For the case where we assume only two LST urban incidents have happened to date (after four years), the mean rate ratio for urban collisions is 0.29, but as noted above, we cannot confirm this as a statistically significant result. Table 9 shows our projections based on the assumption that the incident rates experienced (one every two years) and the growth in distance travelled were to continue at the same rate in future years, i.e. three incidents in six years, four in eight years etc.

5.35 Using classical statistics, we find that the rate ratio would become statistically significant if we observed three incidents after six years. **If we did actually observe only three LST urban incidents after six years (end 2017) we would be reasonably confident in a conclusion that the LST urban incident rate was significantly lower than the background population urban incident rate**.

Table 9: Rate ratio significance test results assuming two LST urban incidents (public locations only) to date, then simulating the results for longer trial periods by assuming that background and LST incidents continue to occur at the same mean rate and M = 1.

	Trial period 2012-2015 4 years	Trial period 2012-2017 6 years	Trial period 2012-2019 8 years
Background population of urban collisions in public places (assumed)			
Mean collision rate per billion veh km	566	**566**	566
LST population of urban collisions (assumed)			
No. of collisions	2	**3**	4
Billion vehicle km	0.012	**0.018**	0.024
Mean collision rate per billion veh km	165	**165**	165
Rate ratio test results (ratio of LST urban collision rate to background urban collision rate)			
Mean rate ratio	0.29	**0.29**	0.29
95% confidence limit of rate ratio	0.04 – 1.05	**0.06 – 0.85**	0.08 – 0.75
p value that rate ratio equals 1	0.07	**0.02**	< 0.01
Statistical interpretation	Not significant at the 5% level. Insufficient evidence to reject null hypothesis that the rates are the same	**Significant at the 5% level. Sufficient evidence to accept alternative hypothesis that the rates are different.**	Significant at the 5% level. Sufficient evidence to accept alternative hypothesis that the rates are different.

5.36 The third statistical analysis we have performed uses Bayesian statistics to examine the data.

5.37 Applied to this problem, the Bayesian analysis results determine the probability that the LST injury incident rate is higher or lower than that for the background population. In simple terms, the Bayesian analysis gives an insight into how far away from a robust result we might be.

5.38 The results are sensitive to the assumed value of M - as shown in Table 10 - and have changed materially as a result of including the 2015 data.

5.39 If the M is 0.75 – meaning the LSTs travel only 25% less on urban roads than the background population of semi-trailers - then the Bayesian analysis indicates that there would be a probability of 93%, that the LSTs have an incident rate that is lower than the background population. If in fact the LSTs on the trial are travelling on urban roads less frequently than this, the confidence level reduces, because of the very low number of urban injury events in the data.

5.40 **If M is greater than 0.5 (i.e. the ratio of LST urban/rural operation vehicle kilometres is greater than 50% of the ratio for the non-LST trailers) then there is a 78% probability that the LST incident rate is lower than that for all articulated HGVs.**

Table 10: LST Urban injury incident rate - Bayesian Analysis

Bayesian Analysis Summary of urban incidents STATS19 Equivalent Case (2 injury events)	Median Collision Rate Ratio	The probability that the LST (injury) incident rate on urban roads is:	
		HIGHER	LOWER
	=LST/RST rates & (HDI*)	than the background rate for all large articulated HGVs.	
To end 2014 with M=1.0	0.32 (0.04-1.5)	6%	94%
To end 2015			
M=1.0	0.31 (0.07-1.0)	2%	98%
M=0.75	0.42 (0.10-1.4)	7%	93%
M=0.5	0.63 (0.14-2.0)	22%	78%
M=0.35	0.90 (0.21-3.0)	44%	56%

The value of 'M'

5.41 All three of our statistical analysis results vary depending on the presumed value of M. In the Bayesian analysis, the probability that the LSTs have a lower urban injury rate than the regular semi-trailers (RSTs) is very high if M=1, but reduces with lower values of M. In order to remove this variable from the analysis, we would need to have a robust estimate of how much of the LST distance travelled took place on roads we could classify as 'Urban – Not Motorway'. Options for further analysis that could estimate M more accurately, are discussed in Section 7.

Damage only incidents – LST trial data

LST trial data

5.42 In earlier Annual Reports we presented multiple breakdown charts of all non-injury events. Our focus now is on events that:

- resulted in some damage
- were located on the public highway (or in a publically accessible area)
- were assessed as being related to the fact the trailer was an LST.

There have been around 80 damage only incidents where the LST was identified as being a possible cause of the event.where some damage was recorded (either to the vehicle or public/private property). Of these, only 161 occurred in a public location (as noted earlier – para 4.39).

5.43 Table 11 shows a summary of the breakdown of the 540 where some damage was recorded (either to the vehicle or public/private property). Of these, only 161 occurred in a public location (as noted earlier – para 4.39).

Table 11: LST Non-injury incidents by location

LST Non-Injury incidents recorded as resulting in damage 2012-2015	Was incident 'LST Related' ?					
Filter levels: PUBLIC/PRIVATE > Location > Manoeuvre before incident	Yes	Yes - Partly	Maybe	Unclear	No	Totals
PUBLIC ROAD / LOCATION	45	16	20	9	71	161
00 On main carriageway - not in restricted lane						
01 Reversing		1	2	1	4	8
03 Waiting to go ahead but held up	1				4	5
04 Slowing or stopping					2	2
05 Moving off		1			5	6
06 U turn	2		1	1		4
07 Turning left	30	5	8	2	8	53
09 Turning right	11	8	7	1	15	42
10 Waiting to turn right			1			1
11 Changing lane to left					3	3
12 Changing lane to right					2	2
13 Overtaking moving vehicle on its offside				1	1	2
15 Overtaking on nearside					1	1
16 Going ahead left hand bend				1	2	3
18 Going ahead other	1		1	2	22	26
07 Entering lay-by or hard shoulder					2	2
08 Leaving lay-by or hard shoulder		1				1
PRIVATE LAND	119	57	51	13	139	379
10 Company Property / Depot	87	33	32	3	100	255
11 Other Private Property (not on road)	32	24	19	10	39	124
TOTAL	164	73	71	22	210	540

5.44 Each event is classified by the operator with their judgement of whether it was 'LST Related', using the options show in the columns of where some damage was recorded (either to the vehicle or public/private property). Of these, only 161 occurred in a public location (as noted earlier – para 4.39).

5.45 Table 11. The operator judgements are checked by Risk Solutions and, where necessary, amended with their permission. Where there is limited narrative information, for any event where the impact was at the rear of the trailer, we prudently assign it as 'LST Related = Yes'.

5.46 If we conservatively count all the events noted as 'Yes – partly' or 'maybe' as LST related, we have 81 events of interest. There is no national database against which this can be compared, to see whether it is better or worse than standard semi-trailers. **The LST performance equates to:**

- **1 damage only event for every 2.5 million km travelled by the LSTs**
- **1 damage only event for every 21,500 journey legs operated by LSTs.**

Incident rates over time, allowing for increase in LST fleet size

5.47 The charts in Figure 20 show a time trend of the full set of non-injury incidents. The key observation at this stage of the trial is that the normalised rate of non-injury events reduced from the start of the trial until the end of 2013 and has remain broadly steady ever since.

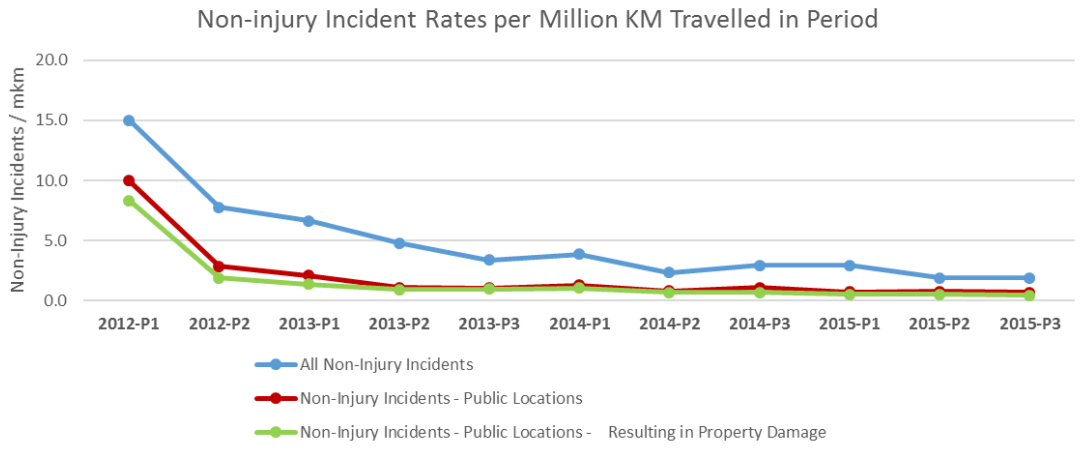
Figure 20: Analysis of non-injury incidents by trial period

Source: LST Trial data

Figure 20 (a) Summary Data

	2012		2013			2014			2015		
	P1	P2	P1	P2	P3	P1	P2	P3	P1	P2	P3
	May-Aug	Sep-Dec	Jan-Apr	May-Aug	Sep-Dec	Jan-Apr	May-Aug	Sep-Dec	Jan-Apr	May-Aug	Sep-Dec
INCIDENT COUNTS											
All Non-Injury Incidents	27	49	57	52	42	62	59	79	85	57	67
Non-Injury Incidents - Public Locations	18	18	18	12	13	21	20	30	21	23	24
Non-Injury Incidents - Public Locations - Resulting in Property Damage	15	12	12	10	12	17	17	19	15	16	16
NORMALISING FACTORS											
LSTs Operating (by period end)	161	334	383	570	576	707	964	1194	1323	1502	1511
Million Vehicle Km (in period)	1.8	6.3	8.6	10.8	12.4	16.1	25	27	29	30	35

Figure 20 (b) Non-injury incidents by total LST distance travelled



5.48 Some operators have commented that they have also detected a reduction in all incidents once a group of drivers in a depot have 'settled in', with the pattern being repeated, albeit with fewer events, each time trailers are introduced at a new location. This may be the case, since for those early periods of the trial, there was only a small group of operators and they would all have been 'new' at the same time. In the later periods, any evidence of the same effect being seen in those joining the trial would be damped in the data by the fact they were going through their learning period in smaller numbers at any one time, while the overall dataset would reflect the growing set of operators who had 'settled in'.

Damage only incidents - sample of operator in-house data

5.49 As reported last year, we have done a special analysis of incident data recorded in the in-house databases of four operators. The purpose of the study was to see whether we could calculate relative damage incident rates of LSTs and regular semi-trailers:

- on a **common** basis for the LSTs and other trailers within one fleet
- on a **comparable** basis for LSTs and other trailers between the fleets of different operators.

5.50 If this proves possible, then it would overcome the problem of there being no national 'damage incident' database (comparable to STATS19 for injury incidents) against which to compare the trial data on LST damage events.

5.51 This small study was primarily designed to assess the feasibility of doing such analysis across multiple operators, rather than necessarily to produce any useable results for the evaluation. The study has done both, but the results reported here need to be considered noting that they cannot be presumed to be based on a representative sample of the LST operators since:

- **The sample of just 4 operators is very small** and was intentionally targeted to include:
  - Operators A and B - running mainly between distribution centres or suppliers
  - Operators C and D - running mainly to and from retail sites

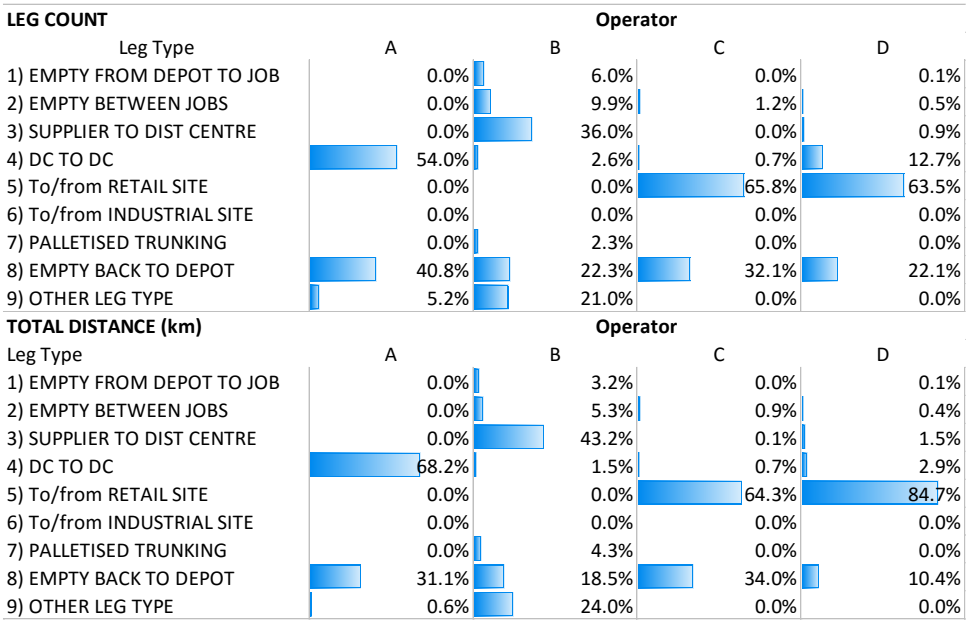
  on the assumption that one group might be using urban roads more than the other.
- The sample operators were selected largely because we knew they had reasonable in-house data collection and reporting systems
- The sample covers only 2014 and 2015 incidents, as shown in Table 12.

Table 12: 'Damage only' in-house data sample

	2014	2015
All reported incidents	2,545	2,916
Incidents on public highway	1,374	1,301

- The data was not originally collected for use in detailed incident analysis and therefore may not have been subject to the same level of checking and validation that, for example, would apply to a dataset like STATS19.
- Where data was unclear or comparison was problematic, we made prudent assumptions.

5.52 As noted above, the operators were selected based on their having a strongly dominant leg type in their data. Figure 21 shows the trial data for Leg Type by both leg count and distance for the four operators in the study. The operators confirmed that this mix of leg types also applies to their RSTs against which are were comparing the LSTs.



LEG COUNT	Operator			
Leg Type	A	B	C	D
1) EMPTY FROM DEPOT TO JOB	0.0%	6.0%	0.0%	0.1%
2) EMPTY BETWEEN JOBS	0.0%	9.9%	1.2%	0.5%
3) SUPPLIER TO DIST CENTRE	0.0%	36.0%	0.0%	0.9%
4) DC TO DC	54.0%	2.6%	0.7%	12.7%
5) To/from RETAIL SITE	0.0%	0.0%	65.8%	63.5%
6) To/from INDUSTRIAL SITE	0.0%	0.0%	0.0%	0.0%
7) PALLETISED TRUNKING	0.0%	2.3%	0.0%	0.0%
8) EMPTY BACK TO DEPOT	40.8%	22.3%	32.1%	22.1%
9) OTHER LEG TYPE	5.2%	21.0%	0.0%	0.0%

TOTAL DISTANCE (km)	Operator			
Leg Type	A	B	C	D
1) EMPTY FROM DEPOT TO JOB	0.0%	3.2%	0.0%	0.1%
2) EMPTY BETWEEN JOBS	0.0%	5.3%	0.9%	0.4%
3) SUPPLIER TO DIST CENTRE	0.0%	43.2%	0.1%	1.5%
4) DC TO DC	68.2%	1.5%	0.7%	2.9%
5) To/from RETAIL SITE	0.0%	0.0%	64.3%	84.7%
6) To/from INDUSTRIAL SITE	0.0%	0.0%	0.0%	0.0%
7) PALLETISED TRUNKING	0.0%	4.3%	0.0%	0.0%
8) EMPTY BACK TO DEPOT	31.1%	18.5%	34.0%	10.4%
9) OTHER LEG TYPE	0.6%	24.0%	0.0%	0.0%

Figure 21: Journey leg types by leg count and distance for four operators

Comparison of LSTs with RSTs using in-house incident data is resource intensive.

5.53 The in-house data we reviewed is collected for specific purposes (e.g. repair and maintenance, insurance) and so are not tailored to our use of them. For two of our four operators, it was not straightforward to identify which incidents related to LSTs and which related to RSTs.

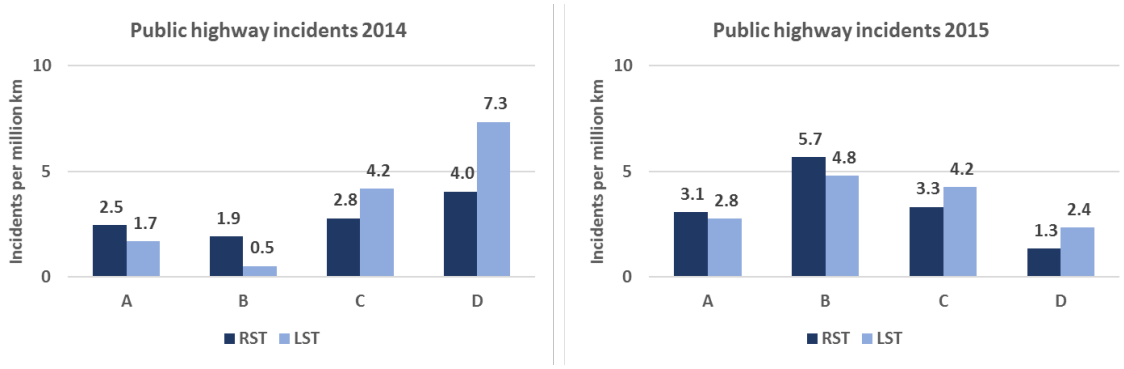
5.54 This was highlighted by comparing LST incidents reported to us with those in the datasets provided. For any consideration of a wider comparison of RST and LST incidents using in-house data; it would be necessary as a first step to ensure that operators could readily identify LST incidents in their datasets.

5.55 Beyond this basic requirement, we found that we needed a significant amount of time and effort liaising with each operator to clarify the correct interpretation of their diverse data systems, in order to produce comparable results across the four operators.

5.56 In summary – it is feasible to do this 'in-house' data analysis across diverse operators, where they have reasonably developed electronic incident recording systems, but doing so is resource intensive for both the operator and the analysts.

Sample data from two operators running mainly To/From Retail sites appear to have experienced a higher incident rate for their LSTs than their regular fleet. This was not the case for sample data from two operators running primarily DC to DC.

5.57 We looked at numbers of incidents on the public highway per million vehicle km for RSTs and LSTs separately to generate an incident rate for each trailer type and company, in Figure 22

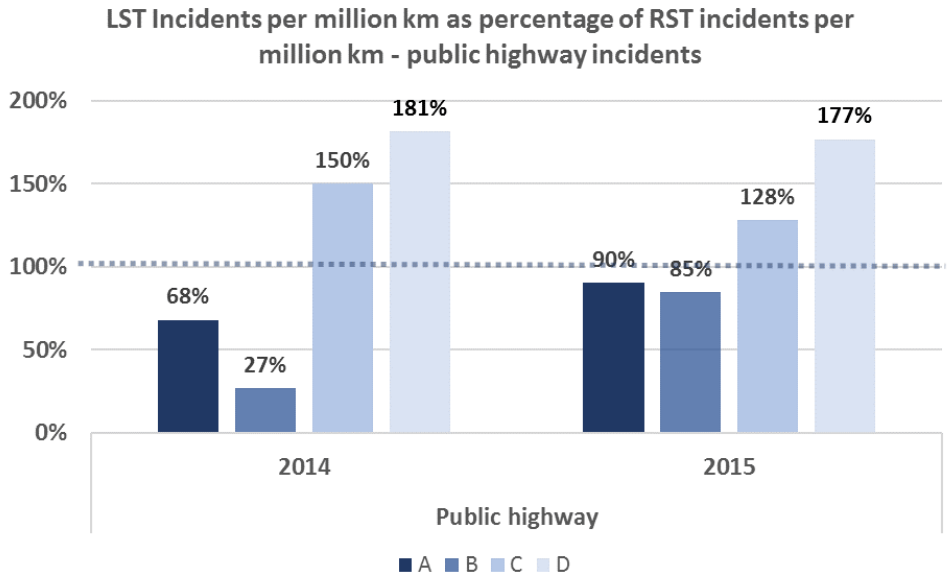


Source: Sample in-house operator data

Figure 22: Damage incident rates for LSTs and RSTs from 'In-House' data

5.58 The ratio of the two rates is compared in Figure 23, where:

- the two operators running primarily from distribution centre to distribution centre or supplier sites ('logistics operations') are shown as 'A' and 'B'
- the two operators in our sample running mainly To/From Retail sites ('retail operations'[21]) are shown as 'C' and 'D'.



Source: Sample in-house operator data

Figure 23: Comparative incident rates on public highway for LSTs and RSTs for four operators

5.59 Each bar indicates the ratio of LST incidents per million km to RST incidents per million km, for public highway incidents. Bars below the dotted line indicate that LST incident rates were lower than RST incidents, while for bars above the dotted line, the reverse is true

5.60 **For the two 'retail operations', LST incident rates are higher than RST incident rates** for both 2014 and 2015. **For the two 'logistics operations', LST incident rates are lower than RST incident rates** for both 2014 and 2015.

[21] Note – the use of the abbreviation 'retail operations' describes the nature of the operation based on the leg type, and hence would include journeys by a general haulier operating to from retail sites as well as a retailer's 'own account' operations.

5.61 Where data were unclear, we assumed that an incident occurred on the public highway. While prudent, this may overestimate the number of incidents on the public highway, particularly for retail operators where we assume that incidents occurring at stores are in areas accessible to the public, whereas they may have taken place in secure loading areas.

5.62 Having noted all the reasons why the results might be conservative or not representative of the wider LST fleet, our discussions with operators suggested that both retail operators had been aware that their LSTs were involved in relatively more incidents than their RSTs, and had begun to consider means of addressing this.

Changes in the background incident rates from 2014 to 2015 are more significant than the difference between the RST and LST rates.

5.63 From Figure 22, we can see that there are significant movements in the incident rates between 2014 and 2015. For the two 'logistics operations', incident rates in 2015 were higher than in 2014. For one of the two 'retail operations' the RST incident rate has increased a little, while the LST incident rate is unchanged. For the other 'retail' operator, both RST and LST incident rates were lower in 2015 than in 2014. It is not clear whether these changes are significant in themselves, but the variations for a single company between the two years, are as significant as any difference between the LSTs and RSTs in any single year.

LST damage incidents may arise from lack of driver awareness when changing between trailer types rather than any inherent difficulty in manoeuvring with the extra length.

5.64 We also asked the operators about the familiarity of drivers with the LSTs and how often they might be asked to pull them. Managers from two logistics operations noted that their drivers tend to drive one type of trailer, only occasionally switching form RST to LST or vice-versa. Managers of the retail operations told us that their drivers were required to switch from one trailer type to another more frequently.

5.65 All four operators that we spoke to considered issues related to driver awareness of LSTs to be analogous to issues they encountered relating to driver awareness of double-deck trailers. Their view was that the issue was not the basic ability of drivers to adjust their driving pattern to suit different trailer designs, but the need for a prompt to remind drivers that they are pulling a high/long trailer where:

- working patterns mean they do so infrequently
- journey routes meant that the driver left a large depot and then spent a significant time on motorways and major roads (reducing the immediate awareness of the trailer being high/long) before entering an urban area.

5.66 The operators noted that a range of visual cues had been adopted, including warnings on driver paperwork, and painting the front of trailers in different colours (as a visual cue from the cab). They were discussing the possibility of using any in-cab telematics or job display screens as another option for delivering such a reminder.

A limited analysis of 'costs of repair' revealed no evidence that the severity of damage in LST events was different from that for RST events.

5.67 Ideally, we would like data showing the extent of damage caused to local infrastructure, kerbside furniture or other road vehicles by incidents involving both LSTs and RSTs, in the same way that we can compare the injury rates using STATS19 data. However, there is no comprehensive database of such damage, the information being dispersed between highways authorities, local authorities, insurers and other parties.

5.68 We were able to obtain some data on costs of repair to both LSTs and RSTs from an operator participating in this special topic study. We looked at this to see whether there was any evidence that LST incidents cost more to repair, which might indicate that they caused more serious damage to whatever was hit. Note that we had no information on any costs for repair or replacement of third party assets.

5.69 We analysed one set of data on repair costs per incident. This provided no evidence of any difference between the distribution of repair costs for LST incidents and RST incidents.

Incident outcomes summary for LSTs vs. GB articulated HGV fleet

5.70 For communication with the general public and non-technical interested parties, it can be useful to summarise the key incident impact results in terms of "1 event in every x km" to convey a sense of the scale of the incidents being observed with LSTs, compared to existing semi-trailers in common use in the country.

5.71 The summary shown in Table 13 refers only to incidents involving an LST, operating in a public place (on the highway or on private land with public access) and where the fact that the trailers was an LST has been determined to be relevant to the event occurring or to the outcome.

Table 13: Summary of LST-related incident outcomes compared to those for all GB Articulated HGVs (>7.5T)

Summary of LST-related incident outcomes after 202 million km travelled, compared to those for all GB Articulated HGVs (>7.5T)			
Casualties / Damage resulting from LST related incidents in all public locations* 2012-15	**GB Artic HGVs 1 in every …**	**LST Involved 1 in every …**	**LST Related 1 in every …**
Fatality	**116** million km	**No Incidents**	**No Incidents**
Serious injury	**33** million km	**51** million km	**No Incidents**
Slight injury	**5** million km	**17** million km	**101** million km
Property damage only	*No national figures*	**1.2** million km	**2.5** million km

Notes to Table

- 'All public locations' covers all public roads and also private land where there is public access. These figures are national averages. They do not consider any special subsets of the data, such as 'urban operations only'.
- LST Involved: Any injury event in which an LST was involved, even if the trailer being an LST was not relevant.
- LST Related: Events involving an LST where the fact that the trailer was an LST rather than a standard length was considered to be at least part of the cause – two such injury incidents have occurred in public locations during the trial.
- GB Articulated HGVs: Based on DfT National data for all articulated HGVs > 7.5T. Total distance 3 years of data 2012-2014 (TRA3105) = 39.9bn km. Injury incidents – STATS19 data 2012-14, casualty totals = 344 fatalities, 1208 serious and 8075 slight injuries.

6 TRIAL OUTCOMES 2: LST UTILISATION ANALYSIS

Outcomes

Journeys (Carbon) Saved

Safety Impact

Qualitative experience

6.1 The data sources, collection and analysis methods have been fully described in earlier annual reports[1]. In this report we have only included notes of any amended or new methods or processes.

Loading levels

6.2 The fundamental assumption in the analysis of how efficiently the LSTs are operating, is whether the additional length is being used, based on the declared 'Deck%' data reported by operators in the DSF.

6.3 The analysis classifies legs that are estimated to be using more than the standard 13.6m UK trailer length as being **'Fully Loaded'**, meaning they are using some or all of the additional length of the LST. The extent to which that extra length is being used is calculated as part of the analysis.

6.4 There are two main categories of semi-trailer operated in the trial, trailers up to 14.6m in length and trailers up to 15.65m in length. The additional length in each case is used to assess the extent of the additional loading as a percentage of a 13.6m trailer load. Of the trailers put into operation during the trial to date 85% have been 15.65m length.

Environmental Impact

Since the start of the trial, the use of LSTs has removed between 8.7 and 10.6 million vehicle kilometres of freight traffic from the roads of Great Britain. This equates to removing around 75-90,000 journeys by the 13.6 metre trailers which are our longest standard articulated HGVs currently allowed on our roads.

6.5 One of the purposes of the LST trial is to understand the environmental impact of the LSTs. Table 14 shows the cumulative vehicle kilometres saved during the course of the trial. The lower bound represents the basic calculation, considering only loaded legs. The upper bound takes account of some empty return journeys also being saved, where loaded legs are to retail sites.

Table 14: Cumulative vehicle km saved by using LSTs

Distance saved (million vehicle km)	At end 2015	At end 2014	At end 2013
Lower bound	8.7	4.2	1.4
Upper bound	10.6	5.2	1.7

6.6 As described in detail in our previous Annual Reports[1] the trial outcomes are being measured in terms of the estimated reduction in the number of journeys, and hence vehicle kilometres, as a result of the operation of fully laden longer semi-trailers. This provides a good proxy for the reduction in direct environmental impact by operating the LSTs in place of standard trailers[22].

[22] Assuming all other conditions are the same – journeys, mix of tractor units, traffic, road conditions etc.

6.7 The distance savings calculated from the journey logs and loading data are moderated by a 'loss factor' (1.8%)[23] reducing the distance saving (only present where the LST is loaded beyond 13.6m length) reflecting the marginally increased direct environmental impacts of the LSTs on all the legs travelled. The detailed figures are shown in Table 15 and Table 16

6.8 The simple estimate of 75-90,000 'journeys removed' is the total distance saving divided by the 117 km average leg length.

Table 15: Distance savings to end 2015, lower bound

Source: LST trial data – Lower bound - loaded Legs Only Trailer Length:	14.6m	15.65m	Total
Total vkm for legs where LSTs are reported to be full	16,258,459	94,017,359	110,275,817
Total vkm operated by all LSTs	30,965,066	169,764,502	200,729,568
Percentage of vkm operated by full LSTs	53%	55%	55%
Assumed saving for vkm operated by full LSTs (additional load carried)	0-7%	0-15%	
Vkm saved (lower bound)	874,886	11,485,740	12,360,626
Vkm 'increase' on all LST vkm as a proxy for emissions increase of 1.8%	557,371	3,055,761	3,613,132
Estimated net vkm saved	317,515	8,429,979	8,747,493

Table 16: Distance savings to end 2015, upper bound

Source: LST trial data – Upper Bound includes some empty legs Trailer Length:	14.6m	15.65m	Total
Total vkm for legs where LSTs are reported to be full	16,258,459	94,017,359	110,275,817
Total vkm operated by all LSTs	1,667,706	17,002,489	18,670,196
Percentage of full vkm operated to/ from retail sites	10%	18%	17%
Vkm saved in non-retail operations	799,982	9,685,660	10,485,642
Vkm savings for outward full retail journeys	74,904	1,800,079	1,874,984
Total Vkm saved in retail operations	149,809	3,600,159	3,749,967
Vkm saved (upper bound)	949,790	13,285,819	14,235,609
Vkm 'increase' on all LST vkm as a proxy for emissions increase of 1.8%	557,371	3,055,761	3,613,132
Estimated net vkm saved	392,419	10,230,058	10,622,477

LST utilisation analysis – percentage savings

Over the whole fleet and across the trial we have calculated that the average % distance saving is 4.9%, which equates to 1 in 19 journeys.

6.9 The analysis above calculates total distance savings. We also analyse savings as a percentage, reflecting the simple 'rule of thumb' used by many in the trial, that by adding 2m of additional length to a trailer, you have a potential increase of 15% on any individual journey.[24]

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23 The 1.8% was the factor for increased tailpipe emissions in the original LST Impact Assessment. See footnote 1

24 15% is based on the increase from 26 standard pallets on a single deck 13.6m trailer, to 30 pallets on a 15.65 LST (a 15.4% increase). The theoretical gain when loading standard cages is actually higher, with the potential load moving up from 45 to 54 units, i.e. 20%, and we have also recently learned that for teardrop-shaped trailers with more limited front capacity, the percentage gain can also be greater, so our calculations represent a low estimate.

6.10 This value is informally translated into statements such as ‘a 15% saving’, or ’10-15% fewer legs to move the same amount of cargo. While these ‘headline’ statements are useful in conveying the scale of the potential savings, they do not take into account the nature and shape of goods being transported. They express the additional length of the trailer (or number of additional pallets), whereas our analysis addresses the saving in distance travelled or trips that would been required to move the same (actual) goods on standard, 13.6m trailers.

6.11 On this basis, on a fully loaded 15.65m LST, we would anticipate that **the maximum savings we would expect to see are** 13% (1 in 7.5 journeys) before the application of the 1.8% environmental impact factor or **11.5% (1 in 9) journeys after applying the 1.8% factor.**

6.12 Over the whole fleet we have calculated that the **average % distance saving is 4.9%,** which equates to **1 in 19 journeys** – both slightly higher than the figures calculated for 2014.

The most efficient LST operations are saving up to 1 in 9 journeys.

6.13 This average figure masks considerable differences in efficiency of operation and levels of loading across the range of operators taking part in the trial. Figure 24 illustrates this distribution. Comparison with last year’s results shows that the distribution of those gaining benefits from the trailers has shifted to the right a little, which indicates that more operators are making better use of the additional trailer length or that the mix of operators/work has changed towards those able to deliver the greater efficiencies.

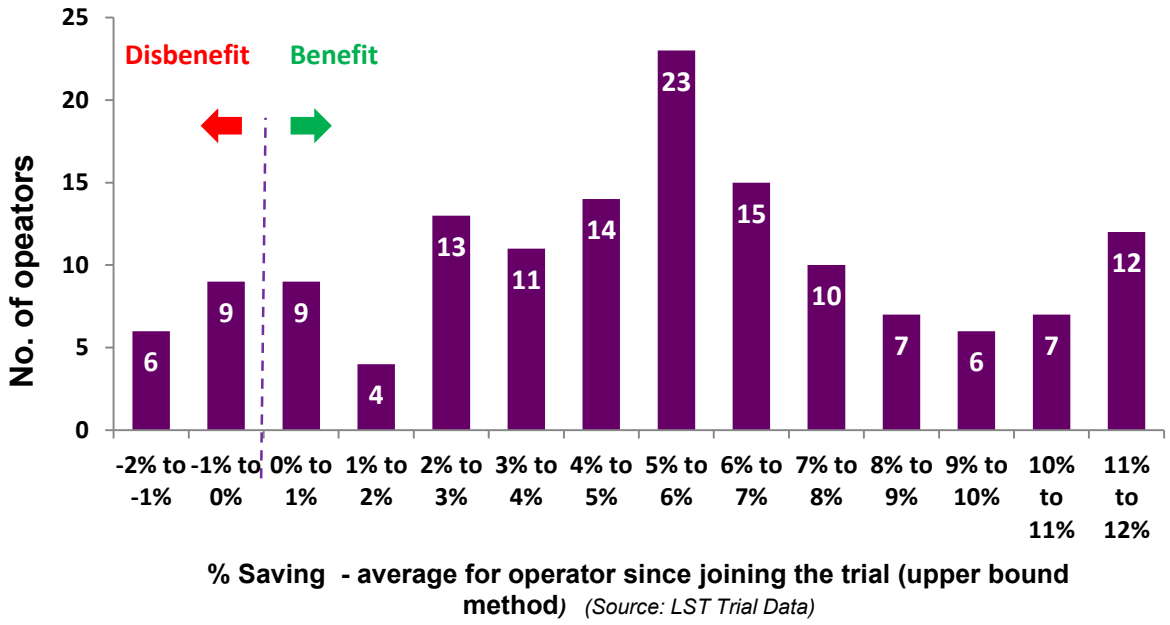

Figure 24: Distribution of % distance saved using LSTs by operator

6.14 A more detailed study of the operators appearing at the lower end of the range of savings shows that there are possibly two groups.

6.15 The first group are operators where we can see that their operation involves large numbers of ‘out-full/back-empty’ but they are not in the group for which we have applied the ‘upper bound’ criteria which takes credit for the saving of the return leg as well as the outbound one. A more refined analysis of the operational patterns of operators would allow the upper-bound calculation to be applied to these operators. This would move them ‘up’ the savings range and the peak of the distribution in Figure 24 would move to the right.

Once calculation conservatism has been removed, there are a small number of cases where little or no saving from LSTs is being reported.

6.16 This leaves the second group, those operators who do not appear to be making use of the additional length of their LSTs very often. A small number fall in the 'Disbenefit' section of the chart. Disbenefits arise due to the assumed additional fuel used to operate the longer trailer, while not utilising any of the additional length available in loading. This data certainly merits further investigation to understand why these operators are unable to make more efficient use of their trailers, as this could have implications for the overall evaluation of the performance of the trailers and their likely take-up more widely were they approved for more general use.

7 WIDER IMPACTS - LOOKING AHEAD

Evaluation data status summary

Wider Impacts

Applicability of results to general UK semi-trailer fleet

7.1 The build-up of the LST fleet to the original aim of around 1800 trailers has taken considerably longer than envisaged when the trial was launched. However, the data produced to date has still given useful results on both LST utilisation and safety.

7.2 The projection is that statistically significant conclusions the specific issues of urban safety well within the remaining trial period.

7.3 The journey leg data gathered up to the end of 2015 is substantial and we anticipate that when the 2016 data is added we can expect to have around 3 million trailer leg records covering around 300 million km of LST operation.

The utilisation and incident threads of the study are at different stages of development.

7.4 **The analysis of utilisation** to date has indicated the potential savings in journeys (and hence reductions in CO_2 emissions) being seen by trial operators. By the end of 2016 we may expect to have some data from the entire fleet of trailers and operators and for the longer standing participants, enough data to test whether there are any significant signs of a change in the patterns of operation.

7.5 It should be possible to use this data to scale up the trial results and hence provide an estimate of the potential CO_2 savings that could be realised from a national rollout of LSTs. This estimate could, in turn, be compared with the numbers used in the original impact assessment.

7.6 Performing the scaling on the basis of the data to the end of 2016 would also provide insights into how much more utilisation data, if any, would be required to create enough evidence to support the cost/benefit part of any resulting policy impact assessment.

7.7 **The analysis of injury incidents** currently shows that there is **no evidence that LSTs are more dangerous than other trailer types when measured nationally** (i.e. all road types combined) and the same is true for rural/motorway operations. However, the **incident analyses are not yet yielding statistically significant results for injury incidents in urban operations**. Further analytical work to estimate the actual proportion of LST distances covered on non-motorway urban roads would allow us to determine more clearly how close to statistical significance we are and how much longer the trial would need to continue before the results become statistically robust.

7.8 **The analysis of damage-only incidents** from a very small sample study of operator's own in-house data, is pointing to the need for further investigation. There is an indication that while for many operations the damage incident rate is no worse than that of other semi-trailers, for the two operators running predominantly into retail sites, the LST damage-only rate appeared to be higher. Further work would be required to see how representative the results of operations across a wider group of operators, especially those also operating on retail delivery.

Analysis priorities

DfT and Risk Solutions are in considering five options for further analysis.

7.9 **QSF v2**. Issuing a new version of the QSF once the final operators have entered the trial would give us an opportunity to take a new 'snapshot' of current data such as the use of telematics, route planning practices and an up to date view of the qualitative experience of using the LSTs.

7.10 A new QSF would also allow us to gather information on the actual extent of 'out-full / back empty' operations for each participant. This would allow us to refine the 'upper bound' calculation of journey savings, which we believe is currently still conservative, as it only applies for leg type To/From Retail.

7.11 Finally, we could use a new QSF to assess the potential 'take up' of LSTs for various operator types, were LSTs to be permitted beyond the trial in larger numbers. We might also test what factors would limit their uptake (depot infrastructure, client site constraints, route limitation etc.). This would be invaluable in any calculations to scale up the impact of any future national LST roll-out.

7.12 **Urban Operations Analysis via LST Route Mapping**. During 2015 we considered a range of options for assessing the actual proportion of LST distance travelled on urban roads. The best option appeared to be one where the existing data on origin and destination for each LST leg would be used to model a 'likely' route for the journey, using HGV friendly routing. While the route modelled might not be exactly the route taken for any individual leg, across the large dataset, the method would give a reasonable estimate for the distance spent on different road types.

7.13 Such modelling would involve some complex steps, not least the tools to map a route back to the digital road network data. In late 2015 we ran a short feasibility study to prove the proposed methods for the most important steps in the process, review the likely outcomes and to assess the resource requirements, for modelling the entire LST journey leg file.

7.14 Route modelling results depend on locating the postcode for each origin and location. In anticipation of some form of routing being carried out, postcodes are being requested in all origin and destination data from 2016-P1 and required from 2016-P2.

7.15 It is possible that a basic version of the modelling could determine a first estimate for the value of 'M' – the relative urban operations percentage compared to the 6% (approximately) published for the GB articulated large HGV fleet as a whole. A more robust second stage of development would include more tailored HGV friendly routing a full connection to the full road network data and options for visualisation of the results.

7.16 DfT will need to consider the value of such a route modelling exercise to the final evaluation outcomes. There may be a trade-off between investing in the route modelling in order to reach robust statistical results faster and, perhaps, shortening the trial from the current 2022 end.

7.17 **Further analysis of damage only incidents**. This might include expanding the dataset to include more operators and/or a more detailed investigation of the existing records to gain deeper insight into the nature of the damage incidents in both LSTs and RSTs.

7.18 The first aim of further analysis would be to verify (or otherwise) the indication from the small initial sample that in some circumstances, the LSTs are involved in more damage-only incidents than the regular semi-trailers on the same operational patterns.

7.19 If the result from the small sample is verified, then the analysis would provide useful insights into the causes of the increase and appropriate responses, perhaps in the area of route planning or driver prompts and awareness training.

7.20 **Scaling Up:** An initial impact assessment of a national roll-out of LSTs based on data so far.

7.21 **Integrating operational and VCA design data:** Once the VCA detailed design data parameters are available with the necessary linking field (Model Report vs VIN) then it will be possible to analyse breakdowns of any aspect of the trial data by any design parameter. For example, looking at distances covered and incident numbers in relation to trailer tail swing.

8 CONCLUSIONS AND RECOMMENDATIONS

Trial inputs, activities and processes

8.1 The allocation process has been completed. The main inputs to the trial by DfT (Policy), Risk Solutions (Evaluation) and the industry (trailer investment and data submissions) are established. Compliance by operators in submitting data is generally good, with additional support required for some operators. Processes are in place for escalating and resolving cases of non-compliance.

8.2 **The LST fleet** is now all on the road or on a VSO and a very small number nearing build completion. No further allocations are planned as the projected LST fleet is now large enough to meet the data analysis requirements of the trial.

There is a good mix of trailer designs in the fleet, including some dual deck, flatbed and skeletals.

8.3 Work to link trial data to the more detailed design details held by VCA is almost complete.

8.4 **Recommendation: The work by VCA to link the design parameters of individual LST designs into the master trial dataset needs to be completed to enable analysis of operational and incident patterns in relation to key design measures such as tail-swing.**

Data submission process and compliance management

8.5 The operator's raw data remains confidential between the operator and Risk Solutions

8.6 The introduction of a customised contact and relationship management application during 2015 has given a much greater level of monitoring and compliance tracking.

8.7 The majority of operators are submitting journey data of good quality and on time. Where operators fail to submit data, are persistently late or are not establishing a robust data collection process, Risk Solutions provide support up to a point, before referring the case to DfT for action.

8.8 **Recommendation: As the trial progresses, Risk Solutions and DfT will be challenging non-compliance earlier, especially for operators who have already been on the trial for several periods, in order to reduce the resource being taken up with missing/late cases.**

Operational data and utilisation and qualitative feedback

8.9 LSTs had travelled over 200 million km by the end of 2015 and with the full fleet on the road, the distance travelled in each future year is expected to be > 100 million km.

8.10 More than half of the distance covered by LSTs is between 'industrial', rather than 'public' sites, suggesting limited use of LSTs in town or major public locations.

8.11 Empty running of LSTs is only 2/3 that for regular semi-trailers in the same period.

8.12 LSTs have been 100% full for 30% of their distance travelled, with part of the additional length of the LSTs in use for around 53%.

8.13 Most operators reported no problems incorporating LSTs into their existing operations, most with some self-imposed special measures. Feedback from LST users (managers, drivers, loading staff etc.) is generally very positive with any issues being overcome fairly quickly.

Trial outcomes 1: safety impact

Incident data summary

8.14 There have been no fatal accidents involving LSTs in 202 million km of operation.

8.15 There have been 15 injury incidents involving an LST of which 11 were on the public highway.

8.16 There are have been 81 LST related non-injury incidents in public locations, resulting in damage.

8.17 Since the last annual report, there have been five further injury incidents involving LSTs, resulting in one serious and nine slight injuries. The injury incidents are not all definitely 'LST Related'.

8.18 There has been one reported slight injury to a pedestrian involving an LST. However, while we have included the event in our calculations, it may not be truly representative of normal operations, as it occurred on an assessment route - specifically designed to challenge the skill level of the driver - not on a regular operational delivery.

Injury incidents – comparison to other semi-trailers

8.19 Overall incident rates for LSTs are substantially lower than those of the standard fleet.

8.20 There have been too few LST related injury incidents in **urban operations** to determine (statistically) the relative safety of LSTs in urban situations at this stage of the trial. A statistically robust conclusion on urban (excluding urban motorways) operational risk should be reached by year 6 of the trial (data to end 2017) at current incident rates and LST usage.

8.21 If the ratio of urban/rural operation vehicle kilometres for LSTs is greater than 50% of the ratio for the non-LST trailers, then there is a 78% probability that the LST incident rate is lower than that for all articulated HGVs.

8.22 **Recommendation: For a robust, statistically significant result on the relative safety of LSTs in urban operations, we recommend the trial data collection continue until at least the end of 2017 and that further work be carried out to study LST urban operations.**

Damage only incidents

8.23 The trial data includes 81 damage only incidents in which the fact the trailer was an LST was noted as being or possibly being part of the cause. This equates to one in every 2.5 million km.

8.24 The sample study comparing LSTs with RSTs using in-house incident data from just four operators showed that it is possible, but resource intensive.

8.25 In the sample study, data from two operators running mainly To/From Retail sites appear to have experienced a higher incident rate for their LSTs than their regular fleet. The converse was the case for sample data from two operators running primarily DC to DC.

8.26 The operators involved in the sample study observed that as with Dual-Deck and other tall trailers, LST damage incidents may arise from lack of driver awareness when changing between trailer types rather than any inherent difficulty in manoeuvring with the extra length / height.

8.27 **Recommendation: Further analysis of the issue of damage-only incidents should be carried out to verify (or otherwise) the results of the sample study of in-house data.**

Trial outcomes 2: LST utilisation analysis

8.28 Since the start of the trial, the use of LSTs has removed between 8.7 and 10.6 million vehicle kilometres of freight traffic from the roads of Great Britain, equating to 75-90,000 journeys.

8.29 Over the whole fleet and across the trial we have calculated that the average % distance saving is 4.9%, which equates to 1 in every 19 journeys.

8.30 The most efficient LST operations are saving up to 1 in every 9 journeys.

8.31 There are a small number of cases where little or no saving from LSTs is being reported.

Wider impacts - looking ahead

8.32 The utilisation and incident threads of the study are at different stages of development. The data on journey patterns and utilisation are now supporting robust conclusions on the extent of journeys being saved, and hence a related reduction in carbon emissions and freight traffic. The safety analysis is encouraging at a national level, but requires further data and analysis to support statistically robust conclusions on urban LST operations.

8.33 Analysis priorities to be considered, subject to resource availability, focus on activities that would,

- increase our understanding of experience of the operators, including their likely LST uptake of the trailers if they were available beyond the trial, to inform a future impact assessment
- model the LST routes, leading to an improved estimate of the proportion of total LST distance travelled on urban routes (or local road) and (optionally) other analysis linked to road network asset information and options for route visualisation
- further investigate the results of the sample study of relative frequency of damage only incidents involving LSTs compared to other trailers, using the operator in-house data
- initial calculations to scale up the trial results to represent the impact of a national roll-out.

8.34 **Recommendation: DfT to consider further work in each of the priority analysis areas and to assess the potential value to the evaluation, in relation to the resources required.**

ANNEX 1: 2014 ANNUAL REPORT RECOMMENDATIONS

The table below lists the recommendations made in Section 8 of the previous LST Trial Annual Report, along with the action taken in each case.

Risk Solutions to prepare and issue an updated DSF containing additional automated checking and further assistance in completing the 'proximity to junction' field.	We noted that analysis using other fields in the incident log was sufficient to clarify the ambiguity in the junction proximity field in some submissions. We therefore decided not to issue a revised template as the current v3-1e is well established and stable in use by almost all operators now.
DfT to reiterate the incident reporting requirements again in September 2015	DfT and Risk solutions take every opportunity to remind operators of the requirements. In particular, Risk Solutions question operators with empty incident logs on a sample basis.
Risk Solutions request that all participants complete an updated QSF as part of the 2015-P3 submission (due in January 2016).	This recommendation was based on an assumption that all operators would be contributing data by 2015-P3. This did not prove to be the case. The current plan being considered is a new QSF that would cover the main points of QSF1, but with added questions covering the longer term experience of running the trailers.
Risk Solutions develop a method with DfT to investigate this [cases of low journey savings by some operators] further during 2015-16. The likely approach would include a process to reflect each operator's estimated saving back to them with supporting data and capture their responses	We have discussed this a number of times during 2015, but again, the analysis proposed would provide most value if performed once the whole cohort of operators has data in the system. We have analysed the raw data further and can see that in some cases, the 'upper bound' calculation currently applied only to legs marked as 'To/From Retail' (Section 6) may also be applicable to a wider group of operators. We are still considering how the analyses could be performed, possibly as part of a new QSF as noted above.

ANNEX 2: EVALUATION PERFORMANCE SUMMARY

The table below summarises the evaluation to date in terms of the elements of the evaluation programme logic model shows in Figure 1. The principles of good evaluation require that we test each stage of the logic model to ensure it is delivering what is needed for the later stages.

PLM Element	Evaluation indicators	
Policy Inputs (DfT)	• Continued investment of time and resources by internal DfT freight policy team, VCA and funding of data evaluation.	✔
VSOs (VCA)	• Live VSO system managed by VCA. Good communication between DfT / VCA / Risk Solutions to update data or correct mismatched records.	✔
LST Designs (Manufacturers)	• 14 manufacturers involved in LST production. • More than 50 unique LST models tested and documented by VCA.	✔
Investment (Hauliers)	• To be confirmed. Initial approach made to contacts in SMMT to discuss the best approach to estimating this value.	?
Eval'n Framework	• Evaluation framework first published in 2013 Annual Report still in use.	✔
Applications and Allocations	• 295 individual applications for LST allocations across all allocation rounds • 163 companies carried allocation forward to trailer order and VSO.	✔
LSTs in Operation	• 1511 LSTs on the road and submitting data at end Dec 2015. 1760 now on road or on VSO with more coming on the road this summer • 98% of the original aspiration of 1800 – fleet judged to be 'complete'.	✔
Data Gathering & Submission	• Total data submitted each period currently around 250,000 legs. • For full fleet of 1760 LSTs, we expect 300,000+ legs per period.	✔
Participation Engagement	• Many operators now submit the data without significant problems, having established a robust process, while some continue to struggle to get consistency. There is no apparent relationship to company size. • More than 2300 individual email/phone/other contacts with operators logged by Risk Solutions in 2015 and a further 300 with DfT.	✔
Data Framework and Process	• Core framework stable since start of the trial. • Current version of data collection tool in use since 2013.	✔
Participation Range	• Satisfactory mix of size and operation type.	✔
Master Data (Quality/Timeliness)	• Quality checking now stable and producing few if any invalid data records. Master data produced within 1 week of the end of a submission period.	✔
LST Ops Data	• Now collecting almost 800,000 journey records a year.	✔
LST Incident Data	• Now 1-200 events reported annually – additional sample of damage data. • Good data on the few injury events.	✔
Qualitative Data	• Majority of experiences very positive – very few poor experiences.	✔
Journeys (Carbon) Saved	• 1 in 19 average across fleet. Best cases 1 in 9. • Work still required to explore data of lower efficiency cases.	✔
Safety Impact	• Nationally – 70% lower than standard fleet. Urban operations impact tbc.	✔ ?
Applicability to general UK fleet	• Beyond current scope of work – 'scaling up' analysis using the trial data will be required for any post-trial policy impact assessment.	-

GLOSSARY

CIF	Company information form - the MS Excel workbook developed to capture background information about the operator's company and standard operations prior to the trial.
DfT	Department for Transport
Double deck/ dual deck	A specialised trailer with two floors covering all or part of its internal length to allow for more cargo to be loaded.
DSF	Data submission form - the MS Excel workbook developed to allow operators to submit all trial data in the required format for analysis.
Flatbed	A flat trailer with no enclosure or doors. Can be loaded/unloaded from the sides or above, and does not require elevated access for forklifts.
FMCG	Fast Moving Consumer Goods - products that are sold quickly and at relatively low cost. Examples include non-durable goods such as soft drinks, toiletries, over-the-counter drugs, processed foods and many other consumables.
FTA	Freight Transport Association
ISO	Containers meeting the international specification for intermodal transport.
Leg	A single journey from A to B.
LST	Longer Semi-Trailer - a trailer exceeding the standard length of 13.6m, towed by a tractor unit (as opposed to RSTs, see below).
LST Related	
MOA	Mode of appearance - the physical form of the load, for example standard pallets, loose/ bulk, livestock.
Model Report	A document specifying the conformance criteria for a specific model to be licensed for use on the road, created by the VCA after testing new vehicle types.
PLM	Programme logic model - a diagrammatic representation of the structure of a process for the purposes of evaluation.
QSF	Qualitative survey form - the MS Excel workbook developed to capture qualitative information from operators about their trial experience.
RHA	Road Haulage Association
RST	Regular Semi-Trailer – i.e. up to a maximum length of 13.6m (not requiring a VSO)
Skeletal	A skeletal trailer composed of a simple chassis for the mounting of an intermodal trailer.
VCA	The Vehicle Certification Agency is an Executive Agency of the United Kingdom Department for Transport and the United Kingdom's national approval authority for new road vehicles, agricultural tractors and off-road vehicles.
VIN	Vehicle Identification Number - a unique 17 digit identifier required on all vehicles, stamped on the chassis on manufacture.
VSO	Vehicle Special Order - a certificate provided by the VCA to allow vehicles that do not conform to standard legislation in terms of dimensions to operate on roads in Great Britain under specially licensed conditions.