## **THE GB LONGER SEMI-TRAILER TRIAL** 2016 Annual Report Summary





## "Making substantial inroads to the decarbonisation of road freight requires innovation in both vehicle performance and logistics...The single most effective change in the short term is use of higher capacity vehicles."

Professor David Cebon, University of Cambridge, Director for Sustainable Road Freight in Logistics Report 2017, Freight Transport Association (p79)

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This document summarises the latest findings from the trial of a new type of heavy goods vehicle trailer – the longer semi-trailer. The full results can be found in the 2016 Annual Report produced by the independent trial evaluators (Risk Solutions) for the Department for Transport (DfT). The full version is available on the GOV.UK website, click <u>here</u> to view.



References to the relevant section of the 2016 Annual Report are provided throughout this summary report.





## The GB Longer Semi-Trailer Trial

#### What is a Longer Semi-Trailer? (LST)

Longer semi-trailers, or 'LSTs', are a new type of heavy goods vehicle (HGV) trailer that have been on trial since 2012. The LSTs are up to 2.05m longer than the current standard semi-trailers on our roads (15.65m instead of 13.6m). These are not the 'mega trailers' or 'road-trains' permitted in some other countries.

While the trailers are longer than existing HGV trailers, they cannot be heavier. The total weight of the trailer, the goods and the tractor unit must still be within the UK domestic weight limit of 44 tonnes. They must also pass the turning circle test applied to the existing 13.6m trailers. To achieve this, LSTs usually have a steering rear axle.

#### Why use LSTs?

By making the trailer two metres longer, you can carry two more rows of pallets or three rows of goods cages on each journey compared with existing trailers.

Fully loaded LSTs can move goods using fewer journeys than current trailers, reducing emissions, congestion and collision risk associated with an HGV journey.

This differs from other approaches to freight carbon reduction, such as increasing engine efficiency or electric vehicles, in being available without the need for further significant technological and infrastructure development.



GB Longer semi-trailer - up to 15.65m

#### Why is there a trial? Why not just allow the trailers now?

The trial was set up to answer a series of important questions:



 What do operators use LSTs for?



2. What are the savings realised in HGV journeys?



- 3. What are the resulting reductions in emissions?
- 4. What about safety will LSTs cause more injuries?



5. What about damage and the associated costs – will LSTs cause more damage on the roads?



Might any special operational requirements be appropriate for LSTs?



7. What proportion of the existing GB fleet of semi-trailers might be replaced by LSTs, were numbers not restricted?

DfT needs to take all these factors into account in deciding whether to allow LSTs for general use on GB roads when the trial ends. This document describes the trial and explains how far it has got towards answering each question in the list.



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#### What does the trial involve?

DfT began the trial in January 2012, when it established an initial allocation of 1,800 trailers for operators wishing to take part, with an initial trial period of ten years.

All participants must submit a detailed set of data on every journey their LSTs make and on all incidents (not just those resulting in injury) they are involved in on the public road or in public areas (such as services).

Operators participate voluntarily, at their own cost and risk. As this is a trial, there is no guarantee that LSTs will be permitted on the road beyond the end of the trial period. The trial was set to run for a long period to ensure it generated enough data to answer the seven questions and to allow participants to recover the costs of investing in LSTs.

#### How many LSTs are there?

The trial started in 2012/13 with just a few hundred trailers in the national fleet. At the end of 2016 all of the initial allocation of 1,800 trailers had been taken up, and 1,775 were on the road and submitting data. The chart below shows how the fleet has grown over time.



In January 2017, the government decided to increase the number of LSTs by an additional 1,000 and to extend the trial by five years, so there will be up to 2,800 LSTs in operation by mid-2018.





#### Who is operating the trial LSTs?

Any licensed GB haulier was eligible to apply to the trial and DfT's aim has been to include a mix of large and small operators.

Vehicle Certification Agency

Companies sign an 'Operator Undertaking' which sets out the terms of the trial, including the requirement to provide data to the evaluation. They also need a Vehicle Special Order (VSO) granted by the Vehicle Certification Authority (VCA).

Operating an LST without a valid VSO is illegal. VSOs can be revoked or suspended by VCA for any serious failure to comply with the operator undertaking. This has been considered only twice in five years, both times for failure to submit data, both were resolved before action was taken.



#### Who is evaluating the information from the trial?

The trial evidence could not be evaluated by DfT or by the industry – there needed to be an independent party to both hold the commercially sensitive data and conduct a fair evaluation of the evidence. **Risk Solutions** has fulfilled this role for the trial since it began in 2012 and we now hold data on over 2.6 million LST journeys to the end of 2016.

Although commissioned by DfT, our role is to provide independent scrutiny of the evidence. We also, on occasion, provide comment on DfT's public statements regarding the trial, to ensure they are accurate and are supported by the evidence. We produce a report of the latest observations and results for each calendar year of the trial. These are available on the DfT website<sup>1</sup>.



#### How is the data gathered?

This is probably the most comprehensive data collection process that DfT has ever conducted for a trial of new equipment.

Operators submit a detailed log of journeys<sup>2</sup>, showing the start and end location and time, the nature of the journey and goods, and most importantly, how much of the available deck space was used. This is a key measure since it is only by using the extra trailer length that journeys will be saved.

Operators must report all incidents involving injuries, wherever they occur, and any incidents on the public highway (or areas like services) that result in damage or major disruption (e.g. a trailer stuck on a junction). Information is not available at this level of detail from any other source.



#### Is self-reporting by the operators reliable?

Yes; with active engagement with operators, and expert support, self-reporting works extremely well and is producing good quality data.

Self-reporting is sensible here because of the duration of the trial, the number of operators involved and the complex mix of data types we need. This would make independent data collection prohibitively expensive. In any case, operators must be closely involved to ensure that the data is of the high quality we need to answer the seven questions listed earlier.

#### A robust approach to collecting self-reported data

We do everything practicable to maximise complete reporting. Our processes seek to create a sense of personal responsibility and informal community with each company contact collecting data.

We provide telephone and email support, share ideas and experiences in making data collection efficient, and facilitate contact between companies with similar operational challenges. We carry out rigorous data checking and reflect any issues back to operators for resolution. Continuing concerns can be escalated to DfT with the most severe sanction available being removal from the trial.

Our direct contact with operators tells us that, in the vast majority of cases, those collating the data are very conscientious, even where it costs them some significant time and effort. In exceptional cases, the chance of losing their VSO has been used by DfT to prompt improvement.

Positive engagement with the industry is vital, and in the 2016 Annual Report we have recommended that DfT liaise with industry bodies and other stakeholders to arrange a further LST Trial industry forum during 2017, to keep participants engaged as the trial enters its sixth year and the trial community grows (**Recommendation 2016-1**).

#### LST trial results after five years

At the end of 2016, almost five years into the trial, we can report a number of key results, in particular on how efficiently the LSTs are being used and whether they are being operated any more or less safely than the standard-length trailers they have replaced. The results then point the way forward for data collection and analysis in 2017-18 and beyond.

The trial 'headlines' are shown in the centre of this document (pages 8-9)

More details of how we carried out the calculations and research can be found in the full 2016 Annual Report.



## 1. What do operators use LSTs for?

#### Nature of journeys

Our trial data provides us with a lot of information about LST journeys: where they start and end, distances covered, what they are carrying and how full the trailers are.

By the end of 2016, LSTs had travelled 319 million km:

- Goods carried are dominated by fast-moving consumer goods (low cost products, sold quickly) and other cage or pallet loads
- 62% of the distance travelled was between industrial locations (depots, distribution centres, supplier sites etc.); around 30% was to, or from, retail sites
- Trailers ran empty for 18% of the total distance travelled, much lower than the figure of around 29% for all articulated trailers<sup>3</sup>
- The trailers made maximum use of the additional length for at least 34%, and made some use for 50%, of the distance travelled
- One company is operating a longer intermodal unit combining LSTs with their railfreight work; LST+Rail is an area for future study (pictured below).

Many operators restrict LSTs to operations where they can run heavily loaded on both outbound and return legs to make the most of what is a significant investment. In many cases, this is between major distribution centres, which will mainly be on trunk roads.

We now have a good dataset on LST operational patterns and have recommended that this aspect of data collection be simplified to allow a greater focus on incidents causing damage (Recommendations 2016-5 & 6).



#### **Nature of routes**

The trial data tells us the start and end of each journey, but not the route travelled. Better route data would help us understand whether incident rates in urban areas are higher, the amount of use on minor roads, and the air quality impact of using LSTs.

Routing information could be obtained using GPS tracking fitted to trailers. However, at the start of the trial, tracking semi-trailers separately from the tractor units that pull them was not standard practice. DfT judged it would be unreasonable to ask operators to fit GPS equipment as a condition of the trial, as it would limit participation to larger companies. While GPS use is now more common, our research suggests fewer than 50% of the trailers are fitted with GPS tracking.

During 2015 and 2016 we developed a method of modelling routes; during the coming year DfT is planning to validate the model using sample GPS data.



## LST trial evaluation: headlines

## Trial take up and journey savings

Trial take up	Trial target total: 1,800 LSTs		
<b>1,806</b> (100%)	LSTs registered on Vehicle Special Orders (VSOs) (% of trial target of 1,800 trailers)		
<b>1,775</b> (99%)	LSTs on the road and submitted trial data (% of trial target of 1,800 trailers)		
161	Number of operators with trailers on the road		
Use and km saved			
2.6 million	Journey legs travelled by LSTs during the trial		
<b>319</b> million	Km travelled by LSTs during the trial		
between 15.1 & 17.8 million	Vehicle km 'saved' by LST operations (end 2015) The upper bound includes some return legs		
Journeys saved	Estimates of equivalent standard 13.6m trailer journeys saved across whole trial period and all operators		
between 125 & 150,000	Journeys by standard trailers saved by using LSTs The upper bound includes some return legs		
1 in 19 journeys 5% distance saved	Average saving across all operators		
1 in 9 journeys 11.5% distance saved	Highest saving achieved by individual operators		



## Trial safety and damage performance

Injury incidents – national				
Collisions	Casualties	Where an LST was involved <b>on public highways or public</b> access areas (2012-2016) resulting in injury		
18	23	All personal injury incidents		
3	3	Personal injury incidents judged to be LST related		
54	72	<b>Three-year average safety incident rate</b> (ALL collisions per billion vehicle km, 2014-2016)		
165	237	Equivalent rate for all GB articulated HGVs		
0.33	0.30	<b>Collision / casualty rate ratio</b> (LST vs All GB articulated HGVs)		

On a per kilometre basis, nationally, LSTs have been involved in around 70% fewer personal injury collisions and casualties, than the average for GB articulated HGVs (95% statistical confidence level).

### **Injury incidents in urban areas** (based on ONS urban areas, excluding motorways)

Incidents	Where an LST was involved <b>on public highways or public</b> access areas (2012-2016) resulting in injury
3	URBAN personal injury incidents (All – regardless of any 'LST related' judgement)
<b>117 – 159</b> collisions per billion vehicle km	<b>Safety incident rate</b> (over whole trial for urban distance est. of 6-8%)
573	Equivalent rate for all GB articulated HGVs
0.2 - 0.28	Urban collision rate ratio (LST vs All GB articulated HGVs)

On a per kilometre basis, we estimate LSTs have been involved in 70-80% fewer personal injury collisions, compared with the urban (excluding motorways) average for all GB articulated HGVs (95% statistical confidence level).

**Damage-only incidents** 1 damage-only event reported to the trial for every:

## 1 in 2.8 million km OR 1 in 23,000 legs

A small study suggests there may be an increased risk of damage collisions compared to standard trailers in some fleets, in some situations. Further work is recommended in this area.



## 2. What are the savings realised in HGV journeys?

We estimate that the average percentage distance saving to the end of December 2016 is around 5%, which equates to 1 in every 19 journeys. The most efficient LST operations are saving up to 1 in every 9 journeys.

The chart shows the range of savings achieved by different operators



In calculating savings, we take into account some of the empty legs saved (where an entire round trip was saved), but only where our analysis of the journey logs detect a pattern of journeys that are 'Full out/Empty back'.

While the best performing operators are achieving more than 10% journey saving, there are a small number of cases (on the left of the chart) where little or no saving is being reported. Some of these are cases where the trailer has been purchased for use on a specific contract, which has then ended and new work has not been found. In other cases, the trailer has simply not been usable on as wide a range of work, or at the loading levels, the operator hoped. We have recommended that additional work is carried out to understand better the reasons for low efficiency use **(Recommendation 2016-2)**.

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## 3. What are the resulting reductions in emissions?

The pre-trial estimate was of a saving of 3,000 tonnes of  $CO_2$ , from the operation of LSTs during the 10-year trial. Since the trial was launched in 2012, the environmental impact discussion has moved on from a focus primarily on carbon, to the combination of carbon and air quality.

While the average saving in distance and journeys of just over 5% provides a rough proxy for all emissions savings, there will be factors other than distance to consider, including the types of engines in use and road speed. We now have a good dataset which, combined with route modelling, can be used in an emissions and air quality model. We have recommended that DfT include a preliminary assessment of environmental impacts in the next phase of work (**Recommendation 2016-7**).



### 4. What about safety - will LSTs cause more injuries?



The trial results are showing that LSTs can be operated safely, even when used on routes involving some roads in urban areas.

#### Numbers of safety incidents - collisions and casualties

During the five years from 2012 to 2016 there have been 18 road traffic collisions involving HGVs pulling an LST. These have resulted in seven serious and 16 slight injuries. For many of these, analysis of the events suggests that the type of trailer being pulled was not a factor.

Three of the slight injury incidents were in urban locations. We define an urban location as one that lies in an area defined by the Office for National Statistics as 'urban' (but excluding motorways).

Urban areas are where LSTs would be expected to perform most high angle turns, this is when any articulated HGV poses the greatest threat to other road users due to tail-swing. Tail-swing is the amount by which the rear of the trailer swings out as the vehicle negotiates a corner. It is larger for LSTs than standard trailers.

#### **Collision and casualty rates**

A key question for the trial is whether the LSTs cause more injury collisions than the standard length semi-trailers. There are two parts to this.

Q1 How many extra injury collisions would have occurred if the same goods had been moved using standard trailers, requiring more journeys?

There will have been a direct safety benefit of around 5% reduction in collisions, equivalent to around 2-3 collisions and 3-4 casualties, saved during the period of the trial using LSTs rather than standard 13.6m trailers due to the reduction in the number of journeys.

#### Q2 Do LSTs have a higher incident 'rate' than the trailers they replace?

This question is about whether the LSTs are having more incidents per kilometre that they DO travel and is independent of Q1. We have looked at this both nationally and also on just roads in urban areas<sup>4</sup>.

Road collision statistics are expressed as 'n incidents per billion vehicle km', which can also be expressed as '1 collision every 'n' km' (see table overleaf).

The LST incident rate is around 1/3rd of the standard trailer rate when measured nationally AND for the 8-9% of LST operations that are on roads in urban areas (both confirmed at 95% statistical confidence level).

A better estimate will be possible if the route modelling can be validated providing a better estimate of LST distance travelled by road class.

'Urban' does not necessarily imply 'town centre'. The definitions is from the Office for National Statistics (ONS) spatial 'Output Areas' (OA). An OA is 'urban' if allocated to a 2011 (census) built-up area with a population of 10,000 people or more So 'Urban' may include substantial routes such as ring roads.

## Summary of LST-related injury incidents and outcomes after 319 million km travelled (26km 'urban'), compared with those for all GB Articulated HGVs (>7.5T)

Collisions in all public locations* 2012-15 and resulting casualties		GB Artic HGVs 1 in every…	LST involved* 1 in every…	LST related** 1 in every…			
All Incidents	All locations	6 million km	18 million km	106 million km			
	Urban only	1.7 million km	8.5 million km	No incidents			
By incident severity (worst injury)							
Fatality	All locations	116 million km	No incidents	No incidents			
Serious	All locations	33 million km	46 million km	No incidents			
Slight	All locations	5 million km	20 million km	106 million km			

#### Notes:

- 'All public locations' covers all public roads and also private land where there is public access.
- 'Urban' here defined as all roads, not including motorways, in ONS defined urban areas.
- GB Articulated HGVs: Based on DfT National data for all articulated HGVs >7.5T. 2012-2015 (TRA3105) = 54.2bn km of which 3.2bn urban non-motorway. Injury incidents from STATS19 2012-15: Total collisions = 9,046 (1,833 Urban), Total casualties = 469 fatalities, 1,638 serious and 10,808 slight. See Table 10 (in the 2016 Annual Report).
- \*LST Involved: 18 events (3 urban). Any injury event in which an LST was involved, even if the trailer being an LST was not relevant – data from latest annual report table – Table 8 (in the 2016 Annual Report). Non-injury (damage) incidents are covered separately.
- \*\*LST Related: 3 events (0 urban). 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. Not used in headline figures for trial injury rates.
- These figures are national / urban averages. The latest annual report includes analysis that concludes that the comparisons between LST incident rates shown here are all statistically robust at a 95% confidence level.

#### So LSTs are safe?

There is no reason why LSTs should be inherently safer than standard trailers, but on the trial, their incident rate is lower than for other trailers. There are a number of reasons why this might be the case:

- The conditions of participating in the trial require that operators provide special driver training for any staff using LSTs
- Operators often report paying additional attention to route selection, route assessment, driver selection and driver familiarity with both the LST and the routes
- The focus brought by having to submit data on every LST journey probably reinforces their 'special' nature, even when, for some operators, they have now been in service for five years
- The LSTs represent a significant investment that operators do not want to see damaged.

Separately to the statistical analysis, we study each injury event in detail to look for any lessons that can be learnt regarding safe operation of LSTs. This has identified important principles in driver training and route planning and most recently resulted in a recommendation to DfT to explore whether an LST might behave differently from a standard trailer when sudden course corrections are required at speed (Recommendation 2016-3).



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## 5. What about damage and the associated costs – will LSTs cause more damage on the roads?

Even if they are reducing numbers of HGV journeys and are being operated safely, one concern the trial needs to look at is whether LSTs are causing any additional problems for the road and roadside infrastructure.

Damage only incidents are harder to analyse than injury events as there is no national database of HGV incidents against which LST performance can be compared. Also, while we are confident that major damage incidents are being reported consistently, we anticipate that there will be some under-reporting of more minor incidents. This is because damage to the infrastructure may be slight and, as with any large vehicle, the driver unaware it has taken place. The damage to the vehicle, if any, may only be noticed when it is next inspected in the depot.

We have analysed damage only incidents in three ways.

#### Trends in LST data on damage-only events

While under-reporting introduces some uncertainty in the data, we believe trends in incident reporting across the fleet can provide useful insights.

Since the start of the trial operators have reported 733 incidents to us that resulted in some damage to the vehicle, or to an object they hit. Of these, 234 occurred on the public highway or in public areas (e.g. services). Of these 234, our assessment concluded that 115 were caused wholly or in part by the fact that the trailer was an LST. The chart below shows the number of events in each year of the trial, as incidents per million km. The rate of events has reduced from the start of the trial until the end of 2013 and has remain broadly steady ever since.



#### Non-injury incidents rates per million km travelled annually – trend

Some operators have commented that they see a reduction in incidents once drivers become familiar with LSTs. While it would be hard to test this systematically, it would make sense of the chart above. The earlier period would be dominated by a small group of operators where LSTs were new for all drivers. In later periods, higher incident rates among new drivers would be masked in the data by the growing set of operators who were now familiar with LSTs.



#### Design factors contributing to incident rate

We examined whether different design features of LSTs were associated with higher or lower damage only incident rates within the LST fleet. We focused particularly on tail-swing (this is measured by VCA).

We found no significant correlation between damage incident rates and any LST tail-swing measurement, or any other design characteristic.

However, we believe it would be valuable for DfT and the industry, to fully understand the significant variations in measured tail-swing among LSTs of similar length and steering arrangement (**Recommendation 2016-4**).



#### Comparison of incident rates within the same operator fleet

We carried out a small study of seven operators looking at damage incidents across their entire semi-trailer fleet, to see if the LSTs had a different incident rate from their overall average. If so, we looked to see if we could identify any contributing operational or environmental factors. This was very labour intensive, so we could only look at a few cases. Operators were chosen to cover a broad range of different types of operator but biased towards those we considered to be at higher risk of incidents due to the nature of their operations.

Of the small sample of seven operators studied, we found statistically significant evidence for three having LST damage only incident rates higher than for their standard trailers, and one where it was lower, but only in one of the two years for which we had data.

The sample is too small to be a reliable indicator of performance across the whole fleet, however, from discussions with the operators two themes emerged:

- 1. Driver familiarity with LSTs: where drivers pulled standard trailers most of the time and only occasionally used an LST (perhaps once a week or less), the operators experience was that there were more damage incidents.
- 2. Driver familiarity with LSTs on a specific route: where drivers pulled LSTs frequently, but did so on diverse routes, limiting the familiarity of the combination of LST and route, again, the operators experience was that the damage incident rate was higher.

## It is unclear whether LSTs across the whole fleet are or are not causing more damage. What can we do about that?

Our recommendation to DfT is that the issue of damage events become a more prominent focus of the next phase of the trial, with the goal being to collect incident data for LSTs, standard semi-trailers and relevant operational information, from all operators (**Recommendations 2016-5 & 6**).



## 6. Might any special operational requirements be appropriate for LSTs?

From our periodic surveys of operators we know that:

- Many operators restrict LST operations to set routes, where:
  - · they can maximise utilisation of the extra length
  - they have assessed the route to be suitable for LSTs
  - the delivery points have been assessed as suitable for LSTs
- Operators have adopted a range of different approaches to drivers' specific LST training
- Many operators seek to ensure that LSTs are operated by drivers who do so regularly, and in some cases, on repeated routes.

These would be a good starting point for a discussion about a standard set of guidance or requirements for operating LSTs. We have recommended DfT open such a discussion (**Recommendation 2016-8**).



## 7. What proportion of the existing GB fleet of semi-trailers might be replaced by LSTs, were numbers not restricted?



We have not yet addressed this question, but during 2017 we have gathered data on the numbers of LSTs that may be taken up by the trial operators, were these to become widely available at some point in the future. When combined with trial performance data and information from other DfT consultations, we believe an initial estimate of future LST take-up across the national fleet will be possible. We have recommended that DfT include preliminary work, in the next phase of trial analysis, to assess potential take-up and the safety and environmental implications of this. This would inform discussion of policy options and allow DfT to establish where additional evidence is required from the trial to arrive at a robust estimate of the impact of LSTs (**Recommendation 2016-7**).



## What next for the trial?

Our recommendations for the next phase of the trial include:

- Rebalancing data collection from January 2018 from detailed journey data to incident and damage information
- Strengthening processes to accommodate the extension of the trial to include a further 1,000 trailers and more than 50 new companies
- Carrying out further analysis in three areas:
  - modelling of LST routes
  - rates of damage only incidents within operator fleets
  - preliminary studies of the environmental impact of the trial, and the safety and environmental impact of making LSTs more freely available sometime in the future.

## THE GB LONGER SEMI-TRAILER TRIAL

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#### **Department for Transport**

The Department for Transport (DfT) is the government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved. DfT began the GB trial of longer semi-trailers for articulated goods vehicles in January 2012 and is responsible for the trial as a whole, including the allocation trial places to companies applying to participate. The evaluation of the trial is funded by DfT under the Specialist **Professional and Technical Services** (SPaTS) framework, but is carried out by independent consultants.

For further details on the trial, view the DfT website or contact the DfT trial project manager:

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#### **Risk Solutions**

Risk Solutions is a specialist management consultancy working in the areas of risk, evaluation and decision support, with specialist expertise in industry engagement and working with complexity and high degrees of uncertainty. Risk Solutions has been involved in policy evidence development, preparation of impact assessments and evaluations for DfT, Defra, BEIS and other government departments and private companies. Risk Solutions was commissioned by DfT in 2012 to help design and implement the LST Trial evaluation process and has since been reappointed twice in the role of independent evaluator.

For further details of Risk Solutions' services, including the evaluation of the trial, follow the link below or contact:

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WSP is one of the world's leading engineering and professional services consulting firms. With over 37,700 talented people in more than 500 offices across 40 countries, 7,150 of which are based in the UK. WSP supplies services to DfT and Highways England under the SPaTS Framework Contract, using a consortium of in-house skills and carefully selected partners, including Risk Solutions. WSP has a dedicated logistics team that combines technical skills in modelling and analysis with a depth of knowledge based on real life operational experience in the logistics and supply chain sector.

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#### **Please note**

Communication from trial participants regarding data collection issues should be directed to the trial email address, lstttrial@risksol.co.uk.

