Evaluation of the National HGV Speed Limit Increase in England and Wales

Year 2 Interim Report

Department for Transport

Project number: 60445774

March 2019

Quality information

Prepared by	Checked by	Verified by	Approved by
Richard Fernandes Senior Consultant Atkins Matthew Turner Senior Consultant Transportation	Nick Woollett Regional Director Transportation	Richard Redfern Regional Director Transportation	Nick Woollett Regional Director Transportation

Revision History

Revision	Revision date	Details	Authorised	Name	Position
0	10th Dec 2018	First Draft		Nick Woollett	Regional Director Transportation
1	4th Feb 2019	Second Draft incorporating DfT comments		Nick Woollett	Regional Director Transportation
2	8th Mar 2019	Third Draft with further minor updates		Nick Woollett	Regional Director Transportation
3	22nd Mar 2019	Final		Nick Woollett	Regional Director Transportation

Prepared for:

Department for Transport

Prepared by:

Nick Woollett
Regional Director
Transportation
T: +44 (0)1392 663212
E: nick.woollett@aecom.com

AECOM Limited
Belvedere House
Woodwater Park, Pynes Hill
Exeter EX2 5WS
United Kingdom

T: +44 1392 663200
aecom.com

Prepared in association with Atkins

Table of Contents

Glossary

Annual Average Daily Traffic	This is an average measure of traffic flow for a given road or link. It represents the average amount of traffic using the road in a twenty four hour period.
Automatic Traffic Counter	A device mounted within or on the carriageway to record information about the number of vehicles passing across it in a specific time period, but often additional information such as vehicle classification and vehicle speed.
Ex-ante	Meaning 'before the event', this refers to the datasets or evaluation work from the period prior to the intervention which is being evaluated, in this case the increased speed
Ex-post	Meaning 'after the event', this refers to the datasets or evaluation work after the intervention being evaluated.
Heavy Goods Vehicle	Any goods vehicle with a gross mass of over 3.5 tonnes. Within this report distinction is made between those vehicles with a mass between 3.5 and 7.5 tonnes, and those over 7.5 tonnes to which the increased speed limit applies.
Impact Evaluation	The assessment of benefits/disbenefits of policy through the analysis of outturn indicators and metrics, including comparison with ex-ante forecasting.
Process Evaluation	The examination of implementation and delivery processes through stakeholder interviews and analysis of secondary data.
STATS 19 Data	Road accidents on the public highway in Great Britain, reported to the police and which involve human injury or death, are recorded by police officers onto a STATS19 report form. The form collects a wide variety of information about the accident (such as time, date, location, road conditions) together with the vehicles and casualties involved and contributory factors to the accident (as interpreted by the police). The form is completed at either the scene of the accident, or when the accident is reported to the police.
Theory of Change	A theory-based evaluation approach that sets out the anticipated outcomes and impacts of a project or policy, and defines the causal pathways that will generate such change.

Executive Summary

In April 2015 new national speed limits came into force for heavy goods vehicles (HGVs) over 7.5 tonnes on single carriageway and dual carriageway roads in England and Wales. The new limits are 50 mph (up from 40 mph) and 60 mph (up from 50 mph), respectively. In October 2015 the Department for Transport (DfT) commissioned a three year evaluation of the speed limit change with the primary aims of generating the evidence needed to support future policy decisions and validate the initial impact assessment for the increase. This document is the second annual Interim Report, presenting the outputs of analysis covering approximately the first two years of operation of the new speed limits.

The Year 2 work reported in this Interim Report is an impact evaluation of vehicle speeds and safety on roads affected by the policy change.

Speeds

Single Carriageways

The Year 2 impact evaluation has established that the average speed of HGVs >7.5t on 60 mph single carriageway roads has increased by 1.5 mph (44.1 to 45.6 mph) with analysis suggesting this is at least partially attributable to the policy change. Speeds of light vehicles have increased by 0.2 mph (47.9 to 48.1 mph) since the policy change.

17% of HGVs >7.5t exceeded the 50 mph speed limit for this vehicle type on 60 mph single carriageway roads (prior to the HGV speed limit increase this figure was 9%). The proportion of HGVs speeding has decreased by 68% (falling from 85% to 17%) since the policy change.

Dual Carriageways

The average speed of HGVs >7.5t on 2-lane 70 mph dual carriageway roads has increased by 0.4 mph (52.0 to 52.4 mph) and that this is at least partly attributable to the policy change. Speeds of light vehicles have increased by 0.2 mph (65.0 to 65.2 mph) since the policy change.

6% of HGVs >7.5t exceeded the 60 mph speed limit for this vehicle type on 2-lane dual carriageway roads (prior to the HGV speed limit increase 5% of HGVs exceeded 60 mph). The proportion of HGVs speeding has decreased by 74% (falling from 81% to 6%) since the policy change.

Safety

Statistical modelling has been undertaken on safety data for all roads affected by the speed limit change. This is based on 10 years of ex-ante data and 21 months of ex-post data accumulated to date. The analysis finds there is a statistically significant reduction in collisions, though this is found to be a highly sensitive finding which should be treated as tentative until further data is available. For now, there is confidence that the outcome is non-negative.

1. Introduction

In April 2015 new national speed limits came into force for heavy goods vehicles (HGVs) over 7.5 tonnes on single carriageway and dual carriageway roads in England and Wales. The new limits are 50 mph (up from 40 mph) and 60 mph (up from 50 mph), respectively. In October 2015 the Department for Transport (DfT) commissioned a three year evaluation of the speed limit change with the primary aims of generating the evidence needed to support future policy decisions and validate the initial impact assessment for the increase. This document is the second annual Interim Report, presenting the outputs of analysis covering approximately the first two years of operation of the new speed limits.

1.1 Evaluation Approach

The evaluation of the speed limit change commenced in October 2015, with a short scoping task and rapid evidence review. The main evaluation has three periods summarised below:

- **Year 1 (2016):** process evaluation with HGV drivers, non-HGV drivers and residents. Impact evaluation covering safety and speeds;
- **Year 2 (2017/18):** update of the impact evaluation work from Year 1 using approximately a year's worth of additional ex-post data. This update, combined with the Year 1 impact work, is the subject of this report;
- **Year 3 (2019):** Some additional process evaluation work. Update of Year 1 & 2 impact evaluation work on safety and speeds using approximately a year's worth of additional ex-post data. Addition of environment impact evaluation and an economic evaluation of the policy change. Year 3 work is commencing immediately following the completion of the Year 2 work.

The detailed requirements of the evaluation were defined by the set of evaluation questions within the commission tender documents, which were reviewed and updated during the scoping phase. These questions covered a range of anticipated impact areas of the speed limit change, which are summarised below:

- **Qualitative Research:** are HGV drivers and other road users aware of the speed limit change; have HGV operators made any changes to their policies or routeing as a result of the speed limit change; and have HGV operators or local authorities perceived any costs or benefits arising from the change;
- **Impact Evaluation – Speeds & Flows**: has the speed limit increase resulted in a measurable change to HGV (and other vehicle) speeds on single carriageways and dual carriageways; and are there any impacts on traffic volumes;
- **Impact Evaluation – Safety**: has the volume and severity of collisions changed on affected roads; and have there been changes in the types of collisions or contributory factors involved;
- **Impact Evaluation – Environment**: taking into account any changes in speeds, are there likely to have been any changes in fuel consumption, carbon emissions, air pollutants (NOx and particulate matter) and noise; and
- **Economic Evaluation**: using the parameters from the impact evaluation, what is the benefit-cost ratio for the policy; and how does this compare to the benefit cost ratio from the impact assessment.

1.1.1 Methodology Overview

Throughout this report, the roads subject to the change in speed limit will be referred to as the *study roads*. This refers to any single or dual carriageways that are operating at the national speed limit in England and Wales. It is on these roads that the speed limit for HGVs (over 7.5 tonnes) has been increased, and is thus the focus of this report.

A detailed methodology for the Speeds Impact Evaluation work is contained in Appendix A. These follow the same principles as applied for the Year 1 work and rely on the same core datasets to support the analysis and conclusions:

- Safety: STATS19 records of all collisions in England and Wales are the primary data source for the safety analysis. These records are completed by the various Police forces in England and Wales and checked / processed centrally by DfT;
- Speeds: traffic speeds and flows provided by the Traffic Surveys Team at DfT are the primary data source speeds analysis. These data are taken from the network of automatic traffic counters which the DfT maintains. In addition to data from DfT count sites based on study roads, data from motorway sites have been used, establishing a counterfactual group for comparison with the ex-post policy change data.

A change has been made to the Year 2 methodology for the analysis of speeds. In Year 1 the analysis was based on aggregated hourly data. In Year 2 AECOM has worked with the DfT team to specify requests and these have been processed on vehicle-by-vehicle data within the DfT database and summarised for reporting. This refinement to the methodology provides greater accuracy in terms of the statistical calculations applied to the Year 2 dataset.

As HGVs >7.5t are speed limited to 90 kph (56 mph) theoretically there should be no vehicles speeding in the observed ex-post dataset for dual carriageways (where the speed limit for HGVs is higher at 60 mph); however, there are occasions where higher speeds are observed in the dataset. There are a number of reasons why this could be the case and these are explored when presenting the results in section 3.

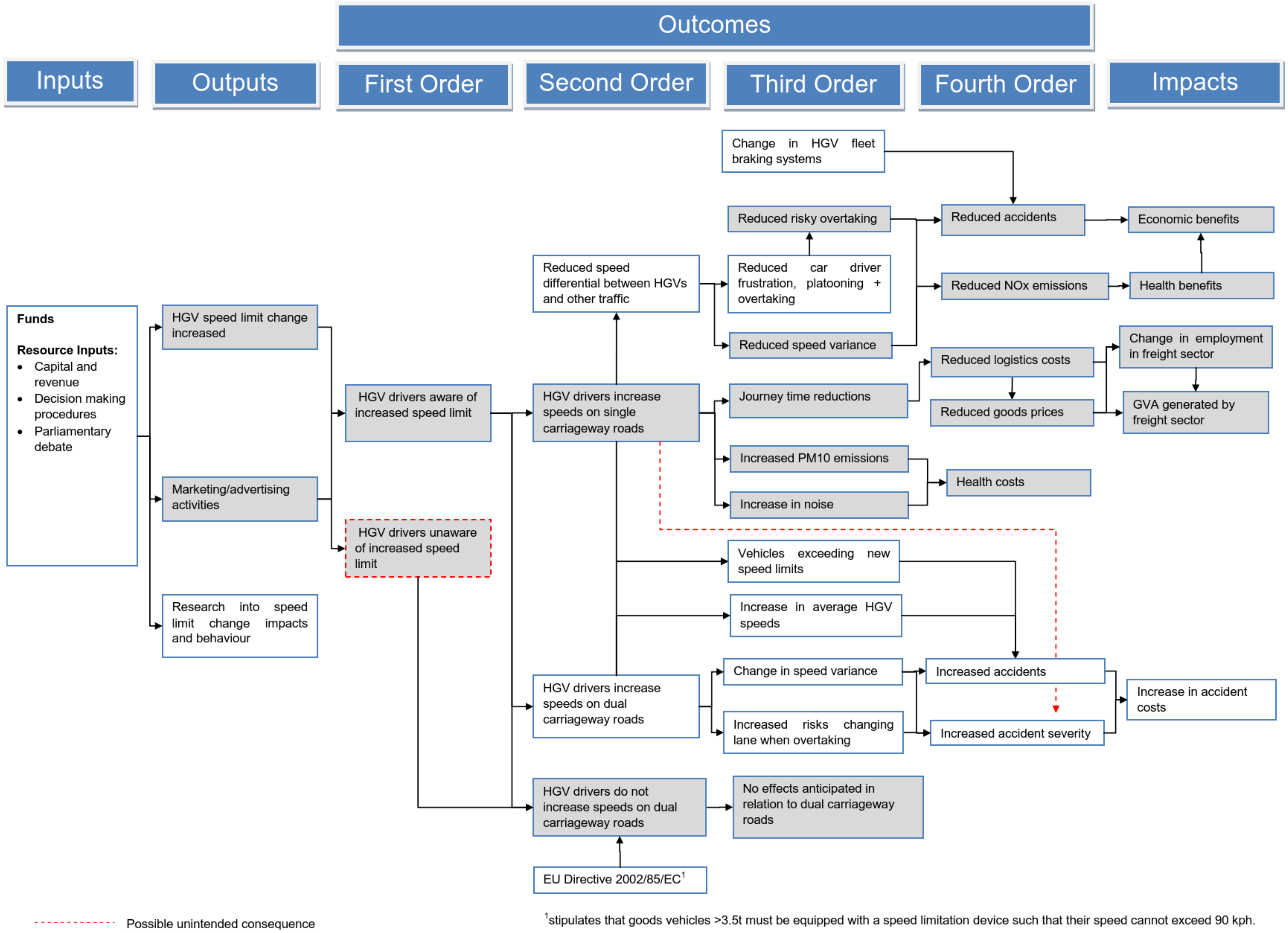
1.1.2 Theory of Change

The evaluation design needed to address the range of issues within each of the core anticipated impact areas (e.g. safety), maximising the use of existing datasets and enhancing this with bespoke qualitative and quantitative data collection. A central challenge within the evaluation was the need to determine the contribution of the speed limit change to changes in key outcome data e.g. the number of road traffic collisions. The evaluation design therefore consisted of two main approaches:

- **Outcome Metrics**: the use of available quantitative data to assess key outcomes (such as changes in HGV speeds, changes in collisions) on an annual basis forms the central analytical thread of the evaluation. Many of the anticipated impact areas (speeds, collisions) are very data rich, permitting extensive quantitative analysis on an annual basis. The complex environment in which the speed limit change has been introduced, and the myriad of factors that influence metrics such as speeds, represented a challenge for the evaluation. Statistical modelling techniques have therefore been adopted for the safety impacts, to consider the counterfactual scenario. The results of these analyses will form the basis of the economic evaluation task in Year 3 to update the DfT's initial impact assessment; and
- **Theory of Change**: to further enhance the ability to understand the contribution of the speed limit changes to observed changes in outcome metrics, a theory of change evaluation approach has been adopted. This included the use of logic mapping and causal pathway analysis, to consider the detailed cause and effect resulting from the policy change. Work included the review of changes in outcomes with stakeholders, through which to consider alternative explanations and to build consensus regarding the

contribution of the speed limit change. Figure 1.1 presents the ex-ante logic map for the speed limit increase, reflecting the anticipated outcomes and impacts of the policy change. This policy level theory of change has been reviewed and tested during the first two years of ex-post analysis, and will be further tested in Year 3 of the evaluation.

Figure 1.1: HGV Speed Limit Increase Ex-Ante Logic Map



[1]stipulates that goods vehicles >3.5t must be equipped with a speed limitation device such that their speed cannot exceed 90 kph.

The ex-ante logic map presented in Figure 1.1 reflects the overarching theory of change and includes a number of individual causal pathways, for example the specific impact areas such as safety on single carriageway roads. As results are presented in later sections of this report, the outcomes metrics will be tested against the intervention logic allowing a review and update of the logic mapping (to produce an ex-post version) based on the evidence available in Year 2.

1.2 Structure of the Report

The remainder of the report is structured as follows:

- Section 2: Single Carriageway Impacts;
- Section 3: Dual Carriageway Impacts;
- Section 4: Other impacts of policy change; and
- Section 5: Conclusions.

2. Single Carriageway Impacts

Main Findings from Year 2 Single Carriageway Impact Evaluation

Speeds

- The average speed of HGVs >7.5t on 60 mph single carriageway roads has increased by 1.5 mph (44.1 to 45.6 mph) with analysis suggesting this is at least partially attributable to the policy change;
- Speeds of light vehicles have increased by 0.2 mph (47.9 to 48.1 mph) since the policy change;
- 17% of HGVs >7.5t exceeded the 50 mph speed limit for this vehicle type on 60 mph single carriageway roads (prior to the HGV speed limit increase this figure was 9%). The proportion of HGVs speeding has decreased by 68% (falling from 85% to 17%) since the policy change.

Safety

- There has been no statistically significant change in the number of accidents involving at least one HGV on single carriageway roads, though there are initial indications that there may be a reduction on all study roads; an outcome that requires further data to provide more confidence.

2.1 Introduction

In April 2015 the speed limit for HGVs >7.5t increased from 40mph to 50mph on single carriageway roads in England and Wales (subject to any locally applied speed limits). The national speed limit for light vehicles is 60 mph on this road type.

The DfT Single Carriageway Impact Assessment[1], produced as part of the evidence base for the policy change, did not produce forecasts of changes in the speeds of HGVs >7.5t, but tested a lower and upper bound of speed changes in the National Transport Model (NTM). The range of speed increases tested was between 0.6 and 4.7 mph (with variation to distinguish between rigid and articulated HGVs and A and B roads). Table 2.1 shows the input lower and upper range speeds used for the DfT single carriageway impact assessment. An illustrative estimate of safety impacts was made using a relatively simplistic approach based on models around the effect of speed on accidents. This predicted an additional 2 to 3 fatal accidents and 4 to 9 serious accidents per annum across affected roads.

[1] - Department for Transport (2014); Impact Assessment: Raising the Speed Limit for HGVs over 7.5 tonnes on single carriageway roads in England and Wales

Table 2.1: HGV free-flow speed inputs for NTM single carriageway impact assessment (mph)

	Single carriageway A roads		Single carriageway B roads		Justification
	Articulated	Rigid	Articulated	Rigid	
Do nothing	44.35	45.51	44.35	45.51	Observed free-flow speed of articulated and rigid HGVs
Option 1 – lower	46.09	46.09	46.09	46.09	Observed free-flow speed of 2-axle Rigid HGVs
Option 1 - upper	49.09	49.09	47.85	47.85	Free-flow speed of cars as modelled in the NTM

This section discusses the findings from the impact analysis as it applies to single carriageway roads.

2.1.1 Theory of Change

An initial anticipated outcome of the policy change on single carriageways was a level of HGV driver awareness of the speed limit change. Awareness is an important precursor to any subsequent behaviour change. The process evaluation work undertaken in 2016 as part of the Year 1 work included screened focus group discussions with HGV drivers. All of the 23 drivers included in these focus groups were aware of the change in speed limit on single carriageways.

The intervention logic indicated an expectation a likelihood that average HGV speeds would increase on single carriageways due to the speed limit increase. This expectation reflected the average speeds of HGVs in the baseline period (44.1 mph), which were above the ex-ante 40 mph limit. The ex-ante DfT 2014 Impact Assessment anticipated that an increase in speed limit would lead to reduced journey times compared with the counterfactual with the resulting benefits to the economy, particularly in the freight / distribution sector.

Another potential outcome of the policy change is for non-HGV average speeds to increase as a result of not following slower moving HGVs. A consequence of this could be additional economic benefits of the policy from reduced travel times.

Traffic flow information is considered principally a contextual data source, giving an indication of traffic growth over time across England and Wales. Whilst it is possible that the policy change produces changes in traffic volumes and / or routeing, this impact is very difficult to measure or separate from other drivers of traffic growth.

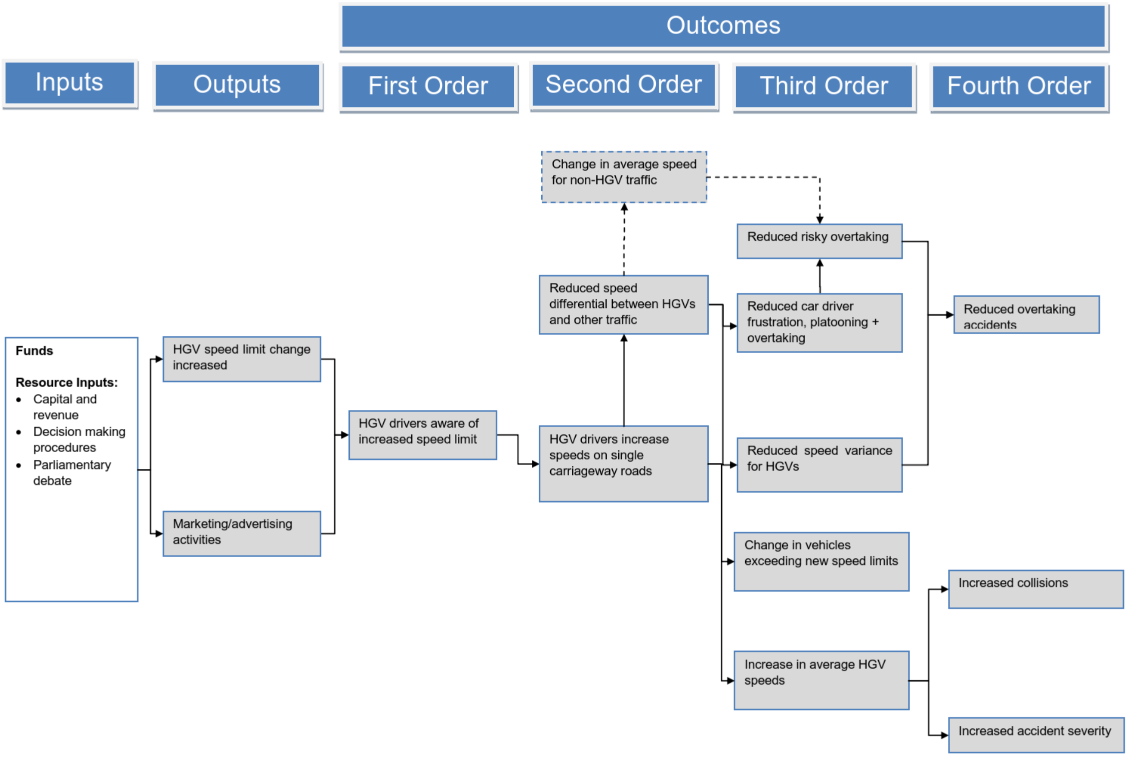
Impacts on safety are more complex to map due to two separate arguments in terms of likely impact. There is research demonstrating the link between increases in vehicle speeds and the increased rate of collisions extending over many years[2]. However, increased HGV speeds might also be expected to reduce driver frustration for other vehicle types, leading to a reduction in overtaking which is a high risk action on single carriageway roads.

The impact of changes in average HGV speeds on the average speeds of other vehicles, and the variance in speeds across the HGV classification, is causally linked

[2] TRL Project Report PR58: 'Speed, Speed Limits and Collisions', Finch et al. (1994)

to overtaking behaviour in the logic mapping. The number and severity of road traffic accidents (and the role / contribution of HGVs within these) is linked to risk arising from overtaking HGVs on single carriageways and also to any observed changes in the average speeds of HGVs on single carriageway roads. Figure 2.1 shows the ex-ante logic mapping pathway for single carriageway roads.

Figure 2.1: Ex-Ante Logic Mapping Single Carriageway Pathway



The remainder of this section sets out the results of the Year 2 analysis as they apply to single carriageway roads, covering:

- Average speeds;
- Speed variance;
- Proportion of vehicles exceeding speed limits;
- Contextual factors;
- Impacts of observed speed changes on road safety.

2.2 Analysis of Average Speed Impacts for Single Carriageway Roads

2.2.1 Evaluation Questions

The principal evaluation questions to be addressed through the analysis of average vehicle speeds on single carriageways are:

- Have average free-flow speeds for HGVs over 7.5t significantly changed on affected roads following the increase in speed limit?
- To what extent can any changes be robustly attributed to the speed limit increase?

2.2.2 Key Metric Analysis

The analysis of average speeds is based upon traffic speeds and flows data provided by the DfT. These data originate from the network of automatic traffic counters maintained by the DfT. The data provides individual vehicle speeds and a classification of vehicle type. A full detail of the methodology applied can be found in Appendix A.

Vehicle classification has been used to present the analysis results as follows within this report:

- Light vehicles: cars and goods vehicles less than 3.5 tonnes;
- 2-axle Rigid HGVs: includes vehicles >3.5 tonnes some of which also exceed 7.5 tonnes and therefore a mixture of vehicles affected / not affected by the policy change;
- HGVs: all other rigid / articulated HGVs. All vehicles in this class are > 7.5 tonnes and therefore affected by the policy change.

The DfT data also includes vehicles which are unclassified. These are included in the count of vehicles using road space at any given time, but not presented as a category in the results.

Two years' worth of data have been used for both the:

- Ex-Ante period: April 2013 to March 2015; and
- Ex-Post period: April 2015 to March 2017.

In the baseline, the average speed of HGVs on single carriageways, where the national speed limit applies, was 44.1 mph. Analysis of the datasets show an ex-post average speed of 45.6 mph, **an increase of 1.5 mph in the speed of HGVs**. For 2-axle Rigid HGVs the baseline speed was 46.3 mph, with an ex-post speed of 46.7 mph **an increase of 0.4 mph for 2-axle Rigid HGVs**. A small increase in light vehicle speeds (cars and LGVs) is also apparent (0.2 mph). The comparison has been undertaken for a range of flows up to 1,000 vehicles per hour. This cut-off has been chosen as it is representative of the point at which the average speeds of different vehicle classes converge because there is sufficiently high traffic flow to constrain vehicle speeds. Table 2.2 summarises these results for HGVs, 2-axle Rigid HGVs and light vehicles. Figure 2.2 provides plots of average speeds by vehicle type and flow band for the ex-ante and ex-post datasets.

Analysis of the two 50 mph single carriageway sites in the database produced similar results to the national speed limit sites with an increase in average speeds for HGVs of 1.7 mph across a range of flows up to 1,000 vehicles per hour. Over the same range of flows the average speed of 2-axle Rigid HGVs increased by 0.9 mph and light vehicles by 0.5 mph.

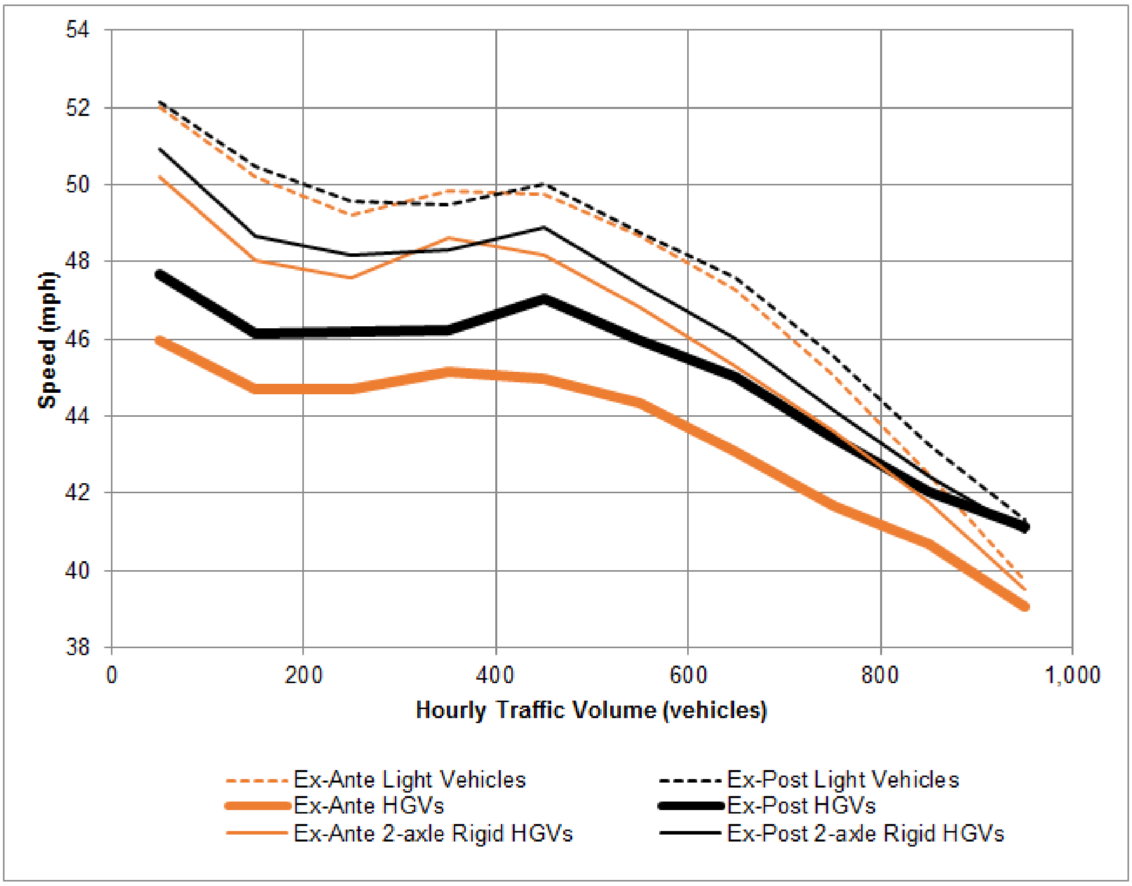
Table 2.2: Average Speed Analysis Results for 60 mph Single Carriageways

Vehicle Class	Pre Limit-Increase Average Speed (mph)	Post Limit-Increase Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)
Free Flow (0 – 100 vehicles per hour)			
Light vehicles	52.0	52.1	+0.15 [+0.13 to +0.16]
2-axle Rigid HGVs	50.2	50.9	+0.73 [+0.67 to +0.79]
HGVs	46.0	47.7	+1.72 [+1.69 to +1.75]
All Flows (0 – 1,000 vehicles per hour)			
Light vehicles	47.9	48.1	+0.15 [+0.14 to +0.16]
2-axle Rigid HGVs	46.3	46.7	+0.40 [+0.35 to +0.45]
HGVs	44.1	45.6	+1.51 [+1.47 to +1.55]

The 95% confidence intervals (presented in Table 2.2) show that, for all vehicle types and for both free flow and across all flows, changes in average speed before and after the speed limit change are statistically significant at the 95% level. **The analysis of the data therefore indicates that there have been increases in average speeds for HGVs, and other vehicle types, on national speed limit single carriageways.**

The confidence intervals are very small (in all cases the interval between the upper and lower confidence interval is less than 0.1 mph). This reflects the very large sample size of the datasets and gives a very high degree of confidence in the estimates of average speed based on the data provided. It should be noted that the confidence intervals to do not assess the accuracy of the measuring devices themselves (DfT automatic traffic counters), but the fact that the data are combined from a number of counters does mean that the analysis does highlight the consistency of the recorded values across these counters. Additionally, the counters are subject to routine maintenance every six months, during which the functioning of the equipment is thoroughly checked.

Figure 2.2: 60 mph single carriageway avg. speeds by flow band & vehicle type



2.3 Analysis of Speed Variance Impacts for Single Carriageway Roads

2.3.1 Evaluation Questions

One of the considerations for the policy change was the large variance in speeds on single carriageways due to the speed limits in place for different vehicle types. On a single carriageway road, prior to the policy change, the speed limit for HGVs >7.5t was 20 mph lower than the national speed limit. Problems associated with this were the speed limit differential generating congestion in some cases and the safety problems associated with overtaking and driver frustration. In terms of the intervention logic, bringing the speed limit for HGVs >7.5t closer to the national speed limit could be expected to reduce the variance in speeds of the traffic stream.

The principal evaluation questions to be addressed through the analysis of the variance of vehicle speeds (the squared deviation of all individual vehicle speeds from the mean speed) on single carriageways are:

- Has speed variance changed on affected roads?
- To what extent can any changes be robustly attributed to the speed limit increase?

2.3.2 Key Metric Analysis

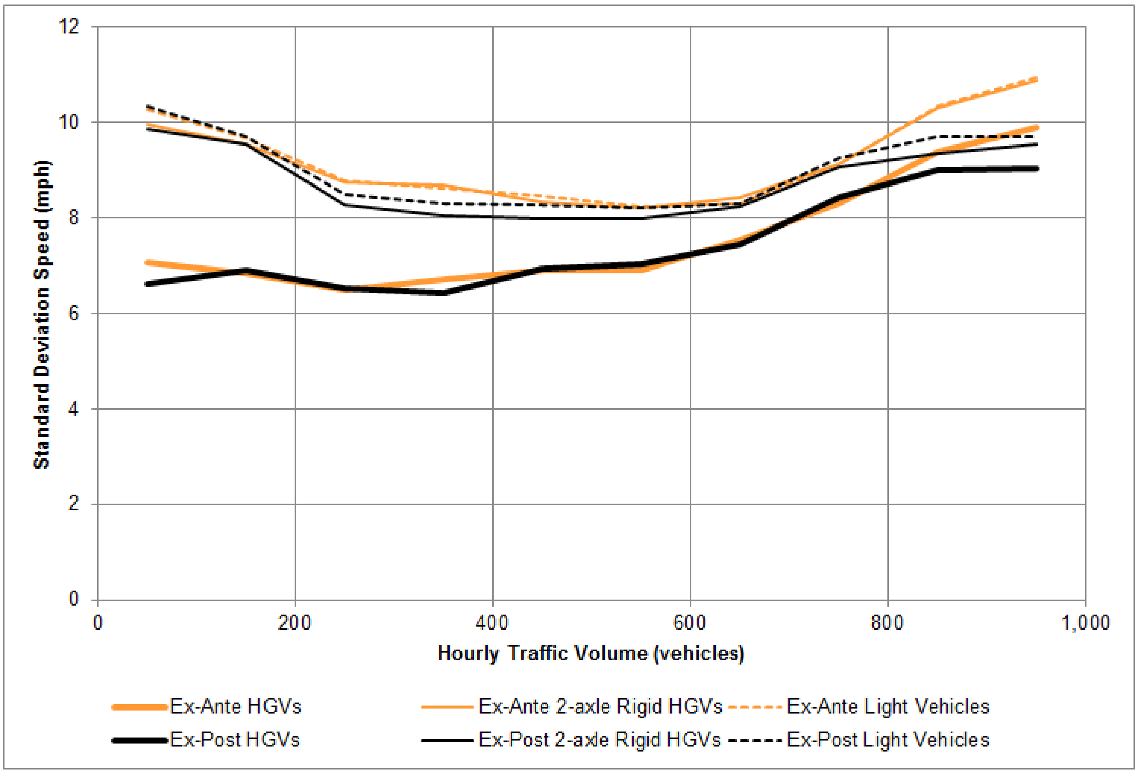
The analysis of variance makes use of the same dataset as the analysis of average vehicle speeds, with variances supplied as part of the dataset received from the DfT[3]. Figure 2.3 plots the standard deviations for the ex-ante and ex-post datasets by vehicle type and flow band.

Differences between the ex-ante and ex-post variances above 800 vehicles per hour will be influenced by the difference in the 2013-14 and 2014-15 annual datasets discussed in 0.

The ex-post variance in HGV speeds is generally at the same level or lower than the variance in the ex-ante dataset. However, these differences are very small, and the reverse is true of the 2-axle Rigid HGV vehicle class, which contains a proportion of HGVs over 7.5 tonnes. On this basis it is not possible to make a conclusive argument in terms of the impact of the policy change on the variance of vehicle speeds.

[3] The results of the variance analysis are presented in terms of the standard deviation of average speeds by vehicle type and flow band, which has units of mph. For a normally distributed dataset, a little more than two thirds of the sample will lie within one standard deviation of the mean.

Figure 2.3: Standard Deviations of Speeds on 60 mph Single Carriageways



2.4 Proportion of Vehicles Exceeding Speed Limit for Single Carriageway Roads

2.4.1 Evaluation Questions

The principal evaluation questions to be addressed through the analysis of the proportion of vehicles exceeding the speed limit on single carriageways are:

- Has there been any change in the proportion of HGVs exceeding the speed limit on affected roads?
- To what extent can any changes be robustly attributed to the speed limit increase?

2.4.2 Key Metric Analysis

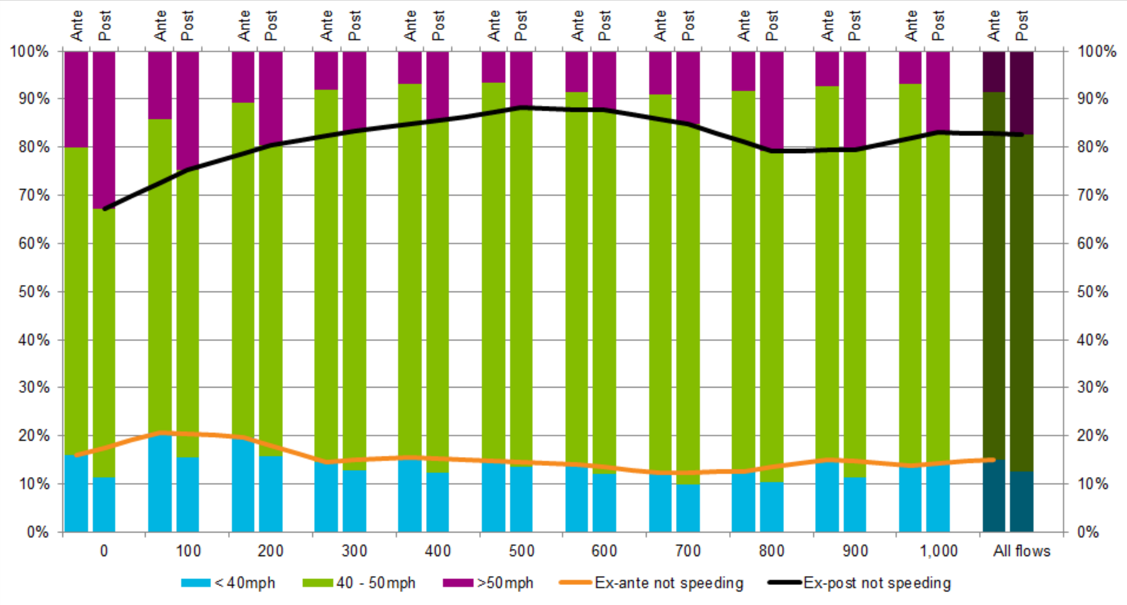
This analysis is built on the core dataset used for analysing average vehicle speeds. On this basis, statistical confidence in the results is in line with the average speed analysis and be considered robust in terms of presenting the observed data. The analysis groups all vehicle observations into speed bands allowing for a presentation of the proportion of vehicles in each speed band and the calculation of the proportion of vehicles speeding.

Figure 2.4 displays the proportions of HGVs by speed band and flow band for both the ex-ante and ex-post datasets. Given the increase in the speed limit for HGVs on this road type it is no surprise that the proportion of HGVs speeding is substantially lower in the ex-post data: less than 20% across all flows, compared with around 85% in the ex-ante data. At low flows, the proportion of HGVs exceeding 50 mph in the ex-post data is more than 30% and this exceeds the ex-ante equivalent proportion by more than 10 percentage points.

The increase in speed limit has therefore resulted in:

- An increase in the proportion of HGVs >7.5t exceeding 50 mph (rising from 9% to 17%);
- A small increase in the proportion of HGVs >7.5t exceeding 40 mph (rising from 85% to 87%); and
- As would be expected, given the increased speed limit, a reduction in the proportion of HGVs >7.5t exceeding the speed limit (falling from 85% to 17%).

Figure 2.4: Proportions of HGVs by Speed Band



2.5 Contextual Factor Analysis

2.5.1 Evaluation Questions

The principal evaluation questions to be addressed through a review of contextual data are:

- Do any other contextual factors appear to have an influence?
- To what extent can any changes in outcome metrics be robustly attributed to the speed limit increase?

Contextual data is important in the evaluation in terms of understanding the contribution of the policy change and the influence of external factors; for example it provides an opportunity to explore other factors which may influence driver behaviour on roads affected by the policy change over the evaluation period. The two key pieces of contextual data presented in this section are:

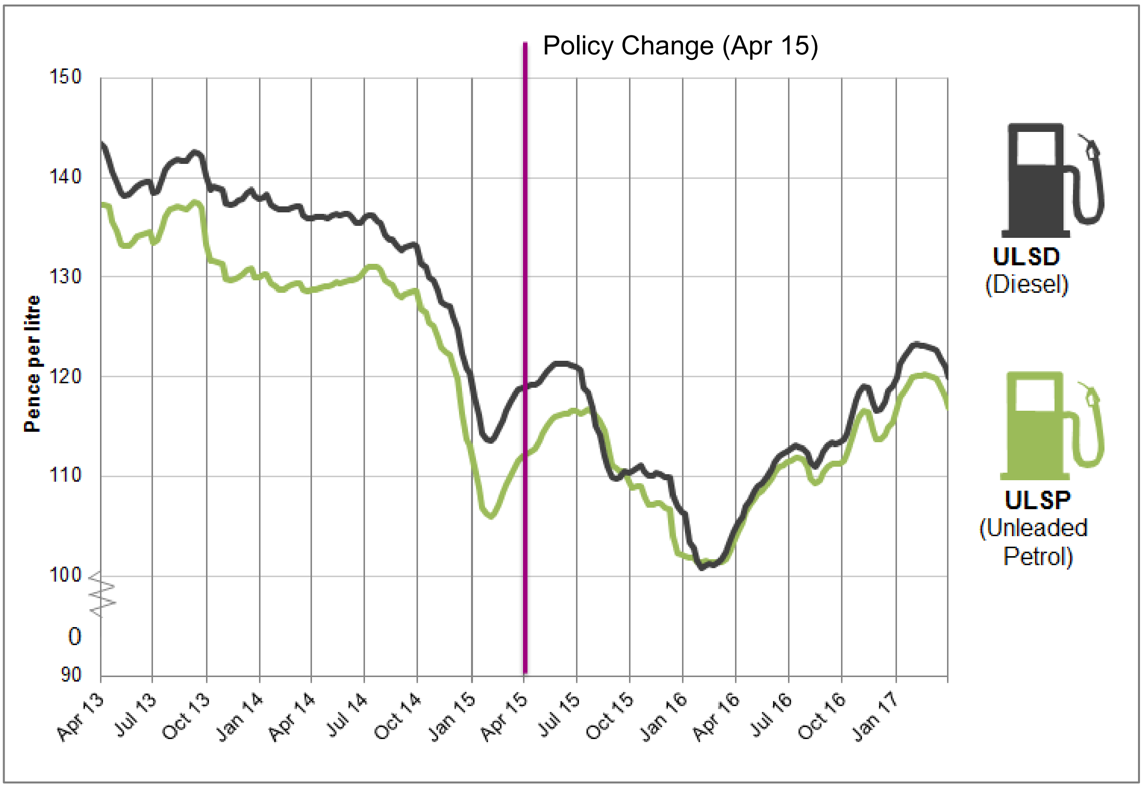
- Weekly UK fuel prices, as a measure of the key direct cost of operating a vehicle. Whilst fuel is only one component of vehicle operating costs, it is typically the largest one and information of cost trends are readily available; and
- Traffic flows in Great Britain by vehicle type and road type, as a measure of changes in travel patterns over time. Consideration of traffic flows is important given the correlation of traffic speeds and flows (increasing flows generally leads to reduced speeds) and the impact of journey time on road user route choice.

2.5.2 Weekly UK Fuel Prices

Fuel prices (petrol and diesel) are subject to the high levels of volatility in the price of crude oil and this is reflected in the variation in fuel prices over the period covered by the average speed analysis work. Virtually all of the HGV fleet use diesel as a fuel and so this is the most relevant price series for this evaluation.

Figure 2.5 plots both diesel and petrol weekly prices covering the period from the beginning of April 2013 to the end of March 2017. At the beginning of the study period diesel prices were in excess of 143 pence per litre, dropping as low as 101 pence per litre in Spring 2016 and rising back to around 120 pence per litre at the end of March 2017. It is clear that on average fuel prices were lower during the ex-post analysis period than in the ex-ante period.

Figure 2.5: Weekly UK Fuel Prices from Apr 2013 to Mar 2017



It could be hypothesised that the lower fuel prices in the ex-post period would reduce the cost pressures on the freight sector and make minimising fuel consumption, by travelling at certain speeds, less of a concern than during the ex-ante period. The discussion which follows covers this premise.

In order to consider the potential impact on operator costs it is necessary to consider the fuel consumption characteristics of HGVs. The WebTAG Databook contains fuel consumption parameters (which allow the calculation of consumption in litres per km) for a range of vehicle types, the relevant types for this study are:

- OGV1: consisting of 2-axle and 3-axle Rigid HGVs (containing a proportion of vehicles impacted by the policy change); and
- OGV2: consisting of all other HGVs (containing entirely vehicles impacted by the policy change).

Table 2.3 contains an estimate of the relative costs for OGV1 and OGV2 vehicles for speeds between 40 and 50 mph compared with travelling at 44 mph (the observed ex-ante average speed for HGVs across a range of flows). For the OGV1 class this demonstrates an estimate of increased fuel costs of up to 5% if travelling 6 mph faster at 50 mph. For the OGV2 class, which is considered most relevant, the increase is much smaller at around 2%. Given that actual ex-post observed speed increases were of smaller magnitude, these represent a very small estimated change in fuel consumption compared with ex-ante speeds. It will be important to explore links between fuel prices and driver behaviour during the qualitative research to be undertaken as part of the Year 3 evaluation.

Table 2.3: Comparison of OGV1 and OGV2 Fuel Costs by Speed

Speed (mph)	Proportion of Costs Compared with 40 mph	
	OGV1	OGV2
40	0.99	1.01
42	0.99	1.00
44	1.00	1.00
46	1.01	1.00
48	1.03	1.01
50	1.05	1.02

2.5.3 Traffic Flows

National traffic flow data published by the DfT provide important context in terms of understanding the changing demand on roads over time. The categories of these data do not perfectly match with the categories used in this evaluation and the differences are noted here:

- Geography: the DfT publishes its annual traffic flow datasets for Great Britain, whilst this study considers roads in England and Wales;
- Road type: the DfT annual traffic flow datasets separate motorways, urban and rural road types. Within the urban and rural categories distinction is made between major and minor roads. We have presented results for motorways, rural major, and all rural roads (including motorways) as being the closest representation of traffic flows to the road types considered in this evaluation;
- Vehicle type: HGVs are presented as vehicles exceeding 3.5t in the DfT traffic flow data, covering both the 2-axle Rigid HGVs and HGVs >7.5t categories presented in this evaluation.

Prior to the global financial crisis of 2008, the UK experienced a long and sustained period of traffic growth (average annual traffic growth in the ten years preceding 2008 was 1.0% and average annual HGVs >3.5t traffic growth in the same period was 0.6%). Traffic levels fell from 2008 to 2010, but began to rise again from around 2011/12. Figure 2.6 and Figure 2.7 show the last ten years of traffic growth, first by vehicle type and then by road type. In both cases the data is indexed (with 2008 traffic levels equating to 100%).

Both figures illustrate that in the period covered by this evaluation (April 2013 to March 2017), traffic flows have been increasing across vehicle types and road types. In the period after the introduction of the HGV speed limit increase, the level of HGV traffic growth decreased relative to the period before. Traffic growth by road type has remained relatively consistent in the period from 2013 to 2017.

Figure 2.6: Indexed Traffic Growth by Vehicle Type 2008 – 2017 (2008 = 100%)

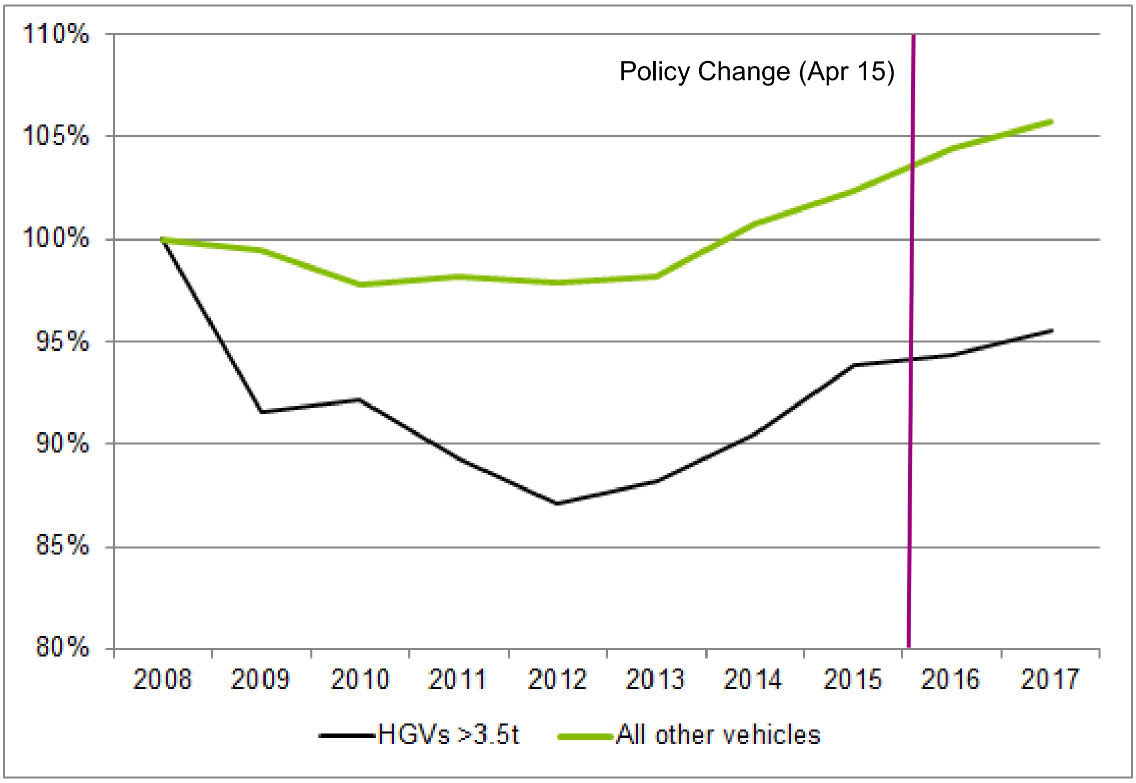
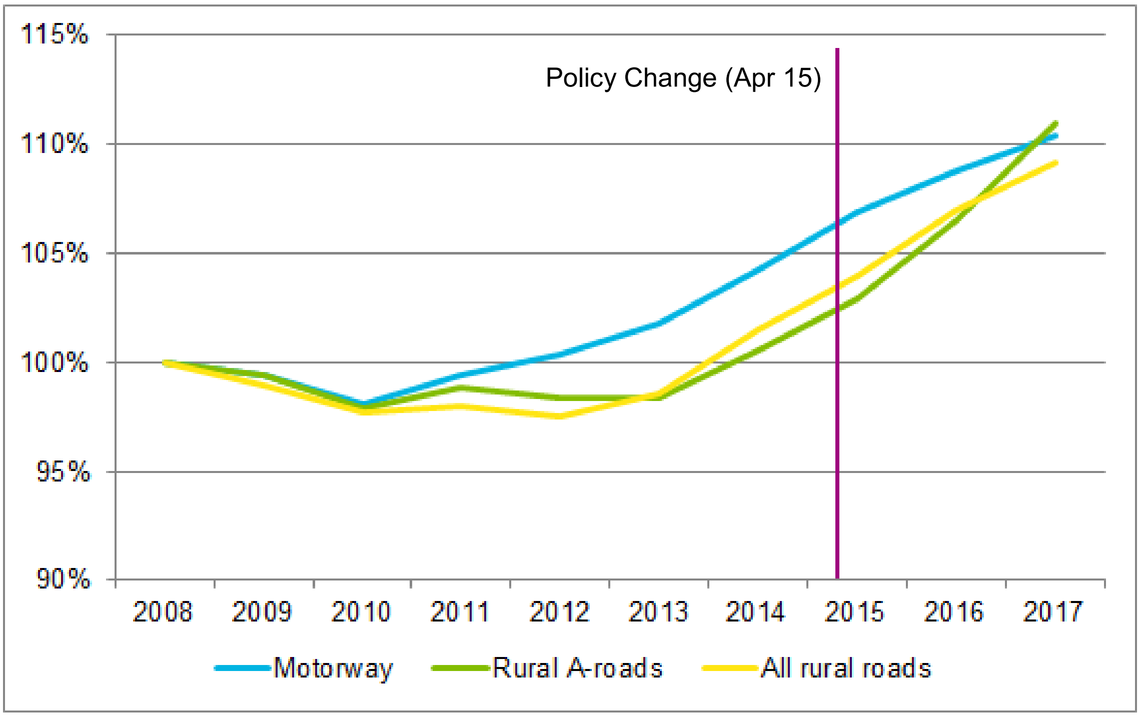


Figure 2.7: Indexed Traffic Growth by Road Type 2008 – 2017 (2008 = 100%)



Based on the results presented above it is likely that, on average, traffic flows have increased on single carriageway roads during the period covered by the evaluation. Increases in traffic flows can generally be expected to result in reductions in average vehicle speeds, which is contrary to the results observed for HGVs (and other vehicle types) on the single carriageway roads in this evaluation. The following conclusions have therefore been drawn:

- The observed increases in HGVs >7.5t (and other vehicle) speeds on single carriageway roads is not therefore due to a reduction in traffic flows;
- The increase in traffic flows may have dampened down the increase in HGVs >7.5t speeds (i.e. without an increase in traffic flows across the evaluation period it is possible the observed HGVs >7.5t speed increase could have been higher); and
- Whilst the observed speeds of all vehicle types increased, the HGVs > 7.5t speed increase was substantially higher than for other vehicle types, and since the increased speed limit only applies to HGVs >7.5t, this supports the conclusion that the increase is at least partially attributable to the policy change.+

2.5.4 Summary of Speed Impacts for Single Carriageways

The analysis of average speeds on single carriageways provides evidence to support the theory of change assumptions, particularly the key metric of the change in HGV average speeds. The analysis shows a 1.5 mph increase in ex-post HGV speeds on single carriageways, and corresponding, smaller increases in 2-axle Rigid HGVs and light vehicles. This secondary impact on other vehicle speeds is logical for single carriageways where the speeds of individual vehicles are sometimes constrained by the speed of platoons of vehicles, particularly as traffic flows increase.

Analysis of each of the two individual years of data making up both the ex-ante and ex-post periods corroborates the results with very good correlation between the pairs of years. The only exception to this is in the ex-ante dataset at higher flows (800 – 1,000 vehicles per hour) where the 2013-14 vehicle speeds track above the 2014-15 vehicle speeds by up to 2 mph.

The analysis of speeds data, combined with the review of contextual data and the analysis of speeds on motorway sites (acting as a form of counterfactual) in section 3 makes it possible to state robustly that the observed increase in HGV >7.5t speeds on single carriageways can be, at least partly, attributed to the policy change.

2.6 Analysis of Safety Impacts for Single Carriageway Roads

Single Carriageway Safety Impacts Summary:
There is some evidence of a reduction in collisions since the speed limit change across all study roads, but this result is very sensitive and so the findings should only be considered indicative at present.
Focusing on just single carriageway roads, there is no evidence of a significant change in collisions since the policy came into force.

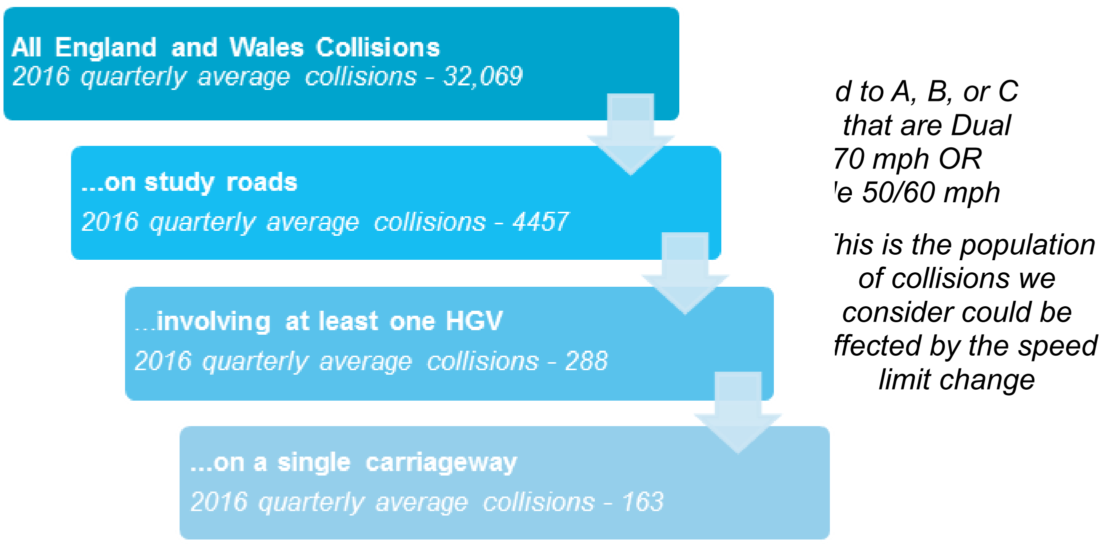
This section of the report considers what impact, if any, the HGV speed limit increases have had on safety, and specifically looks to focus on the impact on single carriageway roads.

To undertake this analysis, collision data (using the recognised STATS19 recording format) from the Department for Transport have been provided, covering the whole of England and Wales between 2005 and December 2016. This means that there are roughly 10 years of ex-ante data and approximately 21 months of ex-post data to analyse in order to measure any impacts. These analyses will be revisited in Year 3 of the evaluation, with the ex-post dataset growing with each subsequent evaluation, which will make the findings more robust over time.

Collision numbers reported in this section have been aggregated into totals by calendar year quarter (i.e. January to March is considered Quarter 1 [Q1], and October to December is considered Quarter 4 [Q4]) for the purposes of analysis.

The collision data from the DfT includes collisions on all roads in England and Wales, and so required substantial filtering to focus on just the collisions of interest to this study (namely collisions involving at least one HGV on a study road). A summary of how the full dataset was subdivided and how the sample reduced the more the data was disaggregated is provided in Figure 2.8.

Figure 2.8: Collision data sample sizes at each level of disaggregation



2.7 Note that while the full database had a substantial number of collisions per quarter, the collisions of interest to this study (i.e. involving an HGV and on a study road) only amounted to around 288 per quarter across both single and dual carriageways. The figure reduced further to 163 on just single carriageways. As such, the consideration of trends or sub-divisions in the data has been undertaken with care not to draw spurious conclusions based on small changes; i.e. being sensitive to the fact that these are fairly uncommon events in the first instance. This is why statistical modelling techniques have been used to understand whether there is confidence in the changes observed.

The following set of evaluation questions in relation to safety were established during the scoping phase:

- Has the number of collisions significantly changed on affected roads?
- Have these changes differed by collision type? (slight, serious, fatal)
- Has there been any change to the contributory factors cited for collisions on affected roads?
- Have there been any changes to the type of collisions occurring on affected roads? (single or multiple vehicle, side, rear or front impacts etc.)
- To what extent can any changes be robustly attributed to the speed limit increase?

Due to the small number of collisions per quarter on study roads and involving an HGV, it was considered that for most of these questions it would not be possible to make robust conclusions when disaggregating the data to both a carriageway type and another metric (e.g. to single carriageways *and* to serious collisions).

Instead, this main section of the report will explore the impact of the speed limit change on all study road collisions and disaggregate down to single carriageway collisions, but not aim to disaggregate any further.

Analysis of specific collision types, the analysis of collision severities, type of collision analysis, and contributory factors has been undertaken with single and dual carriageways combined. This maximises the number of collisions to be analysed and increases the chance of concluding anything from this data, as these are infrequent events. This analysis is therefore presented separately in Appendix B and Appendix C.

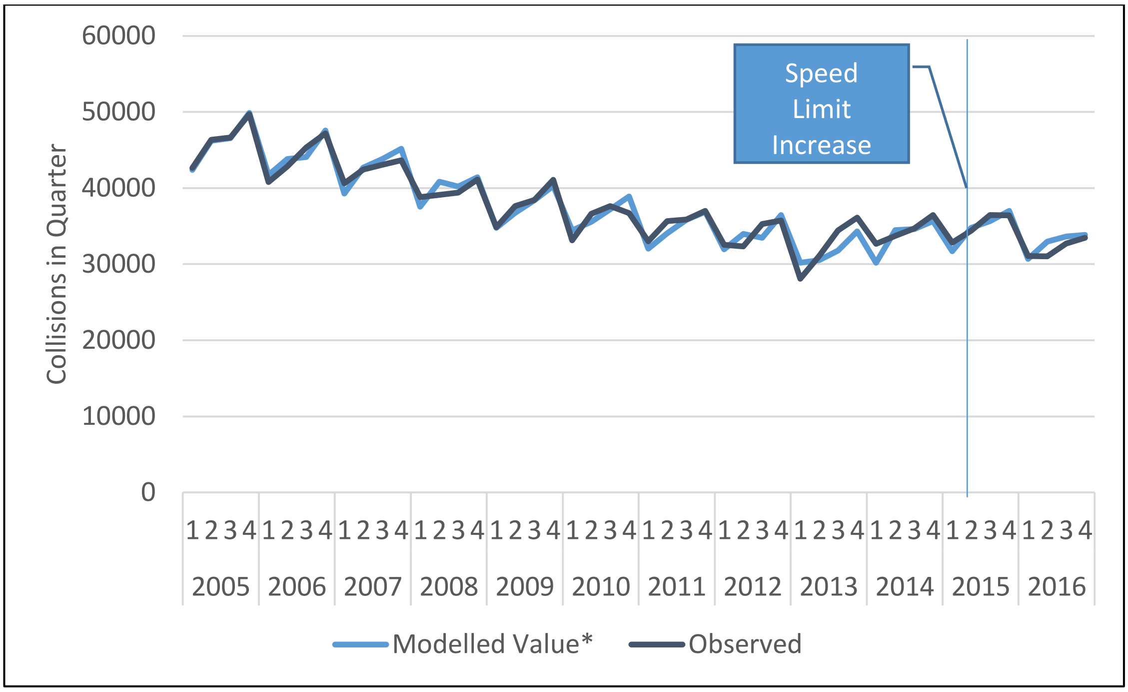
The analysis considered quarterly collisions numbers, which have been analysed using a time series modelling approach[4] which estimates the effect of the intervention (the introduction of the HGV speed limit increase) from 2015 Q2. The statistical modelling approach provides an intervention parameter and confidence interval for this parameter, which have been used to measure the change in collisions since the HGV speed limit change and the confidence we have in this collision change.

2.7.1 All England and Wales Collisions

To provide some context to collision changes on study roads, it is worth looking at the profile over time of collisions on all roads in England and Wales. Figure 2.9 shows the total collisions on all roads in England and Wales by quarter between 2005 and 2016. The number of collisions per quarter declined from year to year, though with underlying seasonality (peak collisions typically in Q4). Within the period from 2005, peak collisions per quarter were near to 50,000 with the lowest collisions per quarter just under 30,000. In recent years the annual decline seems to have plateaued.

[4] The auto ARIMA modelling function was used within the R package. Note that the auto ARIMA function chooses an ARIMA model that is the best fit, and therefore different ARIMA models could be fit to different analyses presented in this report.

Figure 2.9: All collisions on England and Wales roads per quarter



**Model based on logarithmic values. Those presented in the graph are the exponents to compare to observed.*

A time series statistical model was fitted to the data using an intervention parameter to measure the change either side of the HGV speed limit increases.

Table 2.4 shows that the outcome of this model is that it finds no statistically significant change in collisions since the HGV speed limit change. This finding is as expected; HGV collisions on study roads are only a small subset of all accidents in England and Wales, so any changes in collisions due to the policy are unlikely to be observed in these figures, and are explored in more detail in the next sub-section of this report.

Table 2.4: Model outputs for All collisions in England and Wales

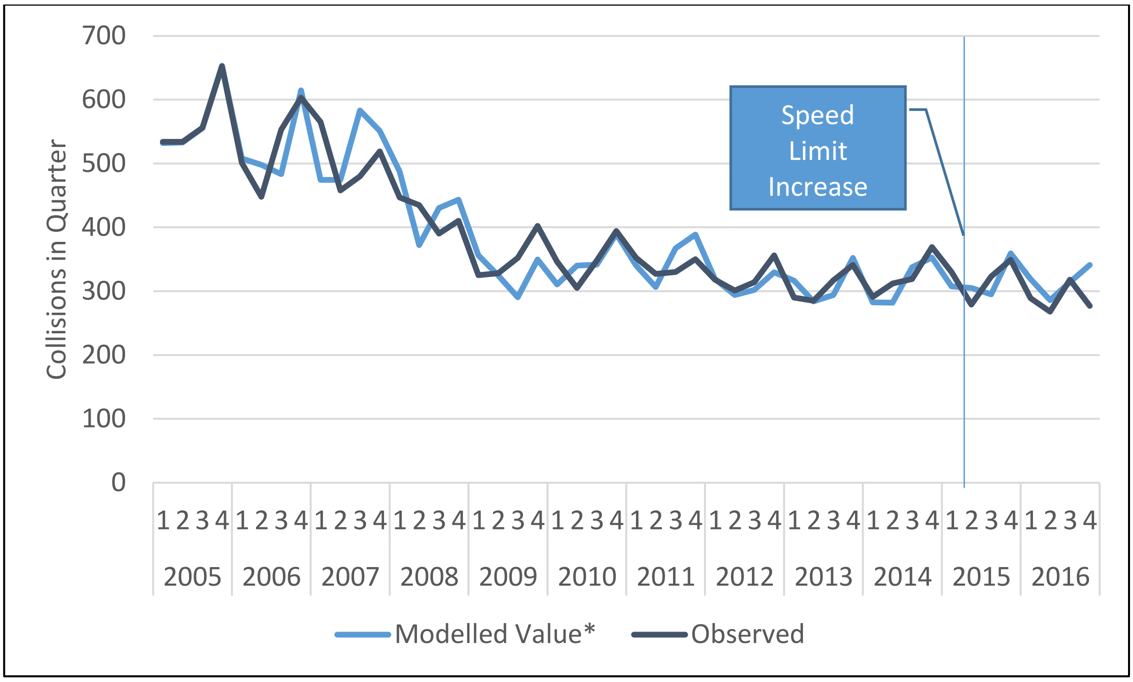
Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
2.9%	-4.2%	10.5%	No

2.7.2 HGV collisions on Study Roads

Before focusing on the impact on single carriageway roads, it is worth considering the impact on HGV collisions on all study roads (both single and dual). This is the most aggregate way in which collisions relevant to this study can be examined, and thus maximises the sample of collisions each quarter, and therefore gives the best indication of whether the new speed limit has had any impact on safety. Figure 2.10 shows total collisions per quarter involving at least one HGV, over time and for all study roads.

There is a divergence between the modelled and observed collisions for 2016 Q4, with the model expecting more collisions in Q4 than in Q3 but the opposite occurring. The reason for divergence is that historically Q4 contains the peak collisions in a year, and so the model has learnt this and thus expects this. However, the collision data for 2016 observed fewer collisions in Q4 than Q3; an unusual occurrence based on previous seasonality.

Figure 2.10: Collisions involving at least one HGV, on all study roads, per quarter



**Model based on logarithmic values. Those presented in the graph are the exponents to compare to observed.*

As before, a time series statistical model has been fitted to the data, using an intervention parameter to measure the change, if any, since the HGV speed limit increase was implemented. Two tests are run here to provide a sensitivity test. The main test runs the model with all post-scheme data included, whereas the sensitivity test is run without 2016 Q4, to understand if the unusual pattern observed here affects the outcome.

Main statistical test

When fitting the model to all the available data, the model's intervention parameter and its confidence interval is provided in Table 2.5.

Table 2.5: Model outputs for HGV collisions on single and dual carriageways

Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
-12.4%	-22.9%	-0.5%	Yes

The table shows that the best estimate of the intervention parameter is for a 12.4% reduction in collisions involving at least one HGV on the study roads. The confidence interval around this result shows 95% confidence that the intervention parameter is between a 22.9% reduction and a 0.5% reduction in collisions. This means that the result is statistically significant, so there is confidence that there has been a reduction in collisions on all study roads.

Sensitivity test

To understand the effect of the unusual pattern of observations in 2016 Q4, a sensitivity run of the statistical modelling has been conducted, with the 2016 Q4 data removed. This run shows that the reduction in collisions since the HGV speed change is not statistically significant. This therefore demonstrates that the divergence between the modelled and observed collisions in 2016 Q4 is having a large impact on the conclusion outcome of the modelling; changing whether or not the result is statistically significant.

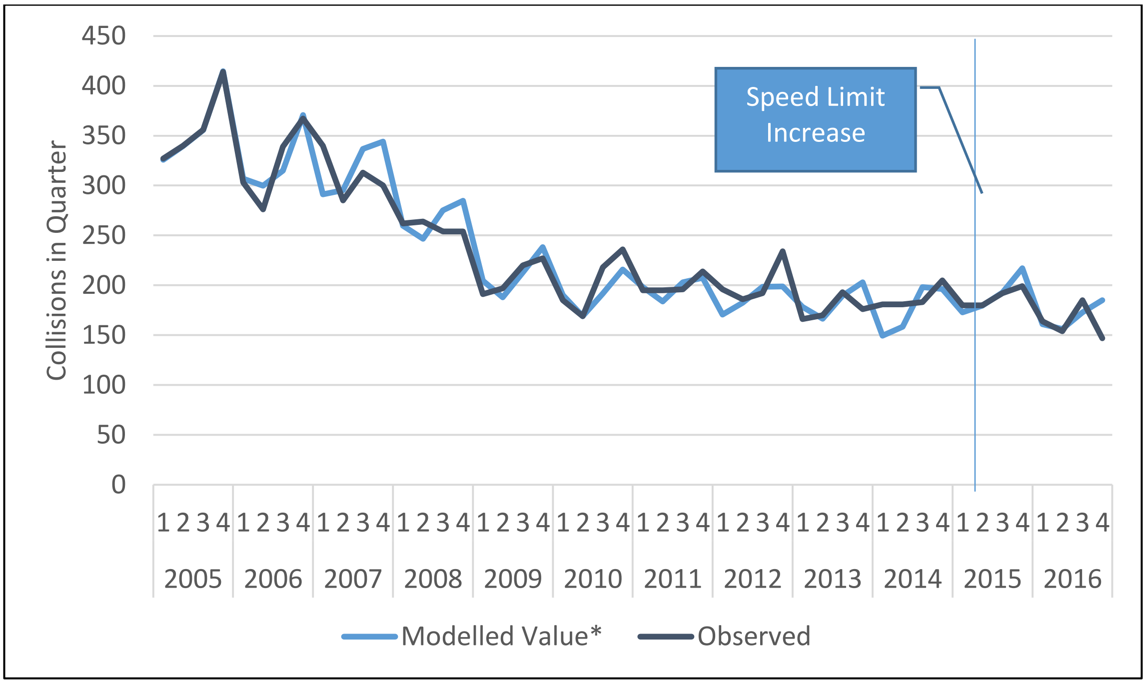
Summary of finding

In summary, the modelling has demonstrated that the outcome is very sensitive to the inclusion of the final observation. As such it is concluded that there is insufficient evidence at this time to conclude on the impact of the policy on collisions on study roads, but with further data in the Year 3 analysis it will be possible to provide a firmer finding on the safety outcome.

2.7.3 HGV Collisions on Single Carriageways

Figure 2.11 shows the total collisions per quarter involving at least one HGV over time for single carriageways subject to the national speed limit. The graph shows the usual decline over time followed by a plateau, with collisions per quarter down to 150-200 in the most recent years.

Figure 2.11: Collisions involving at least one HGV, on single carriageway study roads, per quarter



**Model based on logarithmic values. Those presented in the graph are the exponents to compare to observed.*

The statistical model includes an intervention parameter, which estimated the change in collisions between the ex-ante and ex-post periods. Details of the intervention parameter from the model are provided (Table 2.6), along with its 95th percentile confidence interval.

The model finds no statistically significant evidence of change. The table shows that the best estimate of the intervention parameter is for a 4.9% increase in collisions on single carriageway study roads. However, the confidence intervals ranged from an 11.3% decrease to a 24.2% increase in collisions therefore there is insufficient confidence that the speed limit change has affected safety on single carriageway roads and the conclusion is that there is no change observable at this time.

Table 2.6: Model outputs for HGV collisions on single carriageways

Carriageway Type	Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
Single	4.9%	-11.3%	24.2%	No

2.7.4 Summary of Safety Impacts

This section has considered the impact of the national HGV speed limit increase on personal injury collisions on all study roads and on single carriageway roads. This analysis was based on the ex-post data available to date. As collisions are stochastic (occurring randomly) events whose frequency is subject to fluctuations over time, statistical models were fitted to the collision data to understand how the ex-post collisions differ to what might have been expected to occur without the policy change.

It was shown that across all study roads (single and dual) there is evidence of a statistically significant reduction in collisions involving at least one HGV (the collisions that are the focus of this study) since the HGV speed limit change. However, it also demonstrated that this finding is very sensitive, as when the 2016 Q4 data was removed from the model, the result was no longer significant. The observed 2016 Q4 data was showing unusual behaviour compared to previous seasonality trends, and so further evidence from the Year 3 analysis is required to provide confidence on the outcome.

This section also considered the change in collisions involving at least one HGV on single carriageway roads since the HGV speed limit change. In summary, the recorded data suggested that there has not been any statistically significant change in the number of collisions involving at least one HGV on single carriageway roads since the HGV speed limit change.

Due to the small sample size, the analysis of collision severities, type of collision analysis, and contributory factors has been undertaken with single and dual carriageways combined. This analysis is presented in Appendix B and Appendix C.

3. Dual Carriageway Impacts

Main Findings from Year 2 Dual Carriageway Impact Evaluation

Speeds

- The average speed of HGVs >7.5t on 2-lane 70 mph dual carriageway roads has increased by 0.4 mph (52.0 to 52.4 mph) and that this is at least partly attributable to the policy change;
- Speeds of light vehicles have increased by 0.2 mph (65.0 to 65.2 mph) since the policy change;
- 6% of HGVs >7.5t exceeded the 60 mph speed limit for this vehicle type on 2-lane dual carriageway roads (prior to the HGV speed limit increase 5% of HGVs exceeded 60 mph). The proportion of HGVs speeding has decreased by 74% (falling from 81% to 6%) since the policy change.

Safety

- There has been no statistically significant change in the number of accidents involving at least one HGV on dual carriageway roads, though there are initial indications that there may be a reduction on all study roads; an outcome that requires further data to provide more confidence.

3.1 Introduction

In April 2015 the speed limit for HGVs >7.5t increased from 50 mph to 60 mph on dual carriageway roads in England and Wales (subject to any locally applied speed limits). The national speed limit for light vehicles is 70 mph on this road type.

The DfT Dual Carriageway Impact Assessment[5], produced as part of the evidence base for the policy change assumed that HGVs >7.5t would not choose to travel faster on dual carriageways than on motorways, and consequently that the average free-flow speeds on dual carriageways will not change. A sensitivity test of a 1 mph increase in actual speeds predicted a small increase in accidents, of the order of 1 fatal accident per decade. This section discusses the findings from the impact analysis as it applies to dual carriageway roads.

3.1.1 Theory of Change

As for single carriageways, an initial anticipated outcome of the policy change on dual carriageways was HGV driver awareness of the speed limit change. Awareness is an important precursor to any subsequent behaviour change. The process evaluation work undertaken in 2016 noted that not all of the 23 drivers included in the focus groups were aware of the change in speed limit on dual carriageways. The Year 3 qualitative research will include discussions with stakeholders on the perceived level of awareness in the industry.

The intervention logic indicates an uncertainty over whether the speed limit increase would result in an increase in the average speed of HGVs. This reflects a number of factors:

- Uncertainty over the level of awareness of the policy change amongst HGV >7.5t drivers;

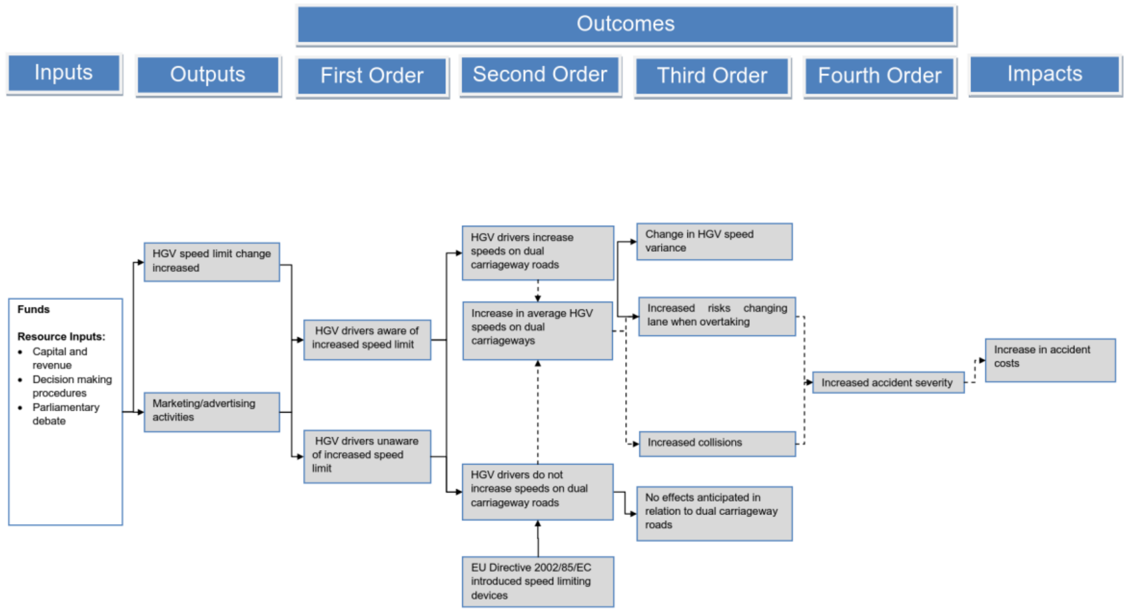
[5] - Department for Transport (2014); Impact Assessment: Raising the Speed Limit for HGVs over 7.5 tonnes on dual carriageway roads in England and Wales

- The fact that HGVs >7.5t must have a speed limiter set at 90 kph (56 mph) fitted to the vehicle, reducing the scope for an increase in average speeds on this road type; and
- That a comparison of HGV speeds on dual carriageways and motorways prior to the policy change[6] indicated that average speeds were already very similar across the road types and it would be counterintuitive to expect average HGV speeds on dual carriageways to exceed the average on motorways.

The primary mapped intervention logic pathway for safety impacts is neutral based on the fact that a change in speeds was considered unlikely. However, an alternative pathway exists which identifies potential increases in collisions and the severity of collisions if an increase in the speed of HGVs does occur on dual carriageways.

Figure 3.1 shows the ex-ante logic mapping pathway for dual carriageway roads.

Figure 3.1: Ex-Ante Logic Mapping Dual Carriageway Pathway



3.2 Analysis of Average Speed Impacts for Dual Carriageway Roads

3.2.1 Evaluation Questions

The principal evaluation questions to be addressed through the analysis of average vehicle speeds on dual carriageways are:

- Have average free-flow speeds for HGVs over 7.5t significantly changed on affected roads following the increase in speed limit?
- To what extent can any changes be robustly attributed to the speed limit increase?

3.2.2 Key Metric Analysis

The analysis of average speeds on dual carriageways was again based upon traffic speeds and flows data provided by the DfT. These data originate from the network of automatic traffic counters maintained by the DfT. The data provided individual vehicle

[6] Impact Assessment: Raising the Speed Limit for HGVs over 7.5 tonnes on dual carriageway roads in England and Wales, Department for Transport (2014)

speeds and a classification of vehicle type. A full detail of the methodology applied can be found in Appendix A.

The same vehicle classification has been used for dual carriageways to present the analysis results within this report:

- Light vehicles: cars and goods vehicles less than 3.5 tonnes;
- Rigid 2-axle HGVs: includes vehicles >3.5 tonnes some of which also exceed 7.5 tonnes and therefore a mixture of vehicles affected / not affected by the policy change; and
- HGVs: all other rigid / articulated HGVs. All vehicles in this class are > 7.5 tonnes and therefore affected by the policy change.

The DfT data also includes vehicles which are unclassified. These are included in the count of vehicles using road space at any given time, but not presented as a category in the results.

In the baseline (April 2013 – March 2015), the average speed of HGVs on dual carriageways, where the national speed limit applies, was 52.0 mph across all flows[7] (Table 3.1). Analysis of the datasets showed an ex-post (April 2015 – March 2017) average speed of 52.4 mph, **an increase of 0.4 mph in the speed of HGVs**. For 2-axle Rigid HGVs the baseline speed was 58.9 mph, with an ex-post speed of 59.7 mph **an increase of 0.8 mph**. A small increase in light vehicle speeds (cars and LGVs) was also observed (0.2 mph). Figure 3.2 provides plots of average speeds by vehicle type and flow band for the ex-ante and ex-post datasets.

Table 3.1: Average Speed Analysis Results for 2-Lane 70mph Dual Carriageways

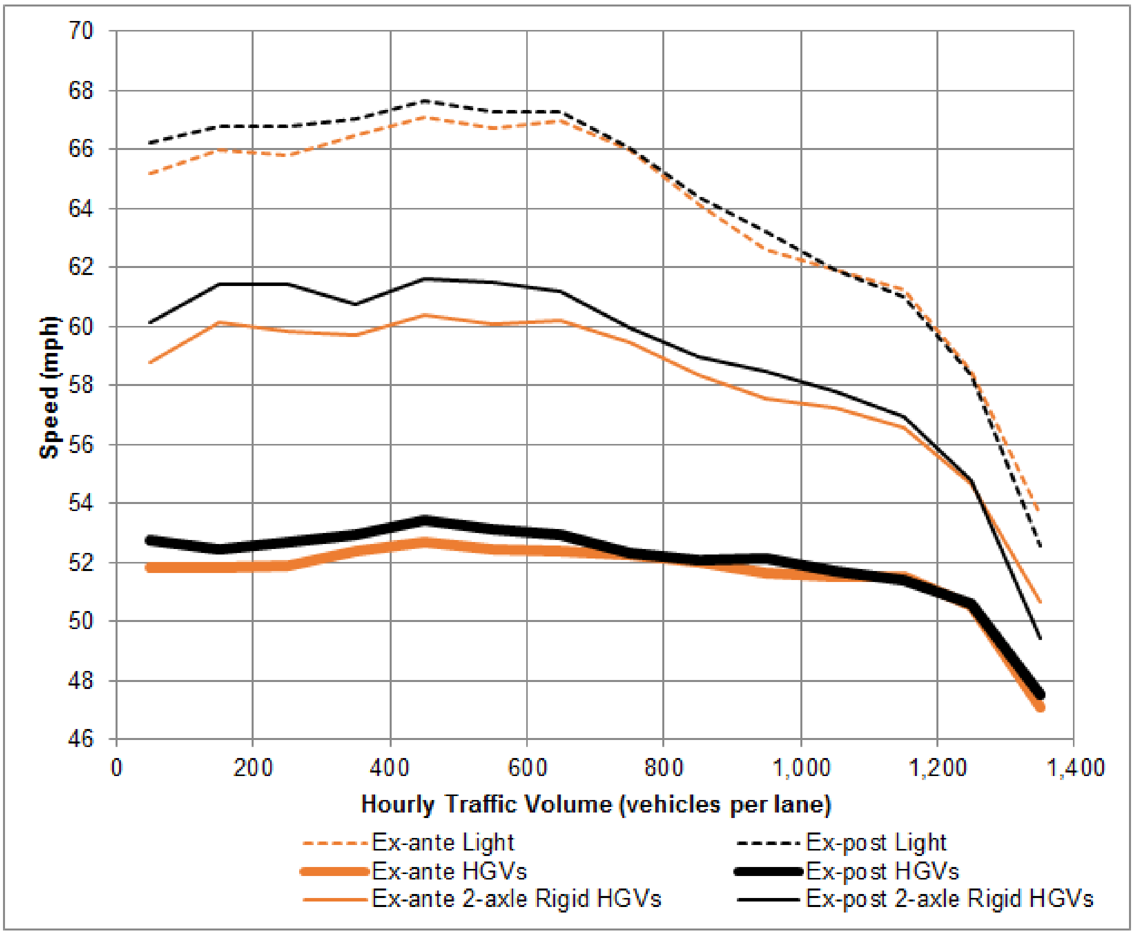
Vehicle Class	Pre Limit-Increase Average Speed (mph)	Post Limit-Increase Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)
Free Flow (0 – 400 vehicles per hour per lane)			
Light vehicles	66.1	66.8	+0.76 [+0.74 to +0.77]
2-axle Rigid HGVs	59.6	60.9	+1.24 [+1.18 to +1.29]
HGVs	52.0	52.7	+0.69 [+0.67 to +0.72]
All Flows (0 – 1,400 vehicles per hour per lane)			
Light vehicles	65.0	65.1	+0.17 [+0.16 to +0.18]
2-axle Rigid HGVs	58.9	59.7	+0.76 [+0.71 to +0.81]
HGVs	52.0	52.4	+0.40 [+0.38 to +0.43]

The 95% confidence intervals (presented in Table 3.1) show that, for all vehicle types and for both free flow and across all flows, changes in average speed before and after the speed limit change are statistically significant at the 95% level. **The analysis of the data therefore indicates that there have been increases in average speeds for HGVs, and other vehicle types, on 2-lane national speed limit dual carriageways.**

[7] The comparison has been undertaken for a range of flows up to 1,400 vehicles per hour per lane. This cut-off has been chosen as it is representative of the point at which the average speeds of different vehicle classes converge because there is sufficiently high traffic flow to constrain vehicle speeds.

The confidence intervals are very small and this reflects the very large sample size of the datasets and gives a very high degree of confidence in the estimates of average speed based on the data provided.

Figure 3.2: 2-lane 70 mph dual carriageway speeds by flow band & vehicle type



3.3 Analysis of Speed Variance Impacts for Dual Carriageway Roads

3.3.1 Evaluation Questions

The principal evaluation questions to be addressed through the analysis of the variance of vehicle speeds on dual carriageways are:

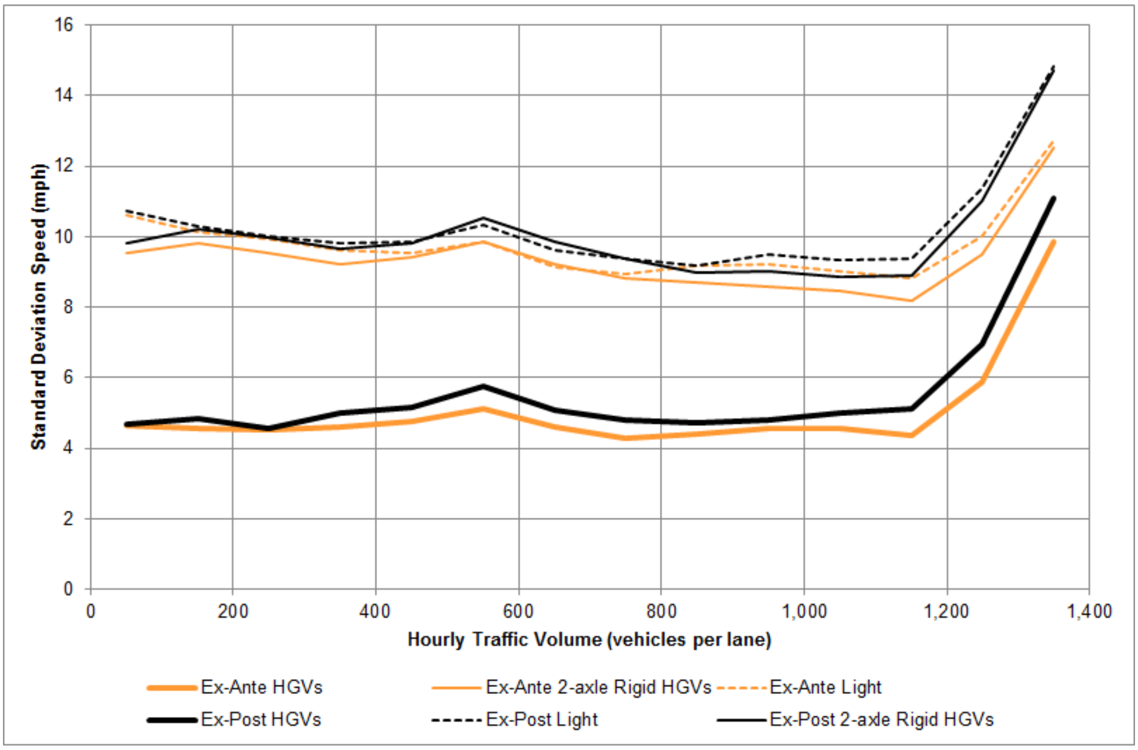
- Has speed variance changed on affected roads?
- To what extent can any changes be robustly attributed to the speed limit increase?

3.3.2 Key Metric Analysis

The analysis of variance makes use of the same dataset as the analysis of average vehicle speeds, with variances supplied as part of the dataset received from the DfT. The results of the variance analysis are presented in terms of the standard deviation of average speeds by vehicle type and flow band, which has units of mph[8]. Figure 3.3 plots the standard deviations for the ex-ante and ex-post datasets by vehicle type and flow band.

The ex-post variance in HGV speeds is generally higher than the variance in the ex-ante dataset and the same is true of the variance of light vehicle and 2-axle Rigid HGV speeds. This suggests that the increase in average speeds following the policy change have resulted in increased variances. This discussion is continued in the next section on the proportion of vehicles exceeding the speed limit.

Figure 3.3: Standard Deviations of Speeds on 2-lane 70 mph Dual Carriageways



[8] As per the single carriageway analysis, for a normally distributed dataset, a little more than two thirds of the sample will lie within one standard deviation of the mean.

3.4 Proportion of Vehicles Exceeding Speed Limit for Dual Carriageway roads

3.4.1 Evaluation Questions

The principal evaluation questions to be addressed through the analysis of the proportion of vehicles exceeding the speed limit on dual carriageways are:

- Has there been any change in the proportion of HGVs exceeding the speed limit on affected roads?
- To what extent can any changes be robustly attributed to the speed limit increase?

3.4.2 Key Metric Analysis

This analysis is, as per single carriageways, built on the core dataset used for analysing average vehicle speeds[9]. The analysis groups all vehicle observations into speed bands allowing for a presentation of the proportion of vehicles in each speed band and the calculation of the proportion of vehicles speeding.

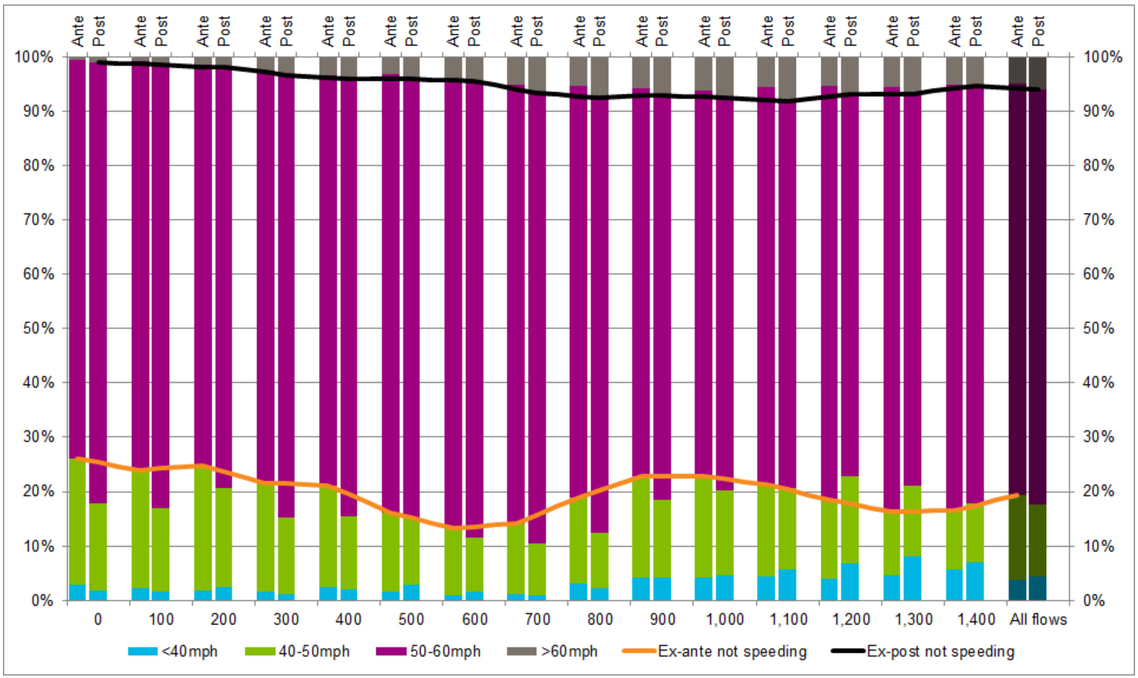
As HGVs >7.5t are speed limited to 90 kph (56 mph) theoretically there should be no vehicles speeding in the observed ex-post dataset (where the speed limit for HGVs is higher at 60 mph); however there are several reasons why there could be exceptions to this in the dataset:

- A measurement error of just 7% or greater by the recording equipment could record a speed in excess of 60 mph for a vehicle travelling at 56 mph. Equally, errors in the calibration of vehicle speed limiters could result in vehicle speeds exceeding 56 mph by a small margin;
- On downhill sections of road it is possible for vehicles to exceed the limited speed;
- A small proportion of vehicles may be operating without or with malfunctioning / disabled speed limiters; and
- Vehicle classification errors (non-HGVs classified as HGVs) will also account for some speeds in excess of 60 mph in the data.

Figure 3.4 displays the proportions of HGVs by speed band and flow band for both the ex-ante and ex-post datasets. The changes in the proportions of HGVs >7.5t by speed band are relatively small, reflecting the small changes to speeds observed in the average speed analysis.

[9] On this basis, statistical confidence in the results is in line with the average speed analysis and be considered robust in terms of presenting the observed data.

Figure 3.4: Proportions of HGVs by Speed Band



3.5 Contextual Factor Analysis

3.5.1 Evaluation Questions

The principal evaluation questions to be addressed through the analysis of the variance of vehicle speeds on dual carriageways are:

- Do any other contextual factors appear to have an influence?
- To what extent can any changes in outcome metrics be robustly attributed to the speed limit increase?

Contextual data is important in the evaluation in terms of understanding the contribution of the policy change and the influence of external factors; for example it provides an opportunity to explore other factors which may influence driver behaviour on study roads over the evaluation period. Contextual data on UK fuel prices and traffic flows was presented in the single carriageway section and is relevant to the application of the policy on dual carriageway roads as well.

A comparison of ex-ante and ex-post speeds on motorways is provided below as an indication of the changes observed in vehicle speeds on a road type where the policy change did not apply. This has been included in this section because of the similarity in the characteristics and traffic regulations of dual carriageways and motorways, but is also relevant as contextual information for single carriageway roads.

3.5.2 Motorway Speeds

Motorway sites have been included in the evaluation to act as a comparison group for the roads impacted by the increase in speed limit for HGVs, particularly for dual carriageways. No changes to motorway traffic speed regulations have been applied during the period of the evaluation. The motorway results therefore provide an opportunity to examine the average speeds of vehicles over the same timeframe as study roads and observe whether any other effects are present in the data.

Table 3.2 and Figure 3.5 shows the average speeds by vehicle type and flow band on motorway sites. This illustrates the similarity in HGV speeds over most of the flow range between the ex-ante and the ex-post datasets. This result supports the conclusions of the average speed analysis for both dual carriageways and single carriageways where evidence of increased HGV speeds was found and attributed to the policy change as applied to those road types.

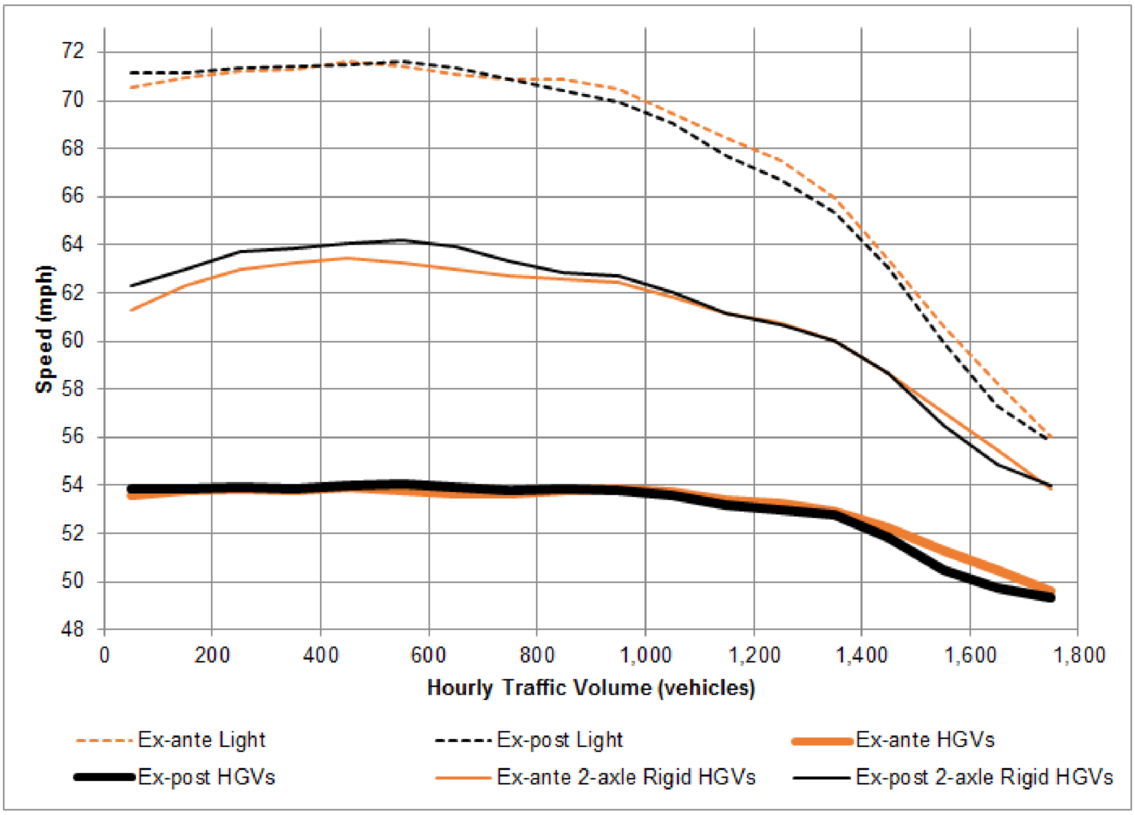
There are small measured reductions in the average speeds of light vehicles (-0.51 mph over the full range of flows) and small increases in average speeds of 2-axle Rigid HGVs (+0.74 mph over the full range of flows). The reductions in the speeds of light vehicles is contrary to the results for single carriageways and dual carriageways where small increases in light vehicle speeds were observed in the ex-post dataset. However, the result for motorways supports the conclusion that the increased light vehicle speeds on study roads is likely to have been influenced by the policy change, and the resulting change in HGV driver behaviour.

The increased speed of 2-axle Rigid HGV speeds on motorways is not as large as present on dual carriageways, but is clearly present in the data. This suggests a mixture of factors are impacting vehicle speeds in this category making it harder to understand the contribution of the policy change to these increased speeds (it is doubly hard as this vehicle class also contains a mixture of vehicles, a proportion of which are not impacted by the policy change).

Table 3.2: Average Speed Analysis Results for 70mph Motorways

Vehicle Class	Pre Limit-Increase Average Speed (mph)	Post Limit-Increase Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)
Free Flow (0 – 400 vehicles per hour per lane)			
Light vehicles	71.1	71.3	+0.20 [+0.18 to +0.21]
2-axle Rigid HGVs	62.5	63.3	+0.74 [+0.69 to +0.79]
HGVs	53.8	53.9	+0.13 [+0.13 to + 0.14]
All Flows (0 – 1,800 vehicles per hour per lane)			
Light vehicles	69.0	68.4	-0.51 [-0.52 to -0.50]
2-axle Rigid HGVs	61.7	62.0	+0.23 [+0.19 to +0.27]
HGVs	53.5	53.5	-0.03 [-0.04 to -0.02]

Figure 3.5: Motorway average speeds by flow band & vehicle type



3.5.3 Summary of Speed Impacts for Dual Carriageways

The analysis of average speeds on dual carriageways provides evidence to support the theory of change assumptions, particularly the key metric of the change in HGV average speeds. The analysis shows a 0.4 mph increase in ex-post HGV speeds on dual carriageways.

Analysis of each of the two individual years of data making up both the ex-ante and ex-post periods corroborates the results with very good correlation between the pairs of years.

The analysis of speeds data, combined with the review of contextual data and the analysis of speeds on motorway sites (acting as a form of counterfactual) makes it possible to state robustly that the observed increase in HGV >7.5t speeds on dual carriageways can be, at least partly, attributed to the policy change.

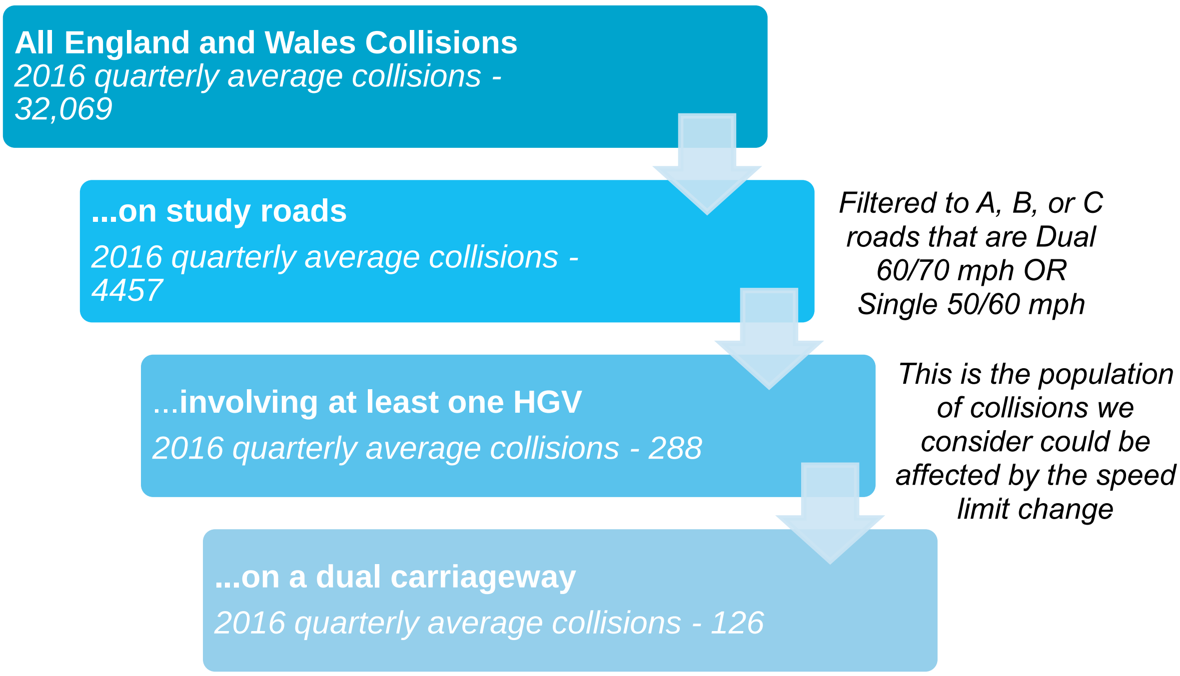
3.6 Analysis of Safety Impacts for Dual Carriageway Roads

Dual Carriageway Safety Impacts Summary:
There is some evidence of a reduction in collisions since the speed limit change across all study roads, but this result is very sensitive and so the findings should only be considered indicative at present.
Focusing on just dual carriageway roads, there is no evidence of a significant change in collisions since the policy came into force.

This section of the report considers what impact, if any, the HGV speed limit increases have had on safety on dual carriageway roads. As per the single carriageway analysis, collision data has been obtained from the Department for Transport, covering the whole of England and Wales between 2005 and December 2016[10]. Collision numbers reported in this section will be aggregated into totals by calendar year quarter (i.e. January to March is considered Quarter 1 [Q1], and October to December is considered Quarter 4 [Q4]) for the purposes of analysis.

The collision data from the DfT again required substantial filtering to focus on just the collisions of interest to this study (namely collisions involving at least one HGV on a study road). A summary of how the full dataset is subdivided for dual carriageways and how the sample reduces the more the data is disaggregated is provided in Figure 3.6.

Figure 3.6: Collision data sample sizes at each level of disaggregation



The collisions of interest to this study (i.e. involving an HGV and on a study road) only amounted to 288 per quarter, across both single and dual carriageways. The figure reduced further to 126 on just dual carriageways. As such, the consideration of trends or sub-divisions in the data has been undertaken with care not to draw spurious conclusions based on small changes; i.e. being sensitive to the fact that these are fairly

[10] This means that there are roughly 10 years of ex-ante data and approximately 21 months of ex-post data to analyse in order to measure any impacts. These analyses will be revisited in the year 3 evaluation, with the ex-post dataset growing with each subsequent evaluation, which will make the findings more robust over time.

uncommon events in the first instance. This is why statistical modelling techniques have been used to understand whether there is confidence in the changes observed.

The following set of evaluation questions in relations to safety were established during the scoping phase:

- Has the number of collisions significantly changed on affected roads?
- Have these changes differed by collision type? (slight, serious, fatal)
- Has there been any change to the contributory factors cited for collisions on affected roads?
- Have there been any changes to the type of collisions occurring on affected roads? (single or multiple vehicle, side, rear or front impacts etc.)
- To what extent can any changes be robustly attributed to the speed limit increase?

Due to the small number of collisions per quarter on study roads involving an HGV, it was considered that for most of these questions it would not be possible to make robust conclusions when disaggregating the data to both a carriageway type and another metric (e.g. to dual carriageways *and* to serious collisions).

Instead, this section of the report will explore the impact of the speed limit change on all study road collisions and disaggregate down to dual carriageway collisions, but not aim to disaggregate any further.

Analysis of specific collision types, the analysis of collision severities, type of collision analysis, and contributory factors has been undertaken with single and dual carriageways combined. This maximises the number of collisions to be analysed and increases the chance of concluding anything from this data, as these are infrequent events. This analysis is therefore presented separately in Appendix B and Appendix C.

The analysis considered quarterly collisions numbers, which have been analysed using a time series modelling approach[11] which estimates the effect of the intervention (the introduction of the HGV speed limit increase) from 2015 Q2. The statistical modelling approach provides an intervention parameter and confidence interval for this parameter, which have been used to measure the change in collisions since the HGV speed limit change and the confidence we have in this collision change.

3.6.1 All England and Wales Collisions

To provide some context to collision changes on study roads, Section 2 presented the profile of collisions on all roads in England and Wales (Figure 2.9). This showed that the total collisions on all roads in England and Wales declined from year to year, with underlying seasonality; peak collisions typically in quarter four of each year. Since 2013 the annual decline seems to have plateaued.

A time series statistical model was fitted to the data using an intervention parameter to measure the change since the HGV speed limit increase. This found no statistically significant change in collisions, as expected, given that the policy targets only specific roads and specific collisions types (i.e. those including an HGV).

3.6.2 HGV collisions on Study Roads

Section 2 also considered the impact on HGV collisions on all study roads, covering both single and dual carriageways. This is the most aggregate way in which collisions relevant to this study can be examined, and thus maximises the sample of collisions

[11] The auto ARIMA modelling function was used within the R package. Note that the auto ARIMA function chooses an ARIMA model that is the best fit, and therefore different ARIMA models could be fit to different analyses presented in this report.

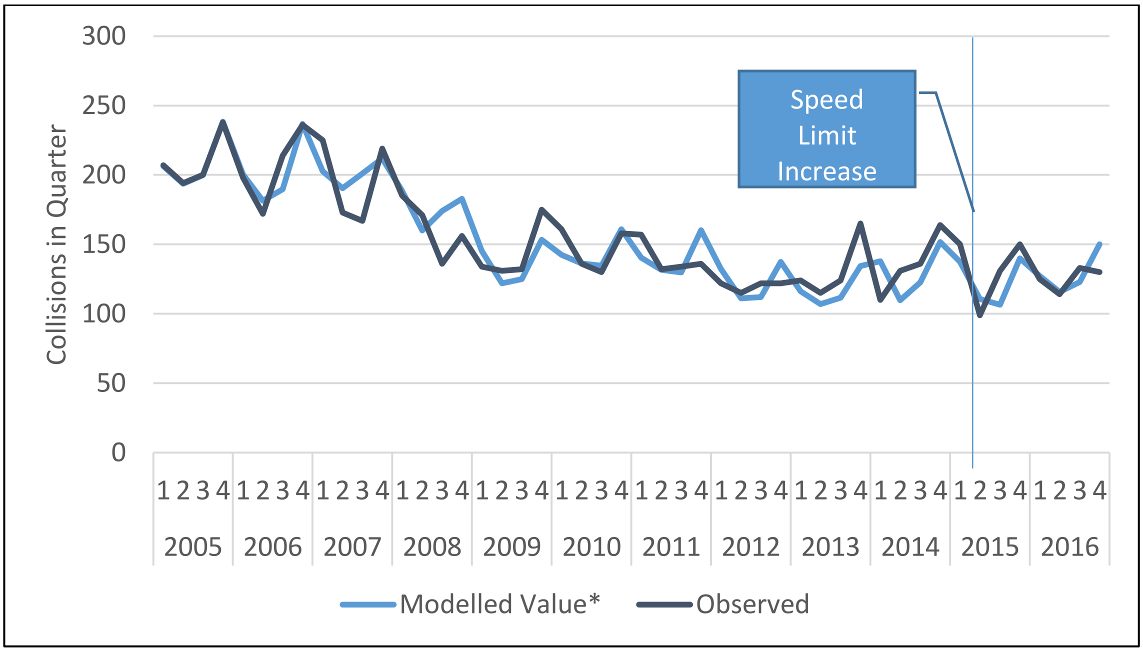
each quarter, and therefore gives the best indication of whether the new speed limit has had any impact on safety. Figure 2.10 showed a steady reduction in the total collisions per quarter involving at least one HGV, over time and for all study roads, before a plateau in later years.

The statistical model found that the outcome is very sensitive. With all the post-scheme data points included the result is a statistically significant reduction in collisions, but with the final data point removed, the finding is not significant. This therefore demonstrates that further data is required to provide clarity on the outcome, which may become clear during the Year 3 evaluation.

3.6.3 HGV Collisions on Dual Carriageways

Figure 3.7 shows a frequency plot for collisions involving at least one HGV over time for dual carriageway roads subject to the national speed limit. As with all previous analyses, the graph shows a reduction in collisions over time followed by a plateau in the recent years. The collisions per quarter range from 100-250 during the period, and between 100-150 in more recent years. As such, there were more collisions on single carriageways than dual carriageways, though this may be due to total length of single and dual carriageways subject to the national speed limit rather than because one is less safe than the other.

Figure 3.7: *Collisions involving at least one HGV, on dual carriageway study roads, per quarter*



The statistical model found no statistically significant evidence of change in collision numbers since the change in policy. Table 3.3 shows that the best estimate of the intervention parameter was for a 18.4% decrease in collisions on dual carriageway study roads. However, the 95th percentile confidence level ranged from a decrease of 35.5% to an increase of 3.1% so the result is not statistically significant, though does point in the direction of a reduction. The range of the confidence interval is large, indicating that there is substantial uncertainty in the model. It is possible that additional data in the Year 3 evaluation will help to narrow the confidence interval and bring more certainty to the finding.

Table 3.3: Statistical model outputs for dual carriageways

Carriageway Type	Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
Dual	-18.4%	-35.5%	3.1%	No

3.6.4 Summary of Impacts

This section considered the impact of the national HGV speed limit increase on personal injury collisions on all study roads and dual carriageways. This analysis was based on the ex-post data available to date. As collisions are stochastic (randomly occurring) events whose frequency is subject to fluctuations over time, statistical models were fit to the collision data to understand how the ex-post collisions differ to what might have been expected to occur without the scheme.

This section considered the change in collisions involving at least one HGV on dual carriageway roads since the HGV speed limit change. In summary, the recorded data suggested that there has not been any statistically significant change in the number of collisions involving at least one HGV on dual carriageway roads since the HGV speed limit change.

4. Other Impacts of Policy Change

This section considers other impacts of the policy change not studied specifically as part of the Year 2 evaluation, but which form part of the wider project namely environment and economy impacts.

The full environment and economy impacts work will be reported in the final, Year 3, evaluation report. A summary of the work which will be undertaken together with the results of the beta testing which was carried out for the environment tasks in Year 1 is provided below.

4.1 Environment

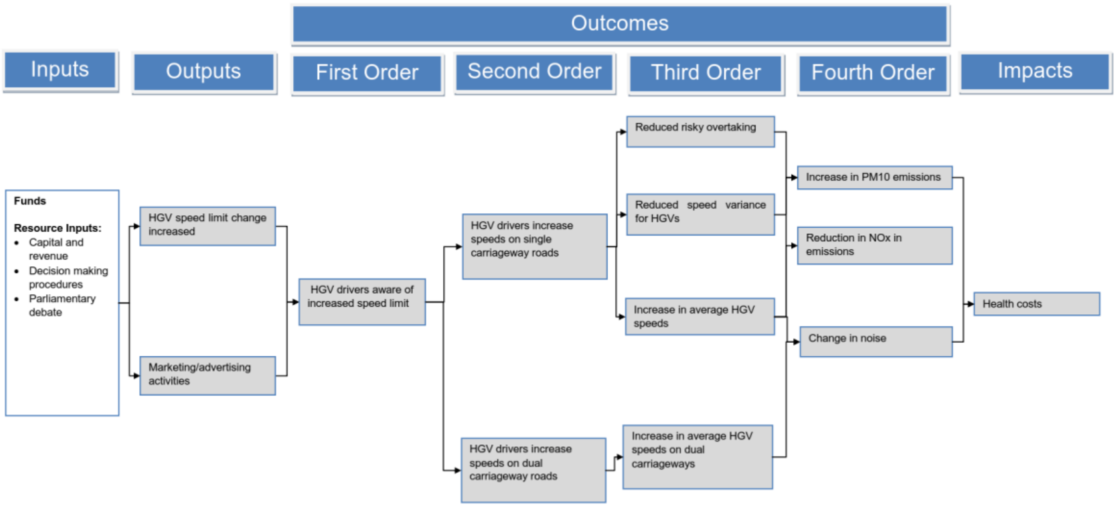
Figure 4.1 presents the ex-ante causal pathway for the environmental impacts of the speed limit change, focusing on the level of emissions. The ex-ante impact assessment of the speed limit change predicted a reduction in NOx emissions on single carriageway roads, as a consequence of HGVs travelling at slightly more efficient engine speeds at the higher end of possible increases in HGV speed assumed in the test (an increase of approximately 4 mph to 49 mph – this increase was taken from the higher end of speed increases tested within the DfT impact assessment for single carriageways). The evidence from the Year 2 evaluation has identified an average speed of HGVs of 45.6 mph on single carriageways, although as noted in Section 2 this was an increase on the pre-2015 figure of 44.1 mph.

For PM_{10}[12] emissions, although some vehicle types were forecast in the impact assessment to operate more efficiently at increased speeds, other types would be above their most efficient speed if average speeds increased to approximately 49 mph as forecast. The ex-ante analysis forecast an overall increase in PM_{10} emissions. No firm conclusions could be drawn on PM_{10} emissions from the 2016 interim analysis and this issue will be considered further in the Year 3 evaluation.

[12] PM_{10} particles are made up of a complex mixture of many different species including soot (carbon), sulphate particles, metals and inorganic salts such as sea salt. The particles vary in size and shape, up to 10 microns diameter.

The ex-ante forecasting of emissions on dual carriageways was based on the assumption that HGV speeds would not change. The data analysed to-date has indicated a small increase (0.4 mph) that is at least partially attributable to the policy change. An increase in vehicle speeds was also causally linked to a change in noise levels; however, the size of any change in noise levels is considered likely to be small. The remainder of this section discusses the noise and emissions beta testing work carried out in Year 1 to confirm a methodology.

Figure 4.1: Ex-Ante Logic Mapping Environment Pathway



4.1.1 Noise

The proposed noise calculation methodology is the standard approach used to calculate the L_{A10} index (the standard index in the UK), which represents the noise level which is exceeded for 10% of the time. This index has been shown to have a reasonably good correlation with community response. Relationships exist which allow the L_{A10} index to be converted to other indices and to allow monetisation of changes in health effects as a result of changes in noise. There is sufficient data to allow daytime and night-time noise levels to be calculated and a monetisation undertaken in the final report.

A single carriageway site has been analysed in the beta test and this has shown that the changes in noise over the standard 18 hour noise assessment period are negligible (+0.1 dB due to effect of increase in speed limit and changes to the proportion of heavy vehicles), which is in line with the result expected at the time the proposal was prepared. Noise effects for individual hours during the night are slightly larger than during the standard 18 hour day, but the results still show negligible changes in noise. Changes in noise may be different for different classifications of road.

The beta testing has shown that analysis of noise levels can be undertaken with the data available, and that results are in line with the initial project expectations. A further analysis considering road gradient could be undertaken.

4.1.2 Air Quality

The proposed air quality analysis approach and tools have been beta-tested, using available data for 2014 and 2015 at one DfT and one Highways England site. Carbon and Oxides of Nitrogen and Particulate Matter (NOx & PM) emissions have been calculated using standard DfT Transport Appraisal Guidance referred to as the WebTAG principles and emission factors - together with hourly flow/speed/ composition data from the traffic data collection element of this study supplemented by DfT national fleet model breakdowns of HGV to determine the >7.5t fleet by emissions class. The approach excludes speed banding (Interim Advice Note 185/15), assumes current tools and datasets are used throughout, and excludes any sensitivity tests. Emissions are converted to Air Quality (AQ) using simplified relationships (based on the Design Manual for Roads and Bridges, DMRB, dispersion curve algorithm for relevant roads).

Our analysis completed on a single carriageway DfT traffic count site, purely as a beta test of the process for the main evaluation, nevertheless seems to be in line with the findings of the DfT Impact Assessment for the intervention. The beta testing has shown that analysis of air quality can be undertaken with the data available (see results in Table 4.1).

Table 4.1: Change in concentration at nearest receptor

Pollutants	2014 concentration at receptor, μgm^3	2015 concentration at receptor, μgm^3	Change in concentration at receptor, μgm^3
NO_2	30.8	29.0	1.8
PM_{10}	18.9	18.8	0.1

Note: this is change attributable to total traffic changes between the before and after years, and not just the change attributable to the change in HGV flow and speed.

4.2 Economy

The DfT undertook a full economic assessment of an increase of the speed limit for HGVs over 7.5 tonnes on single carriageway roads using the National Transport Model (NTM) and indicated a net benefit in the range £65.8m to £229.4m, with a best estimate of £126.5m (equating to an average annual benefit of £19.9m) over an eighteen year appraisal period. The majority of these benefits (£16.3 million per year) are travel time and vehicle operating cost benefits for HGV operators.

The equivalent impact assessment for dual carriageways predicted no benefits in terms of time savings, vehicle operating costs, accidents or other factors, based on the assumption that since current average speeds for HGVs on dual carriageways of 53 mph were already in excess of the 50 mph limit and were equivalent to the average HGV speeds recorded on motorways (also 53 mph), then it was reasonable to expect no change in average HGV speeds on dual carriageways in response to an increase in the speed limit from 50 to 60 mph. It is considered implausible that HGV drivers would choose to drive faster on dual carriageways on average than they choose to on motorways which are of a higher standard.

A sensitivity test was undertaken to measure the impact of the speed limit change assuming that HGV speeds do increase. A speed increase of 1 mph was applied and it was calculated that this would save 650,000 hours per year and £10.3m of HGV driver time.

The ex-post economic evaluation task will be undertaken in the final year of the evaluation. The purpose of the task is to update the impact assessments discussed above in order to understand the economic impact of the speed limit increase in terms of travel time, vehicle operating costs and accidents. The update will use the results of the speeds impact assessment (in terms of average vehicle speeds and speed / flow relationships) in order to run the National Transport Model and understand the benefits / disbenefits of the policy compared with a 'Do Nothing' scenario which assumes no change occurred. The results of the assessment will also enable direct comparison with the impact assessment undertaken prior to the speed limit increase.

5. Conclusions

This report has set out the results from the second year of an ex-post evaluation of the increase in the national speed limit for HGVs > 7.5t on single carriageways and dual carriageways in England and Wales. This has been done in line with a theory of change framework developed to consider the impact of the policy change on speeds, safety, environment and economy.

Results in the second year are focussed on speeds and safety impacts through a quantitative impact analysis of data. Figure 5.1 shows the ex-ante logic map annotated with evidence from the evaluation up to and including the Year 2 work. This highlights the following results:

5.1 Single Carriageways

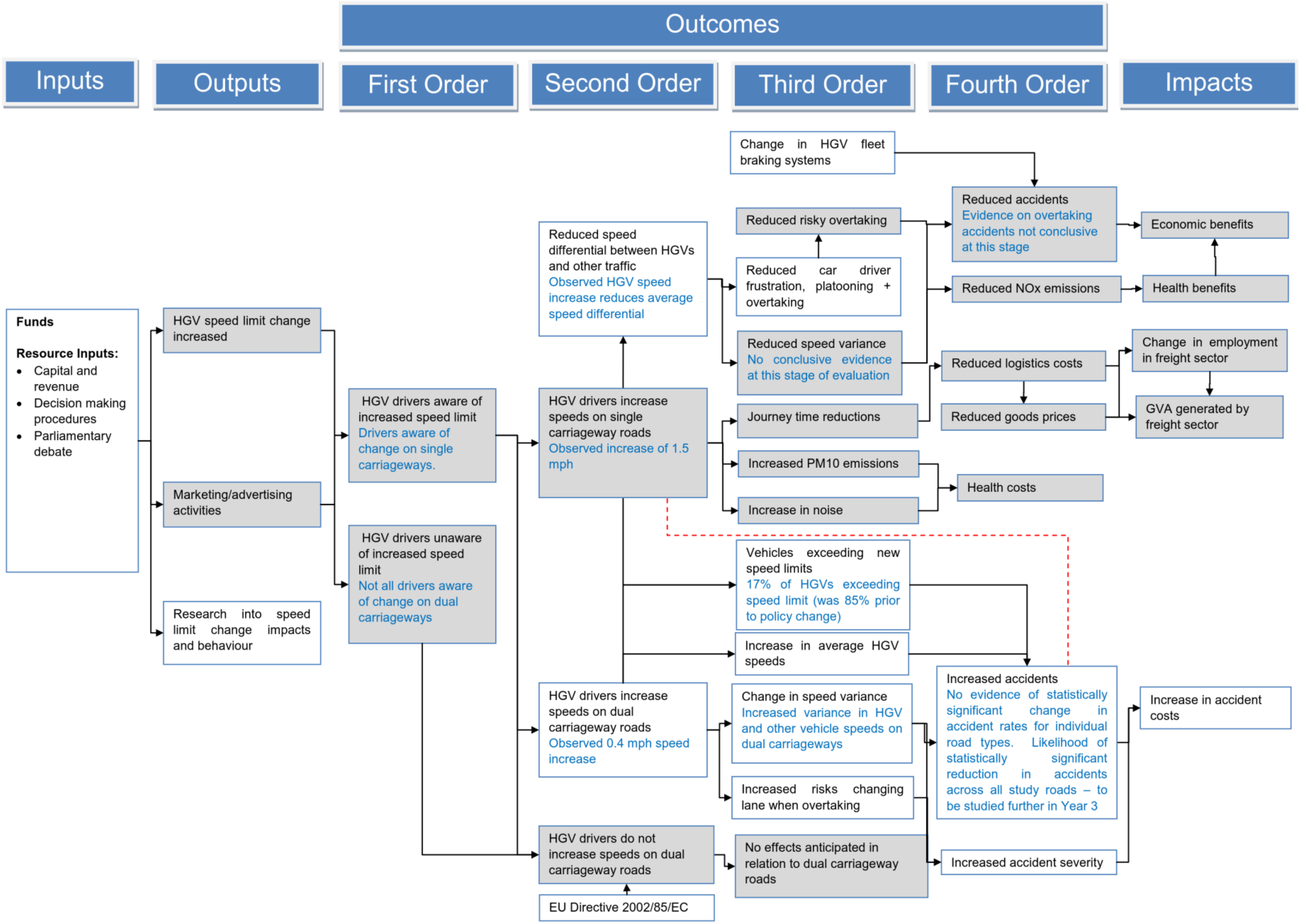
- Awareness of the policy change amongst HGV drivers was good based on the Year 1 process evaluation work;
- The average speed of HGVs has increased by 1.5 mph since April 2015;
- The average speed of other vehicle types has also increased but by smaller amounts;
- The policy change in speed limits for HGVs is therefore considered to be a contributory factor in the observed increase in HGV average speeds;
- The impact of the policy change on speed variance is inconclusive for this road type at this stage;
- 17% of HGVs >7.5t exceed the 50 mph speed limit for this vehicle type on 60 mph single carriageway roads (prior to the HGV speed limit increase this figure was 9%); and
- There has been no statistically significant change in the number of accidents involving at least one HGV on single carriageway roads. There is evidence of a statistically significant reduction in accidents across all study roads, although this finding is sensitive to the data series and will require confirmation from the Year 3 work.

5.2 Dual Carriageways

- The Year 1 process evaluation work suggested that awareness of the policy change amongst HGV drivers was mixed;
- The average speed of HGVs has increased by 0.4 mph since April 2015 and this is considered at least partially attributable to the policy change;
- The average speed of other vehicle types has also increased, for light vehicles (0.1 mph increase) this is likely to have been influenced by the policy change and resulting change in HGV driver behaviour;
- For 2-axle Rigid HGVs (0.8 mph increase) there is evidence of other effects based on the fact that speeds of this vehicle type also increased on motorway sites;
- There is evidence that the variance in HGV speeds is greater following the implementation of the policy change;
- The proportion of HGVs >7.5t vehicles exceeding 60 mph in the ex-post was 6%. Before the policy change this figure was 5%; and

- There has been no statistically significant change in the number of accidents involving at least one HGV on dual carriageway roads. There is evidence of a statistically significant reduction in accidents across all study roads, although this finding is sensitive to the data series and will require confirmation from the Year 3 work.

Figure 5.1: Annotated Year 2 Logic Map



6. Appendices

Appendix A: Speed Impact Evaluation Methodology

Introduction

An outline of the methodology applied is provided in Figure A1. This illustrates the interactions between the AECOM and DfT Traffic Survey team in terms of specifying, collating and analysing the average speeds dataset for this study.

Figure A1: Outline of Impact: Speeds Methodology

DfT Traffic Surveys Team supplies average hourly data for:
- 50 and 60 mph single carriageway roads;
- 70 mph dual carriageway roads;
- Motorways (to act as a control group).

AECOM reviews averaged data on a site by site basis;
Checks whether site is suitable for use in the study;
Identifies periods of data where road works / other anomalies mean data should be excluded from study;
Provides filtered site / time period list back to DfT.

DfT runs database query using filtered site list against vehicle by vehicle records;
Provides output of vehicle speeds / flows grouped:
- by year (2013/14, 14/15, 15/16 and 16/17);
- by road class (single, dual, motorway);
By vehicle type (Light, 2-axle Rigid, HGVs);
-by flow band (100 vehicle per hour per lane bandings).

AECOM checks results against average hourly data to confirm validity of outputs;
Compiles DfT outputs to produce analysis of:
- average speeds (with confidence intervals);
- speed variance;
- proportion of vehicles by speed band.

Data Sources

The key source of data for the impact: speeds work is the DfT Traffic Surveys Team database which contains the vehicle information recorded by the DfT network of automatic traffic counters. These data provide:

- Average hourly and individual vehicle classification and spot speeds across a wide range of sites;
- Single carriageway and dual carriageway sites will be used for primary analysis;
- Motorway sites have been used for comparison / control purposes.

A total of two years ex-ante (2013/14 (Apr – Mar), 2014/15) and two years ex-post (2015/16, 2016/17) data have been provided to conduct the analysis.

A total of 79 sites have been used in the analysis, and a majority of these include both directions of traffic flow. Table A1 summarises the number of sites used in the analysis by road type and covering both the number of sites splitting by direction and the number of site locations as held within the DfT database.

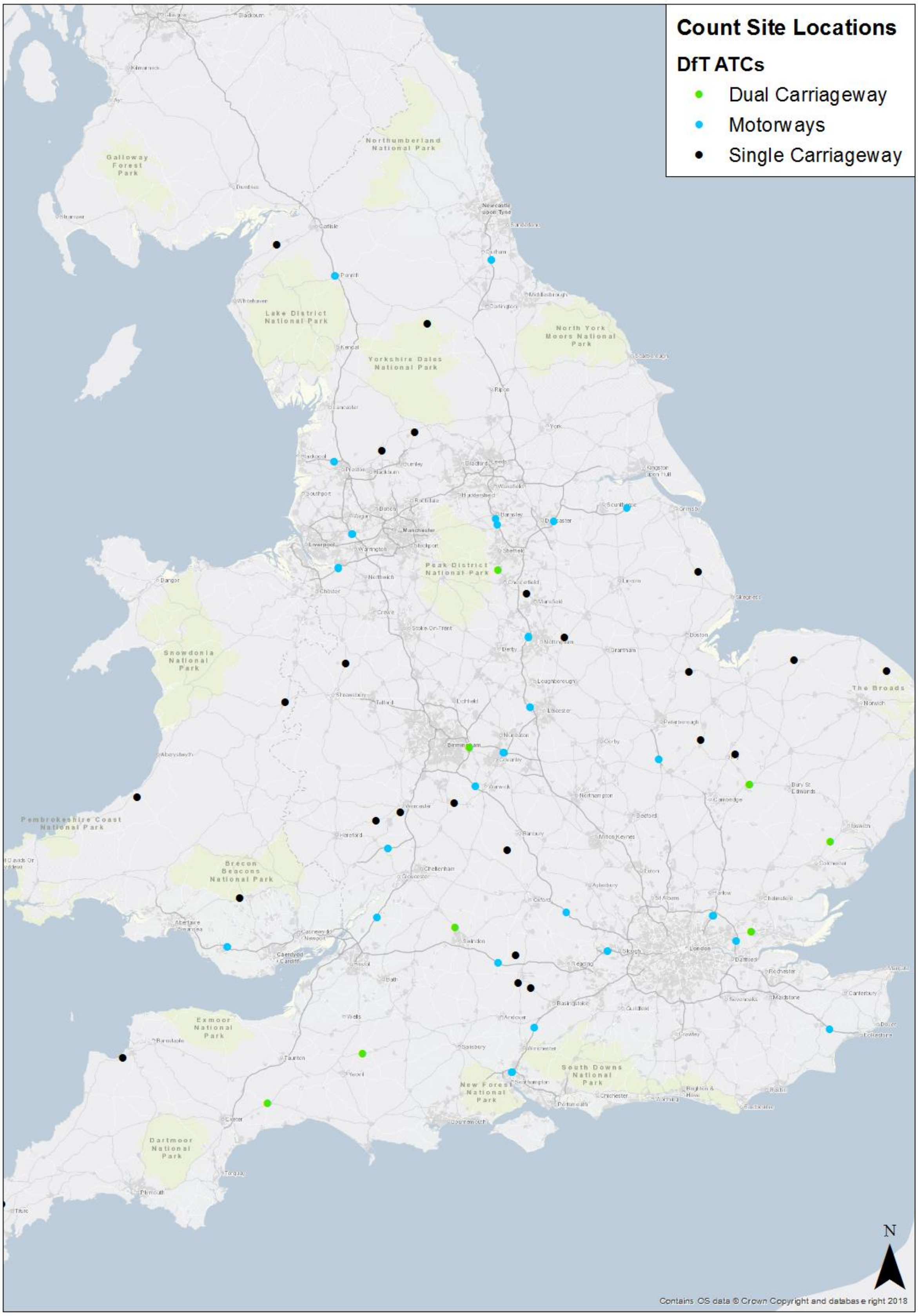
Table A1: Categorisation of count sites to be used in the study

<table>
<tr><th rowspan="2"></th><th rowspan="2">Single Carriageways</th><th colspan="2">Dual Carriageways</th><th colspan="3">Motorways</th><th rowspan="2">All Road Classes</th></tr>
<tr><th>2-lane</th><th>3-lane</th><th>2-lane</th><th>3-lane</th><th>4-lane</th></tr>
<tr><td rowspan="2">DfT Count Sites</td><td rowspan="2">50 (25)</td><td>14 (8)</td><td>2 (2)</td><td>9 (9)</td><td>29 (29)</td><td>6 (6)</td><td rowspan="2">110 (79)</td></tr>
<tr><td colspan="2">All dual carriageway sites: 16 (10)</td><td colspan="3">All motorway sites: 44 (44)</td></tr>
</table>

Note: figures in brackets represent the number of count site locations in each category.
Note: six of the single carriageway sites included in the table have 50mph speed limits.

Figure A2 shows the location of the sites used in the analysis of speeds and flows.

Figure A2: Location of Evaluation Impact: Speeds and Flows Analysis Sites



Data Checking and Cleaning

The DfT automatic traffic count data has been checked by individual site location using a template developed specifically for the purpose. The purpose of checking and cleaning the data for each site was to ensure that misleading or unrepresentative data was not included in the analysis. The checking included a number of techniques such as graphical plotting of the data and statistical calculations, to assist experienced analysts in decisions over which data to exclude.

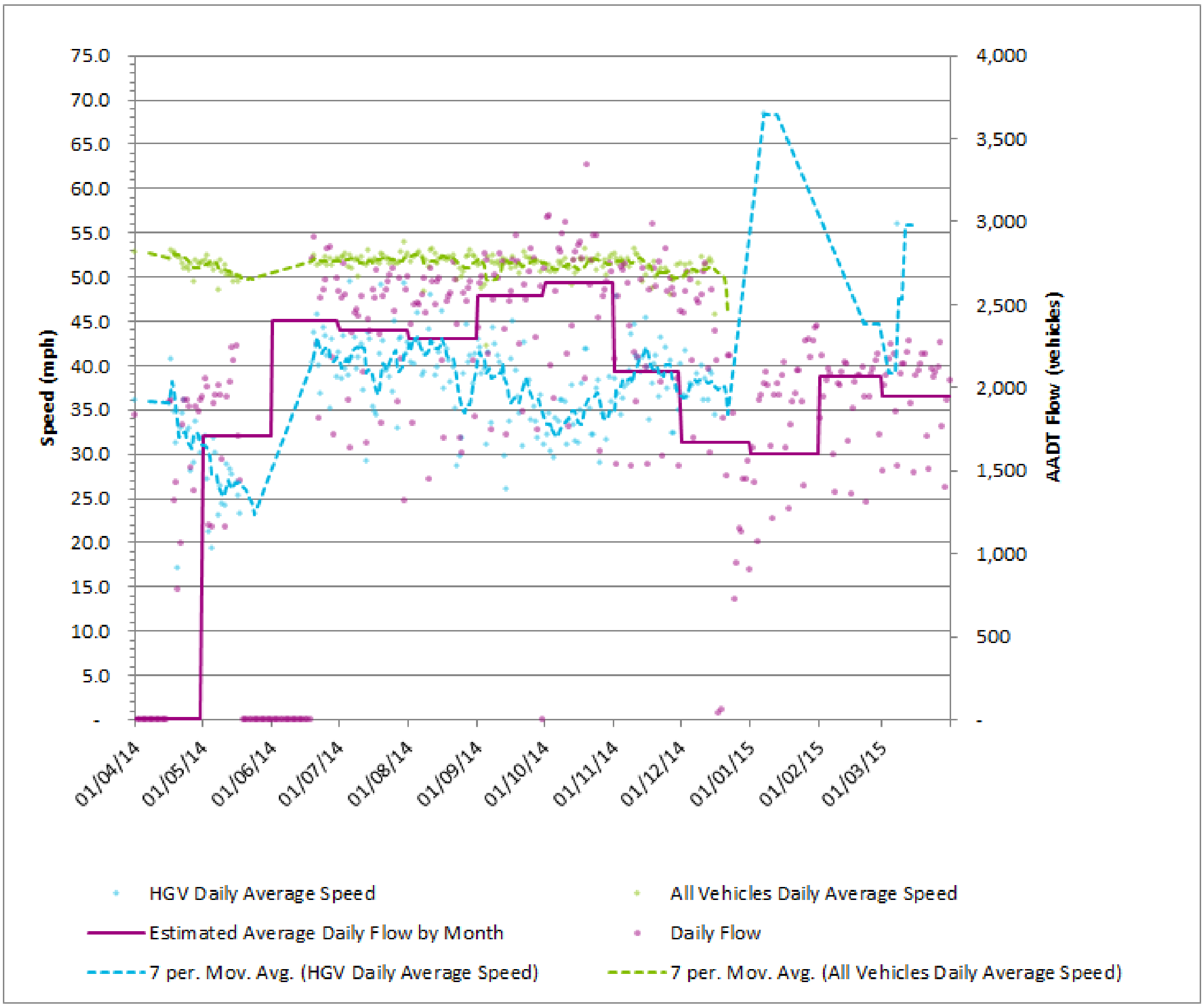
The overall approach was conservative based on the premise that data should only be excluded when there is a good reason for doing so and that rules should be applied as consistently as possible across all sites. The following list of points illustrates the decision making approach used, and a detailed sample of the tool we used for the checking is provided below.

- Looking at the flow and speed data averaged across a whole year, are there periods where traffic flows/speeds indicate that the automatic traffic counter is malfunctioning/broken?
- Looking at the speed data averaged across a whole year, are there periods when the speed varies considerably, indicating a temporary speed limit or road works are in place?
- Looking at the flow and speed data averaged across a weekday, are there time periods when congestion (breakdown of the traffic flow) is likely to be prevalent?
- Looking at a scatter plot of all the traffic flow and speed data, is there evidence of congestion which may impact on the accuracy of the traffic counters and also constrain traffic speeds in a manner which reduces the clarity of comparisons between before and after data?

Long-term analysis

Analysis of speeds and flows across a whole year (or the whole period of the analysis) highlights any periods of time when there may be a reason to exclude data from the analysis dataset. This could include periods when the counter was not functioning correctly, or a temporary speed limit was in place because of road works. Average daily flows and speeds (together with some weekly and monthly moving averages) were used to identify periods when these types of issue were present and these data were removed from the dataset used for further analysis.

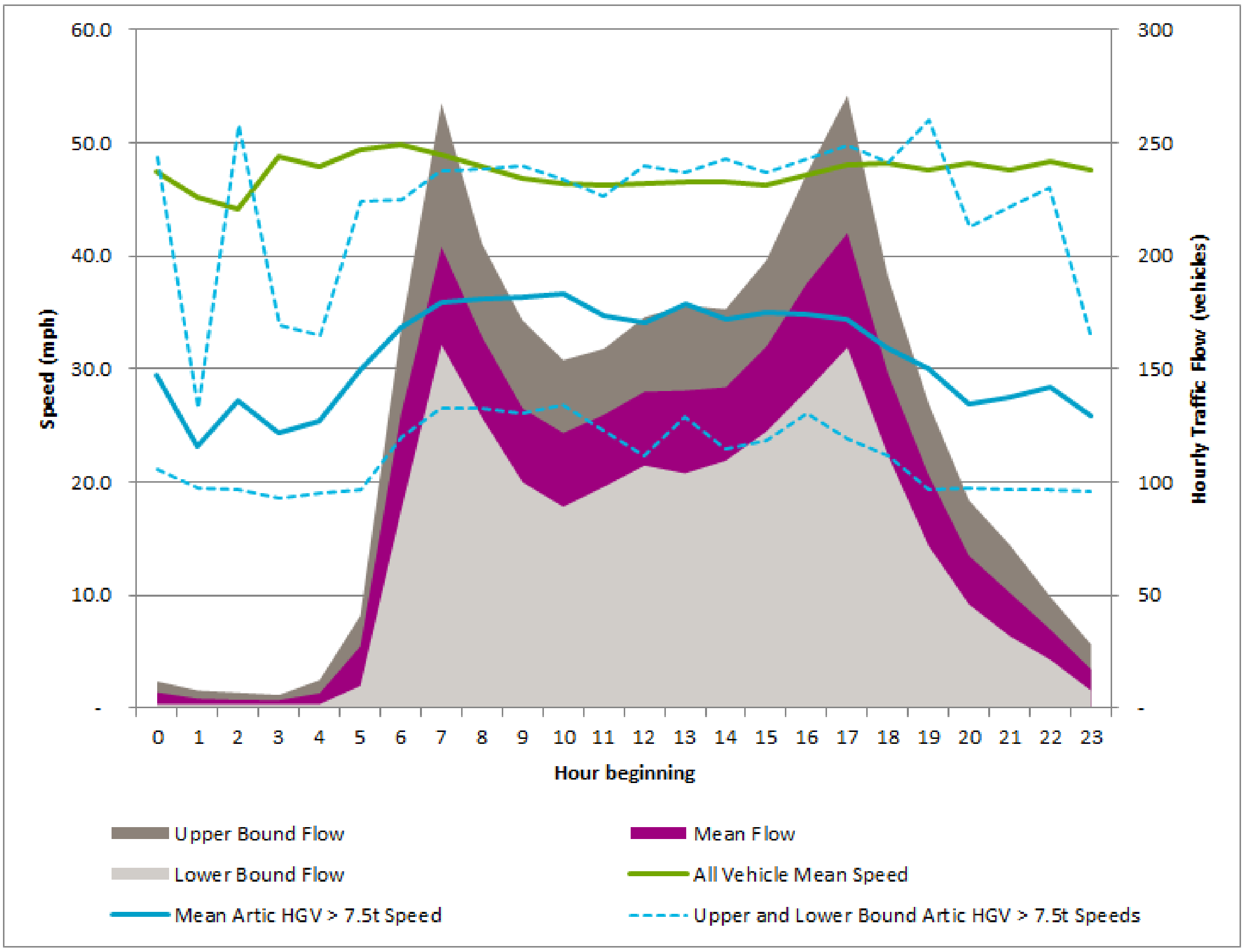
Figure A3: Example of speeds and flows at a site from April 2014 to March 2015



Daily Analysis

Analysis of average weekday flows and speeds for each hour of the day provides an indication of the general profile of traffic at each site and also an understanding of likely periods of congestion. Typically, lower average speeds are expected during periods when the traffic flow at a site is at its highest, and if traffic flows are high enough to result in congestion the reduction in average speeds might be substantial. This type of analysis can also be used to review the variance in speed and flow occurring at the sight through the calculation of lower and upper bounds around the mean (typically 10^{th} and 90^{th} percentile bounds have been applied).

Figure A4: Example of weekday speeds and flows at a site



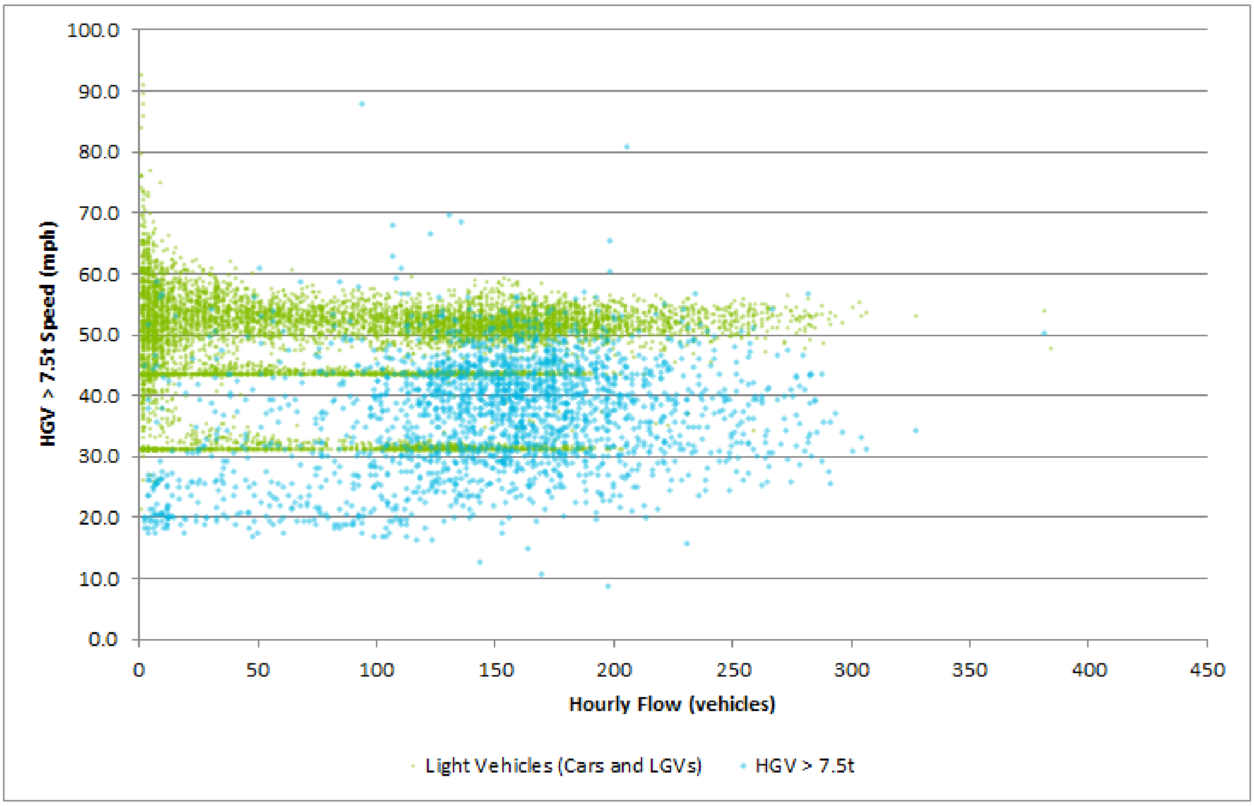
Profile of Speeds and Flows

Another tool used to analyse the raw data was plotting speeds and flows for light vehicles and HGVs > 7.5t. This type of speed / flow plot illustrates whether the typical relationship between speeds and flows is in place at a site. In general this means a scatter plot with speeds reducing as flows increase up to the capacity of the road or the highest recorded flow. If traffic demand for the road does reach the capacity of the road then periods of flow breakdown may occur and these are usually evident below the main ‘stream’ of observations.

For HGVs on dual carriageways and motorways the scatter pattern is often represented by a relatively flat line from free flow conditions up to close to the capacity of the road.

Where flow breakdown is evident and represents a reasonable proportion of results, these points have generally been filtered out of the dataset. There is no definitive way to filter out these data and the analysts have taken a cautious approach so that some of the flow breakdown may remain within the dataset. The reasons for removing flow breakdown are firstly because very slow speeds can affect the accuracy of the automatic traffic counters and secondly because is these conditions the speed of the traffic stream is entirely dependent on the discharge rate achieved at the front of the queued traffic.

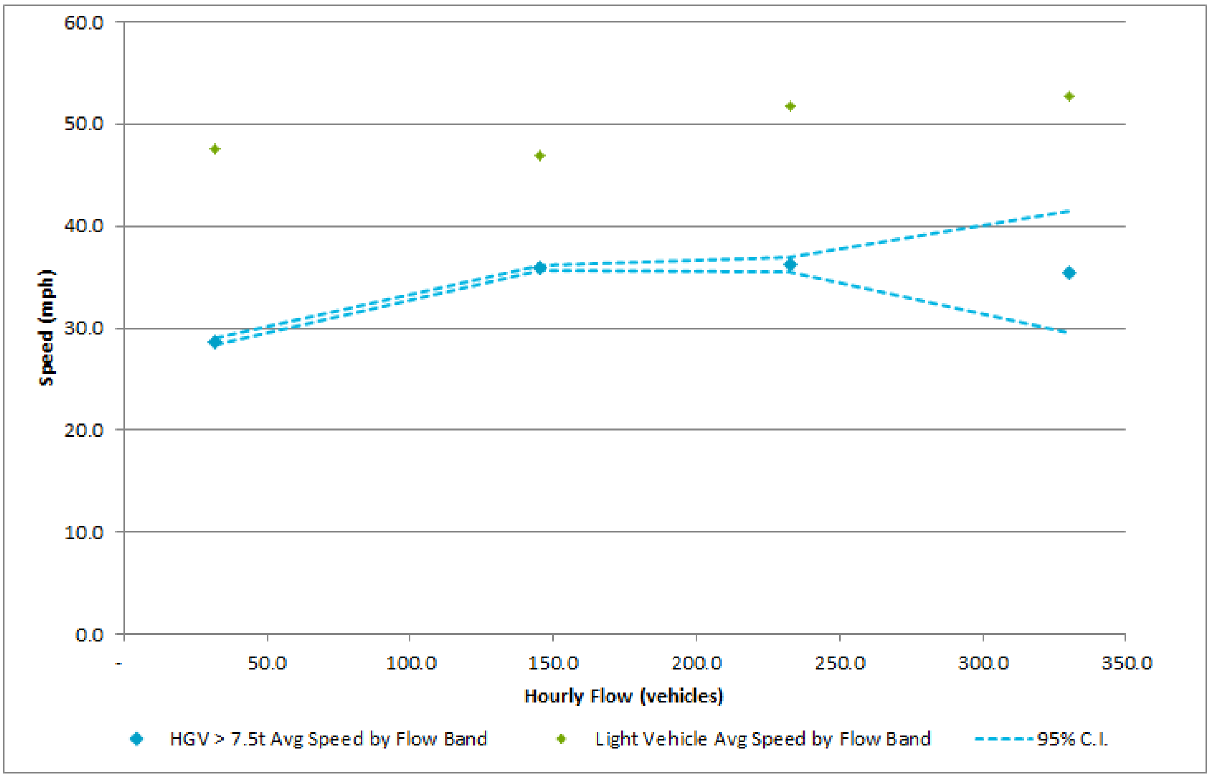
Figure A5: Example scatter plot of speeds and flows for light vehicles and HGVs > 7.5t



Flow Band Profiles

The raw data has also been averaged by 100 vehicle flow band for each site in order to obtain average speeds for light and heavy vehicles which are representative of a range of flow conditions. This averaging enables plotting of speeds and flows with greater clarity than pure scatter plots as the number of points is dramatically reduced. 95% confidence intervals were applied to the plotted HGV speeds in order to get an early indication of the accuracy of average speed estimates at different flow levels.

Figure A6: Example speed and flow plot by 100 vehicle flow bands



Analysis of Speeds

The primary purpose of the analysis of traffic speeds was to measure changes between the ex-ante and ex-post data and assess from these changes the impact of the increase in speed limits of HGVs on traffic speeds. Statistical tests have been undertaken alongside the measurement of impact in order to establish the confidence level in the results. The analysis was undertaken using various metrics to produce an understanding of the impact on speeds, in terms of average speeds, speed variance and proportion of vehicles exceeding the speed limit.

Average Speeds

Absolute changes in traffic flow were calculated by road type and vehicle type for 100 vehicle flow bands using the DfT automatic traffic count data. In order to do this traffic flows and average speeds were aggregated into the flow bands for each of the four study years based on the vehicle by vehicle data stored in the DfT database. Alongside these aggregations, statistical measures were provided for each vehicle type and flow band: sample size, standard deviation, allowing the calculation of a 95% confidence interval. This enabled the calculation of average speeds over a large range of flows and statements on the statistical confidence in these tests.

Speed Variance

Speed variance was calculated by road type and vehicle type from the individual vehicle data received from the DfT. The calculation of speed variance was undertaken by grouping individual vehicle records into vehicle types and 100 vehicle flow bands for data from before and after the speed limit increase. The standard deviation of speeds in each of these flow bands was then recorded in order to compare the impact of the policy change on speed variance.

Proportion of Vehicles Speeding

This calculation was undertaken using the same dataset as the average speed calculation. The aggregation of data was undertaken in the same manner into 100 vehicle flow bands, but additionally the data was then split into a number of speed bands and these were used to analyse the impact of the proportion of vehicles speeding before and after the policy change was introduced.

Appendix B: Quarterly Collisions on Study Roads, in which at least one HGV was involved in the collision

Question	ID	Year	Average	Percent of all	Quarterly Totals 2005				2006				2007				2008				2009				2010				2011				2012				2013				2014				2015				2016			
		Quarter			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
All HGV Collisions		All Collisions	395	100%	534	534	556	652	501	448	553	603	565	458	480	519	447	435	390	410	325	328	352	402	346	305	348	394	352	327	330	350	318	301	314	356	290	285	317	341	291	312	319	369	330	279	323	349	289	268	318	277
Severity	1	Fatal	28	7%	34	44	41	45	30	33	40	41	42	36	42	30	31	28	35	22	24	22	23	28	21	17	24	28	20	23	27	28	19	33	20	26	19	20	26	22	18	21	16	33	26	35	25	26	21	23	30	28
	2	Serious	74	19%	104	84	104	125	87	103	105	117	94	85	84	98	72	73	90	66	72	71	72	63	49	55	81	64	69	50	71	47	57	52	63	68	52	61	75	74	55	64	65	69	55	46	63	76	68	57	61	62
	3	Slight	293	74%	396	406	411	482	384	312	408	445	429	337	354	391	344	334	265	322	229	235	257	311	276	233	243	302	263	254	232	275	242	216	231	262	219	204	216	245	218	227	238	267	249	198	235	247	200	188	227	187
Number of Vehicles	1	Single Vehicle	30	8%	51	41	33	40	37	48	46	36	68	38	42	33	30	48	32	26	29	23	24	28	26	15	21	26	32	29	20	31	30	27	15	29	32	21	15	29	32	27	21	26	21	15	17	31	26	16	22	13
	>1	Multiple Vehicle	365	92%	483	493	523	612	464	400	507	567	497	420	438	486	417	387	358	384	296	305	328	374	320	290	327	368	320	298	310	319	288	274	299	327	258	264	302	312	259	285	298	343	309	264	306	318	263	252	296	264
Manoeuvres	13	Overtaking moving vehicle - offside	52	13%	83	70	86	111	60	71	63	83	71	72	61	78	73	58	60	41	46	47	39	48	49	43	39	54	36	44	49	51	48	28	39	42	29	38	39	55	34	41	40	37	30	30	25	40	31	18	25	33
	14	Overtaking static vehicle - offside	6	2%	10	9	12	7	10	7	5	15	11	4	12	14	8	5	8	9	4	7	0	6	5	4	6	2	6	5	4	2	4	4	3	4	3	5	9	5	6	4	2	3	4	3	2	3	4	1	4	7
	15	Overtaking - nearside	4	1%	7	7	9	5	9	2	9	4	3	4	4	6	7	3	5	1	4	2	4	1	2	7	4	2	4	2	1	5	2	3	6	1	2	2	6	3	2	2	3	3	1	2	3	1	0	1	3	3
Who was injured	0	Pedestrian Injured	9	2%	13	5	10	10	7	16	11	22	10	9	7	15	8	13	11	10	7	7	13	9	5	3	9	12	8	8	10	19	7	3	12	8	9	9	7	8	7	13	7	11	3	6	5	10	13	3	9	10
	1	Cyclist injured	8	2%	6	8	12	9	2	7	4	11	4	10	8	8	9	11	7	10	7	8	5	4	6	6	7	7	7	11	10	5	13	8	6	9	6	6	10	8	4	8	7	7	5	12	11	11	5	5	5	10
	2	Motorbike Rider Injured	2	0%	1	4	4	8	2	1	3	3	2	1	3	0	0	1	3	2	1	1	1	2	2	0	1	0	3	1	1	2	4	2	1	4	0	0	2	3	0	0	2	0	2	0	1	0	1	3	0	2
	3		4	1%	3	1	7	3	3	5	6	6	6	4	1	4	2	2	1	2	2	3	3	3	1	4	6	3	1	6	3	4	5	3	8	2	2	2	9	2	1	2	3	7	3	3	6	4	2	5	6	4
	4		2	1%	2	3	0	2	3	4	4	3	1	5	4	1	2	4	1	2	1	3	3	3	1	2	2	1	1	0	2	0	2	1	3	0	2	1	3	4	1	5	1	3	0	3	1	0	1	2	3	0
	5		15	4%	5	20	41	15	9	25	27	8	10	24	34	16	12	20	31	5	11	18	18	11	6	17	20	10	10	15	18	11	8	16	16	11	6	15	21	5	7	22	17	9	5	16	7	10	4	13	19	9
	16	Horse Rider Injured	0	0%	0	0	0	3	0	0	1	1	0	0	0	1	1	0	0	0	2	3	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0
1st Pt of Impact on HGV	1	Front	182	46%	243	245	250	295	237	193	275	270	262	201	228	225	218	184	198	189	148	148	161	197	170	136	167	172	146	140	144	173	170	145	140	144	146	116	139	156	133	145	150	183	160	128	158	165	160	127	142	137
	2	Back	68	17%	74	101	83	122	80	84	97	99	99	72	75	99	66	70	61	67	55	63	55	75	72	49	49	73	55	61	63	51	45	45	61	62	55	44	60	60	49	57	61	73	66	50	50	63	58	54	68	43
	3	Offside	86	22%	129	129	128	133	111	94	116	129	120	111	111	122	83	107	80	85	54	59	79	86	82	68	83	81	88	78	68	74	53	61	68	70	71	68	74	77	65	73	69	73	74	57	75	78	49	52	68	60
	4	Nearside	44	11%	58	60	67	75	54	56	52	72	65	59	46	57	48	49	40	52	43	30	43	39	38	37	37	50	34	42	32	29	35	42	41	57	29	34	35	40	33	41	31	39	25	34	31	35	20	29	25	29
HGV Skidding and Overturning	1	Skidded	56	14%	79	106	98	110	77	68	87	80	97	72	78	72	63	63	73	52	48	39	61	51	43	49	56	48	42	47	41	41	36	48	38	23	26	28	43	50	28	40	48	56	44	37	36	33	19	32	41	28
	2	Skidded and overturned	10	2%	18	19	15	15	17	20	18	15	24	14	15	7	12	8	8	12	5	11	8	6	7	5	6	10	4	9	6	5	9	9	5	8	9	10	4	4	8	3	10	9	6	3	5	5	4	7	8	2
	4	Jackknifed and overturned	2	0%	3	0	2	1	2	1	0	2	6	1	1	1	1	6	2	0	2	1	1	3	3	0	0	2	1	3	0	0	1	0	2	1	3	5	2	3	0	0	0	2	1	1	1	2	0	2	3	1
	5	Overturned	12	3%	27	19	14	12	13	13	10	17	34	16	18	13	15	24	13	12	11	12	7	11	13	7	10	9	19	13	3	7	7	15	6	13	8	4	10	8	20	9	6	6	12	7	6	14	11	4	7	4
HGV hit object in carriageway	1	Previous accident	0	0%	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	2	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	1
	2	Road works	0	0%	1	0	0	1	1	2	1	0	1	0	2	1	0	0	0	1	0	0	1	1	1	1	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0
	4	Parked vehicle	4	1%	4	7	5	5	11	4	6	7	6	8	6	3	4	1	2	4	2	4	1	3	4	7	5	1	1	6	8	2	1	4	4	3	4	2	3	3	1	5	2	8	6	6	7	2	0	3	4	6
	5	Bridge (roof)	1	0%	1	0	2	1	3	1	4	0	4	1	2	2	0	0	0	0	0	1	1	0	1	1	1	1	1	0	1	0	0	2	0	2	0	0	0	0	2	2	1	1	1	0	1	0	0	0	1	0
	6	Bridge (side)	1	0%	1	2	1	0	1	0	1	0	2	1	1	0	0	1	0	0	1	1	0	1	0	0	0	1	2	0	0	1	1	2	0	0	0	0	0	1	1	0	0	1	1	0	0	0	2	0	1	0
	7	Bollard or refuge	1	0%	1	1	1	3	1	0	2	1	0	0	2	1	1	2	0	1	1	0	1	1	1	0	0	1	0	1	0	0	1	0	1	0	3	0	0	0	0	1	1	0	1	1	0	1	0	0	2	0
	8	Open door of vehicle	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9	Central island of roundabout	0	0%	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0
	10	Kerb	3	1%	5	4	6	5	5	4	4	3	5	5	4	1	3	5	2	2	2	3	6	3	3	4	6	3	3	3	1	4	6	3	1	1	0	2	3	1	1	5	1	3	2	5	3	5	3	2	1	3
	11	Other object	1	0%	0	2	1	1	1	1	4	0	2	1	2	3	0	1	1	0	0	0	0	1	1	2	1	6	1	2	0	0	0	1	0	1	2	0	0	1	2	0	1	0	0	0	3	2	0	3	1	0
	12	Any animal (except ridden horse)	0	0%	0	0	1	1	0	0	0	1	2	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	2	0	0	0	0	0	1	0	0	0	1	1
HGV hit object off carriageway	1	Road sign or traffic signal	3	1%	6	6	6	9	4	6	2	2	6	2	5	1	3	5	3	3	6	3	0	3	2	0	2	3	7	2	4	2	5	2	1	3	1	2	2	6	1	2	2	3	3	2	2	2	1	1	1	0
	2	Lamp post	1	0%	2	4	2	2	2	2	4	2	2	1	2	1	2	2	0	1	0	0	1	4	1	0	2	2	0	1	2	0	0	3	1	2	2	1	1	0	2	0	1	0	1	3	1	0	1	0	1	0
	3	Telegraph or electricity pole	1	0%	3	2	0	2	1	0	0	0	6	0	1	2	0	0	1	1	2	0	0	1	0	1	1	2	2	1	0	2	1	1	2	1	7	2	0	2	0	1	1	2	1	0	0	2	0	0	1	2
	4	Tree	6	2%	4	4	7	11	9	9	8	11	10	7	10	9	7	8	10	2	6	7	6	5	8	4	1	4	7	5	5	7	8	9	0	7	4	5	3	5	3	6	8	7	3	4	3	7	4	5	1	4
	5	Bus stop or bus shelter	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6	Central crash barrier	6	1%	12	7	6	8	9	7	6	10	11	7	6	5	5	10	3	8	3	3	4	7	7	3	8	9	3	2	5	6	5	3	5	4	10	3	5	5	5	3	2	3	3	2	5	8	4	3	1	3
	7	Near/Offside crash barrier	4	1%	6	6	9	5	8	3	7	5	9	4	7	2	5	10	3	3	3	2	4	6	4	6	3	1	6	3	1	1	5	5	5	1	5	5	5	2	2	3	4	3	6	1	1	2	2	0	0	2
	8	Submerged in water	0	0%	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9	Entered ditch	8	2%	14	24	11	19	15	13	9	6	20	7	10	10	9	5	4	8	9	7	3	4	9	6	4	3	4	4	2	9	3	11	3	7	7	3	6	3	7	6	4	7	3	4	6	8	3	5	2	0
	10	Other permanent object	9	2%	15	16	16	23	9	9	13	17	21	16	14	11	11	10	10	12	8	10	8	12	10	7	9	9	9	10	1	6	5	13	4	6	5	7	6	3	5	7	6	8	6	3	2	4	4	2	4	1
	11	Wall or fence	1	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	2	1	0	1	6	1	2	4	3	4	5	4	1	2	2	1
Vehicle Leaving Carriageway	1	Nearside	33	8%	55	61	42	55	50	41	41	38	72	38	47	32	38	40	28	33	29	26	23	28	31	22	31	18	24	25	24	25	26	43	24	27	37	23	24	19	31	22	23	29	23	27	27	25	21	19	13	11
	2	Nearside and rebounded	3	1%	2	4	5	8	6	2	5	6	8	4	2	0	0	4	2	5	3	1	2	3	2	4	1	0	0	4	0	3	2	6	1	2	5	4	3	1	0	2	0	3	4	4	1	3	1	1	1	3
	3	Straight ahead at junction	0	0%	0	3	0	0	0	0	0	0	2	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	1	0	0	0	0
	4	Offside on to central reservation	3	1%	6	5	6	8	4	4	6	1	7	5	4	6	3	3	2	3	1	2	1	4	3	2	7	3	3	1	3	5	1	3	3	1	6	3	3	2	1	2	2	3	5	2	2	3	1	1	1	3
	5	Offside on to centrl res + rebounded	1	0%	1	2	2	2	5	2	0	3	1	2	0	1	1	3	1	4	0	0	0	2	1	0	1	3	1	0	0	1	0	0	2	0	3	1	0	1	2	0	0	0	0	0	2	2	0	1	1	0
	6	Offside - crossed central reservation	1	0%	2	1	0	3	1	3	2	3	4	1	1	0	2	2	0	0	1	1	2	1	0	0	3	2	0	1	1	1	2	0	1	1	0	0	0	5	0	0	1	0	1	0	0	2	0	1	1	2
	7	Offside	14	4%	14	23	25	25	21	15	17	18	21	19	27	14	15	11	13	14	12	11	13	16	17	6	8	15	16	17	10	11	13	8	7	11	10	9	9	9	12	9	11	22	10	5	6	13	14	10	13	9
	8	Offside and rebounded	1	0%	2	3	0	0	1	1	3	1	2	0	1	1	1	0	0	0	0	1	0	1	1	0	1	3	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	2

	101	Poor or defective road surface	2	1%	2.3	3.4	5.6	5.6	1.1	4.5	1.1	4.5	1.1	4.4	1.1	3.3	0.0	1.1	0.0	6.5	2.2	2.2	0.0	2.2	4.5	3.4	0.0	1.1	3.4	2.2	2.2	4.5	1.1	3.3	1.1	2.2	1.1	4.5	2.2	3.3	2.2	0.0	2.2	1.1	2.6	2.6	0.0	2.6	1.2	0.0	2.4	0.0
	102	Deposit on road	6	1%	2.3	6.8	9.0	19.2	4.5	3.3	11.1	12.2	16.6	4.4	8.8	12.2	4.4	2.2	8.7	12.0	4.5	2.2	5.6	7.8	3.4	3.4	2.2	5.6	4.5	2.2	3.4	5.6	1.1	2.2	5.5	5.5	1.1	0.0	2.2	4.5	2.2	5.4	1.1	8.6	2.6	3.8	5.1	11.5	1.2	6.1	2.4	2.4
	103	Slippery road (due to weather)	42	11%	78.9	28.2	48.4	112.7	70.1	34.5	47.9	82.4	53.1	44.2	34.3	57.5	64.4	22.9	39.3	63.3	50.1	18.9	26.7	93.6	80.9	12.4	34.8	89.9	48.1	10.1	19.0	47.0	34.4	27.7	26.6	57.6	41.2	8.9	19.0	34.6	33.4	10.8	17.2	38.8	31.9	8.9	19.1	42.1	30.3	18.2	19.4	19.4
	104	Inadequate signs/road markings	2	0%	2.3	1.1	5.6	4.5	4.5	2.2	0.0	1.1	1.1	2.2	0.0	2.2	2.2	1.1	2.2	3.3	0.0	2.2	1.1	0.0	4.5	1.1	2.2	4.5	1.1	1.1	2.2	1.1	0.0	1.1	0.0	1.1	1.1	0.0	0.0	0.0	0.0	1.1	0.0	1.1	3.8	0.0	2.6	0.0	0.0	0.0	0.0	1.2
	105	Defective traffic signals	0	0%	0.0	2.3	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	106	Traffic calming	0	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
	107	Temporary road layout	2	1%	6.8	4.5	3.4	2.3	3.3	5.6	1.1	4.5	3.3	3.3	4.4	3.3	4.4	2.2	5.5	3.3	2.2	1.1	3.3	3.3	1.1	2.2	1.1	0.0	3.4	1.1	0.0	2.2	1.1	0.0	0.0	2.2	0.0	1.1	2.2	1.1	0.0	1.1	0.0	2.2	2.6	1.3	1.3	3.8	3.6	0.0	2.4	0.0
	108	Road layout	23	6%	34.9	25.9	48.4	43.9	21.2	20.0	37.8	36.7	21.0	28.8	34.3	23.2	28.4	21.8	30.6	25.1	15.6	24.5	26.7	16.7	14.6	15.7	30.3	21.3	24.6	12.3	22.4	13.4	16.6	17.7	26.6	20.0	17.8	15.6	20.1	14.5	20.5	19.4	14.0	24.8	16.6	5.1	10.2	16.6	7.3	20.6	12.1	6.1
	109	Animal/object in carriageway	6	1%	1.1	4.5	10.1	12.4	10.0	5.6	5.6	21.2	11.1	5.5	4.4	5.5	5.5	2.2	1.1	6.5	6.7	2.2	5.6	7.8	4.5	4.5	6.7	6.7	4.5	3.4	5.6	4.5	2.2	7.8	2.2	4.4	6.7	4.5	3.3	3.3	8.6	2.2	5.4	9.7	7.7	1.3	3.8	2.6	1.2	1.2	2.4	2.4
	110	Slippery inspection cover/road marking	0	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	201	Defective tyres	4	1%	4.5	11.3	0.0	3.4	4.5	3.3	8.9	7.8	4.4	3.3	7.7	5.5	4.4	6.5	5.5	4.4	2.2	6.7	2.2	4.5	5.6	2.2	4.5	3.4	3.4	2.2	2.2	4.5	2.2	4.4	0.0	2.2	0.0	4.5	2.2	4.5	0.0	1.1	3.2	3.2	2.6	1.3	1.3	2.6	2.4	2.4	2.4	0.0
	202	Defective lights or indicators	1	0%	2.3	2.3	2.3	2.3	3.3	1.1	1.1	2.2	0.0	1.1	1.1	2.2	1.1	1.1	0.0	2.2	1.1	0.0	1.1	1.1	0.0	0.0	2.2	0.0	4.5	2.2	3.4	0.0	1.1	0.0	2.2	0.0	2.2	0.0	0.0	1.1	1.1	1.1	1.1	1.1	2.6	1.3	0.0	0.0	0.0	0.0	1.2	2.4
	203	Defective brakes	3	1%	0.0	6.8	2.3	0.0	7.8	5.6	2.2	5.6	8.8	5.5	2.2	6.6	3.3	3.3	2.2	2.2	0.0	4.5	1.1	1.1	0.0	3.4	3.4	1.1	2.2	3.4	1.1	1.1	3.3	1.1	4.4	2.2	3.3	5.6	2.2	1.1	2.2	1.1	1.1	1.1	3.8	2.6	0.0	1.3	1.2	1.2	2.4	1.2
	204	Defective steering or suspension	1	0%	2.3	2.3	1.1	1.1	3.3	2.2	0.0	1.1	2.2	2.2	3.3	1.1	0.0	1.1	1.1	3.3	2.2	1.1	0.0	0.0	2.2	0.0	0.0	1.1	0.0	0.0	1.1	1.1	1.1	1.1	5.5	1.1	4.5	0.0	2.2	2.2	2.2	2.2	0.0	2.2	1.3	0.0	0.0	0.0	1.2	2.4	0.0	0.0
	205	Defective or missing mirrors	0	0%	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	206	Poorly loaded vehicle or trailer	7	2%	6.8	10.1	11.3	9.0	11.1	7.8	17.8	11.1	3.3	7.7	12.2	11.1	3.3	8.7	4.4	5.5	6.7	5.6	4.5	4.5	3.4	13.5	10.1	9.0	13.4	4.5	5.6	3.4	5.5	6.7	10.0	4.4	4.5	7.8	3.3	6.7	3.2	4.3	5.4	2.2	2.6	3.8	5.1	1.3	2.4	2.4	3.6	2.4
	301	Disobeyed automatic traffic signal	1	0%	1.1	0.0	0.0	0.0	0.0	2.2	3.3	1.1	2.2	2.2	2.2	3.3	0.0	5.5	1.1	1.1	2.2	0.0	2.2	1.1	2.2	2.2	1.1	0.0	0.0	2.2	1.1	1.1	0.0	0.0	0.0	0.0	1.1	0.0	3.3	1.1	0.0	1.1	0.0	1.1	0.0	2.6	1.3	0.0	0.0	0.0	0.0	0.0
	302	Disobeyed Stop sign/markings	6	2%	13.5	16.9	11.3	13.5	10.0	6.7	3.3	12.2	8.8	5.5	5.5	4.4	8.7	6.5	10.9	6.5	5.6	1.1	4.5	6.7	4.5	6.7	5.6	7.9	7.8	5.6	2.2	3.4	6.7	5.5	1.1	6.7	4.5	2.2	3.3	6.7	4.3	4.3	4.3	5.4	0.0	3.8	1.3	3.8	2.4	2.4	4.8	3.6
	303	Disobeyed double white line	6	1%	7.9	7.9	6.8	7.9	6.7	8.9	5.6	10.0	8.8	7.7	5.5	13.3	7.6	5.5	6.5	5.5	6.7	3.3	2.2	5.6	2.2	2.2	5.6	5.6	1.1	2.2	4.5	6.7	4.4	2.2	7.8	4.4	5.6	2.2	4.5	6.7	3.2	4.3	4.3	4.3	8.9	3.8	2.6	2.6	6.1	2.4	3.6	8.5
	304	Disobeyed pedestrian crossing	0	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	305	Illegal turn or direction of travel	3	1%	4.5	2.3	3.4	12.4	4.5	3.3	3.3	2.2	5.5	3.3	3.3	4.4	1.1	2.2	2.2	2.2	3.3	0.0	1.1	4.5	1.1	2.2	2.2	0.0	3.4	1.1	1.1	2.2	2.2	2.2	0.0	2.2	2.2	2.2	2.2	3.3	2.2	1.1	6.5	3.2	1.3	0.0	2.6	3.8	1.2	3.6	3.6	6.1
	306	Exceeding speed limit	15	4%	14.6	14.6	33.8	29.3	13.4	16.7	23.4	21.2	26.5	26.5	33.2	8.8	10.9	21.8	16.4	13.1	13.4	18.9	10.0	8.9	12.4	19.1	14.6	11.2	5.6	8.9	20.1	12.3	6.7	14.4	7.8	7.8	4.5	15.6	12.3	16.7	4.3	11.9	7.5	14.0	5.1	8.9	8.9	15.3	2.4	4.8	13.3	8.5
	307	Travelling too fast for conditions	41	10%	63.1	64.2	65.4	82.3	65.7	51.2	60.1	89.1	75.2	63.0	56.4	66.4	52.4	45.8	30.6	45.8	33.4	29.0	42.3	63.5	20.2	19.1	33.7	39.3	31.3	29.1	36.9	38.0	23.3	24.4	31.0	37.7	24.5	16.7	25.6	26.8	28.0	17.2	11.9	32.3	33.2	19.1	17.9	35.7	27.9	30.3	24.2	17.0
	308	Following too close	42	11%	57.5	64.2	60.8	62.0	62.3	40.1	64.6	55.7	64.2	42.0	52.0	58.6	51.3	40.4	48.0	46.9	33.4	34.5	43.4	57.9	31.5	32.6	38.2	39.3	26.8	39.1	23.5	31.3	27.7	29.9	26.6	48.8	33.4	30.1	33.4	34.6	40.9	34.5	31.3	37.7	47.2	21.7	43.4	31.9	21.8	30.3	46.0	23.0
	309	Vehicle travelling along pavement	0	0%	0.0	0.0	2.3	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	310	Cyclist entering road from pavement	0	0%	0.0	1.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
	401	Junction overshoot	5	1%	10.1	7.9	7.9	7.9	5.6	4.5	7.8	5.6	11.1	5.5	3.3	13.3	5.5	5.5	8.7	7.6	5.6	2.2	1.1	3.3	3.4	1.1	4.5	4.5	3.4	3.4	3.4	7.8	3.3	3.3	4.4	5.5	3.3	6.7	3.3	10.0	5.4	1.1	3.2	3.2	3.8	2.6	2.6	3.8	2.4	0.0	2.4	1.2
	402	Junction restart	5	1%	10.1	12.4	12.4	5.6	4.5	4.5	5.6	7.8	8.8	6.6	6.6	6.6	3.3	1.1	5.5	8.7	3.3	4.5	2.2	6.7	4.5	7.9	6.7	1.1	2.2	3.4	8.9	4.5	5.5	4.4	5.5	3.3	1.1	3.3	1.1	4.5	3.2	6.5	5.4	1.1	1.3	3.8	2.6	1.3	7.3	1.2	4.8	2.4
	403	Poor turn or manoeuvre	71	18%	108.2	102.5	102.5	129.6	106.9	67.9	98.0	114.7	92.9	84.1	70.8	90.7	80.8	87.3	64.4	48.0	51.2	63.5	53.5	65.7	44.9	52.8	51.7	70.8	51.5	67.1	61.5	62.6	63.2	52.1	49.9	84.2	58.0	58.0	69.1	65.8	51.7	63.6	55.0	61.4	54.9	62.5	66.3	67.6	42.4	44.8	47.2	46.0
	404	Failed to signal/misleading signal	7	2%	11.3	11.3	11.3	11.3	6.7	11.1	3.3	14.5	13.3	14.4	8.8	11.1	6.5	9.8	7.6	10.9	7.8	7.8	6.7	7.8	3.4	5.6	5.6	5.6	4.5	7.8	10.1	5.6	5.5	7.8	4.4	3.3	6.7	4.5	7.8	3.3	3.2	8.6	5.4	2.2	2.6	2.6	3.8	8.9	2.4	3.6	9.7	2.4
	405	Failed to look properly	140	36%	149.9	161.1	171.3	198.3	161.4	141.4	180.3	211.5	182.5	134.9	137.2	179.2	144.1	147.4	139.7	132.1	117.0	117.0	104.7	132.6	124.7	125.8	125.8	132.6	123.0	136.5	133.1	135.3	139.7	130.8	124.1	145.2	108.1	110.4	129.3	140.5	99.1	142.2	127.2	155.2	141.6	116.1	142.9	150.5	121.1	90.9	141.7	111.4
	406	Failed to judge other person's speed	117	30%	120.6	147.6	128.4	190.4	131.4	143.6	145.8	160.3	149.3	121.7	118.4	157.1	132.1	132.1	109.1	105.9	79.1	99.1	100.3	105.8	103.4	95.5	98.9	109.0	97.3	120.8	110.7	99.5	118.6	94.2	97.5	106.4	112.6	81.4	104.8	120.4	93.8	115.3	117.5	129.3	113.5	88.0	105.9	102.1	112.7	100.5	105.4	87.2
	407	Passing too close to NMU	4	1%	5.6	3.4	3.4	3.4	1.1	6.7	4.5	6.7	3.3	5.5	3.3	5.5	6.5	6.5	1.1	4.4	3.3	4.5	3.3	0.0	2.2	2.2	4.5	5.6	1.1	4.5	5.6	3.4	6.7	6.7	2.2	4.4	1.1	3.3	4.5	4.5	3.2	2.2	3.2	2.2	1.3	1.3	1.3	5.1	2.4	1.2	1.2	2.4
	408	Sudden Braking	46	12%	50.7	72.1	84.5	84.5	59.0	49.0	75.7	53.4	61.9	48.7	73.0	63.0	64.4	58.9	44.8	50.2	34.5	46.8	44.6	52.4	42.7	39.3	39.3	46.1	29.1	34.7	40.3	32.4	32.1	36.6	31.0	48.8	33.4	23.4	27.9	40.1	23.7	26.9	40.9	44.2	37.0	31.9	25.5	37.0	32.7	26.6	35.1	12.1
	409	Swerved	27	7%	33.8	33.8	33.8	42.8	34.5	26.7	32.3	26.7	42.0	27.7	25.4	22.1	29.5	49.1	17.5	33.8	24.5	26.7	25.6	31.2	35.9	14.6	29.2	35.9	19.0	16.8	21.3	20.1	22.2	20.0	24.4	20.0	29.0	22.3	24.5	14.5	17.2	15.1	23.7	28.0	24.2	17.9	25.5	26.8	19.4	14.5	18.2	9.7
	410	Loss of control	59	15%	75.5	82.3	96.9	105.9	57.9	74.6	92.4	72.4	87.4	59.7	90.7	70.8	74.2	86.2	60.0	68.8	55.7	51.2	50.1	73.5	47.2	44.9	51.7	56.2	50.3	42.5	43.6	44.7	52.1	48.8	39.9	58.7	51.3	44.6	50.2	37.9	49.6	35.6	38.8	61.4	40.8	34.4	40.8	42.1	38.8	43.6	42.4	37.6
	501	Impaired by alcohol	8	2%	16.9	7.9	19.2	9.0	5.6	2.2	5.6	11.1	11.1	11.1	5.5	7.7	5.5	7.6	7.6	10.9	7.8	4.5	4.5	6.7	4.5	5.6	9.0	12.4	8.9	7.8	8.9	10.1	3.3	4.4	8.9	6.7	3.3	8.9	8.9	6.7	3.2	8.6	5.4	3.2	6.4	8.9	11.5	10.2	2.4	6.1	7.3	8.5
	502	Impaired by drugs	2	0%	2.3	1.1	3.4	3.4	1.1	1.1	2.2	2.2	2.2	0.0	3.3	2.2	0.0	0.0	2.2	3.3	1.1	3.3	1.1	0.0	1.1	1.1	3.4	3.4	2.2	2.2	2.2	3.4	1.1	0.0	0.0	3.3	0.0	2.2	0.0	1.1	0.0	2.2	3.2	3.2	1.3	1.3	1.3	3.8	2.4	1.2	2.4	4.8
Contributory Factors	503	Fatigue	19	5%	20.3	23.7	25.9	32.7	25.6	31.2	30.1	18.9	29.9	15.5	28.8	17.7	6.5	17.5	16.4	20.7	10.0	16.7	24.5	20.1	10.1	15.7	16.9	13.5	20.1	22.4	12.3	15.7	12.2	18.8	11.1	22.2	16.7	11.1	22.3	12.3	8.6	16.2	22.6	19.4	14.0	17.9	12.8	15.3	14.5	17.0	18.2	14.5
	504	Defective eyesight	1	0%	1.1	1.1	2.3	0.0	0.0	0.0	1.1	0.0	1.1	0.0	2.2	1.1	0.0	1.1	2.2	3.3	0.0	0.0	1.1	0.0	2.2	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1	0.0	1.1	2.6	0.0	0.0	1.3	0.0	0.0	0.0	1.2
	505	Illness or disability	9	2%	4.5	13.5	4.5	9.0	12.2	7.8	14.5	7.8	4.4	4.4	16.6	6.6	4.4	12.0	12.0	8.7	6.7	10.0	11.1	10.0	4.5	6.7	9.0	7.9	10.1	7.8	5.6	5.6	8.9	8.9	10.0	11.1	10.0	8.9	8.9	10.0	11.9	8.6	8.6	17.2	10.2	14.0	12.8	14.0	14.5	8.5	20.6	13.3
	506	Not displaying lights	1	0%	0.0	1.1	1.1	2.3	5.6	0.0	1.1	4.5	1.1	0.0	1.1	2.2	3.3	0.0	0.0	2.2	2.2	0.0	1.1	0.0	0.0	1.1	1.1	0.0	3.4	2.2	1.1	2.2	2.2	0.0	0.0	2.2	4.5	0.0	1.1	1.1	0.0	0.0	1.1	1.1	1.3	0.0	0.0	3.8	1.2	0.0	2.4	2.4
	507	Cyclist with dark clothing at night	1	0%	2.3	3.4	2.3	1.1	1.1	0.0	0.0	0.0	0.0	0.0	2.2	2.2	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	2.2	1.1	1.1	1.1	3.4	1.1	1.1	1.1	2.2	0.0	0.0	1.1	2.2	0.0	1.1	2.2	0.0	0.0	1.1	3.2	1.3	0.0	0.0	1.3	0.0	0.0	1.2	1.2
	508	Driver using mobile phone	3	1%	1.1	1.1	2.3	6.8	1.1	0.0	2.2	1.1	1.1	1.1	4.4	4.4	3.3	6.5	3.3	1.1	4.5	2.2	1.1	5.6	5.6	6.7	2.2	1.1	3.4	3.4	3.4	2.2	4.4	4.4	3.3	1.1	2.2	5.6	5.6	1.1	2.2	3.2	6.5	6.5	5.1	2.6	3.8	3.8	3.6	2.4	6.1	6.1
	509	Distraction inside vehicle	15	4%	15.8	11.3	12.4	15.8	16.7	23.4	16.7	16.7	13.3	18.8	14.4	8.8	10.9	17.5	14.2	12.0	10.0	10.0	14.5	17.8	5.6	14.6	19.1	12.4	13.4	23.5	14.5	15.7	13.3	11.1	17.7	11.1	8.9	16.7	23.4	10.0	15.1	11.9	22.6	21.6	11.5	24.2	15.3	14.0	15.7	10.9	17.0	17.0
	510	Distraction outside vehicle	7	2%	11.3	13.5	18.0	12.4	14.5	8.9	6.7	12.2	4.4	8.8	4.4	4.4	6.5	9.8	2.2	4.4	8.9	4.5	0.0	5.6	3.4	3.4	5.6	5.6	2.2	5.6	11.2	7.8	8.9	8.9	7.8	2.2	0.0	5.6	5.6	5.6	4.3	3.2	7.5	8.6	2.6	6.4	5.1	6.4	2.4	2.4	6.1	3.6
	601	Aggressive driving	11	3%	23.7	16.9	14.6	20.3	16.7	12.2	10.0	12.2	21.0	13.3	14.4	21.0	10.9	15.3	7.6	9.8	11.1	6.7	4.5	10.0	9.0	13.5	6.7	14.6	14.5	13.4	17.9	11.2	4.4	6.7	5.5	7.8	5.6	6.7	1.1	11.1	7.5	8.6	11.9	6.5	12.8	3.8	14.0	6.4	7.3	6.1	2.4	9.7
	602	Careless/Reckless/In a hurry	64	16%	71.0	95.8	86.8	103.7	84.6	86.8	110.2	101.3	90.7	88.5	91.8	96.2	56.8	66.6	66.6	64.4	51.2	49.0	50.1	68.0	42.7	53.9	62.9	58.4	42.5	66.0	52.6	64.9	37.7	39.9	49.9	58.7	43.5	52.4	49.1	52.4	39.9	49.6	30.2	71.1	53.6	62.5	48.5	48.5	53.3	47.2	55.7	49.7
	603	Nervous/Uncertain/Panic	7	2%	9.0	12.4	9.0	19.2	8.9	8.9	7.8	12.2	6.6	4.4	7.7	3.3	4.4	6.5	4.4	10.9	3.3	5.6	6.7	11.1	11.2	9.0	7.9	3.4	6.7	5.6	6.7	5.6	3.3	2.2	5.5	5.5	11.1	3.3	5.6	5.6	5.4	4.3	2.2	5.4	5.1	7.7	6.4	6.4	2.4	3.6	6.1	1.2
	604	Driving too slow for conditions	2	0%	4.5	3.4	3.4	1.1	4.5	0.0	3.3	2.2	4.4	7.7	1.1	3.3	1.1	5.5	3.3	0.0	0.0	4.5	3.3	1.1	2.2	1.1	0.0	2.2	1.1	0.0	3.4	0.0	2.2	0.0	2.2	1.1	1.1	1.1	0.0	0.0	1.1	1.1	2.2	1.1	1.3	1.3	0.0	2.6	0.0	2.4	0.0	2.4
	605	Inexperienced/learner driver	10	3%	15.8	11.3	15.8	16.9	13.4	12.2	12.2	23.4	13.3	16.6	15.5	12.2	9.8	12.0	14.2	13.1	10.0	15.6	8.9	13.4	4.5	6.7	4.5	6.7	5.6	6.7	10.1	11.2	8.9	3.3	4.4	11.1	6.7	2.2	2.2	7.8	5.4	12.9	4.3	11.9	5.1	7.7	10.2	5.1	9.7	4.8	3.6	3.6
	606	Inexperience of driving on the left	6	1%	10.1	5.6	12.4	9.0	7.8	4.5	7.8	10.0	7.7	1.1	4.4	5.5	3.3	9.8	8.7	5.5	2.2	4.5	10.0	5.6	5.6	6.7	2.2	3.4	8.9	6.7	5.6	4.5	1.1	10.0	3.3	3.3	3.3	2.2	4.5	4.5	4.3	4.3	4.3	5.4	3.8	3.8	5.1	1.3	2.4	1.2	2.4	2.4
	607	Inexperience with type of vehicle	3	1%	5.6	5.6	4.5	3.4	7.8	3.3	4.5	2.2	3.3	0.0	5.5	5.5	1.1	3.3	7.6	2.2	3.3	3.3	1.1	4.5	3.4	6.7	1.1	5.6	4.5	5.6	2.2	2.2	1.1	3.3	1.1	2.2	1.1	4.5	2.2	4.5	2.2	1.1	0.0	2.2	0.0	1.3	1.3	1.3	1.2	1.2	2.4	2.4
	701	Stationary or parked vehicles	4	1%	9.0	7.9	6.8	9.0	5.6	4.5	5.6	7.8	4.4	3.3	5.5	5.5	3.3	2.2	3.3	2.2	4.5	2.2	1.1	6.7	0.0	0.0	10.1	7.9	3.4	1.1	4.5	1.1	3.3	7.8	0.0	5.5	3.3	4.5	2.2	6.7	4.3	2.2	3.2	4.3	2.6	0.0	3.8	2.6	2.4	1.2	3.6	6.1
	702	Vegetation	2	0%	0.0	2.3	5.6	3.4	1.1	1.1	2.2	1.1	1.1	5.5	2.2	2.2	2.2	1.1	4.4	0.0	0.0	4.5	2.2	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	0.0	2.2	4.4	1.1	0.0	1.1	3.3	2.2	1.1	0.0	1.1	0.0	2.6	0.0	0.0	1.3	0.0	0.0	0.0	0.0
	703	Vision affected by road layout	12	3%	15.8	18.0	22.5	32.7	24.5	17.8	22.3	20.0	16.6	16.6	19.9	14.4	8.7	14.2	17.5	22.9	5.6	11.1	15.6	6.7	6.7	6.7	12.4	11.2	5.6	3.4	13.4	11.2	7.8	7.8	14.4	7.8	7.8	6.7	3.3	6.7	6.5	4.3	5.4	10.8	5.1	6.4	6.4	3.8	2.4	6.1	4.8	6.1
	704	Buildings, street furniture	0	0%	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0	1.1	0.0	0.0	0.0	1.1	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.2	0.0
	705	Dazzling headlights	2	0%	3.4	0.0	2.3	3.4	6.7	0.0	0.0	5.6	4.4	0.0	1.1	0.0	1.1	0.0	0.0	6.5	1.1	0.0	0.0	4.5	4.5	0.0	1.1	2.2	2.2	0.0	1.1	0.0	1.1	1.1	1.1	3.3	1.1	0.0	0.0	3.3	0.0	0.0	0.0	6.5	1.3	0.0	0.0	5.1	0.0	0.0	0.0	1.2
	706	Dazzling sun	10	3%	5.6	11.3	15.8	18.0	12.2	3.3	8.9	25.6	19.9	4.4	14.4	18.8	24.0	6.5	4.4	13.1	10.0	2.2	1.1	10.0	7.9	7.9	5.6	20.2	6.7	11.2	6.7	10.1	14.4	6.7	6.7	15.5	6.7	5.6	6.7	16.7	9.7	3.2	6.5	19.4	12.8	2.6	3.8	6.4	9.7	4.8	6.1	15.7
	707	Rain, sleet, snow or fog	13	3%	19.2	31.5	14.6	23.7	14.5	7.8	8.9	42.3	27.7	11.1	7.7	18.8	17.5	7.6	5.5	8.7	20.1	10.0	6.7	13.4	15.7	0.0	7.9	27.0	16.8	1.1	4.5	11.2	12.2	11.1	6.7	20.0	14.5	1.1	5.6	15.6	18.3	5.4	7.5	9.7	3.8	3.8	3.8	16.6	10.9	7.3	2.4	9.7
	708	Spray from other vehicles	2	1%	1.1	1.1	4.5	6.8	3.3	3.3	2.2	6.7	3.3	2.2	1.1	3.3	3.3	0.0	1.1	0.0	5.6	0.0	2.2	4.5	2.2	2.2	0.0	0.0	0.0	3.4	4.5	1.1	0.0	2.2	2.2	1.1	2.2	0.0	0.0	3.3	2.2	0.0	0.0	3.2	2.6	1.3	1.3	0.0	1.2	2.4	1.2	1.2
	709	Windscreen dirty/scratched	0	0%	0.0	0.0	0.0	1.1	1.1	0.0	0.0	1.1	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.2	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1.3	2.4	0.0	0.0	0.0
	710	Vehicle blind spot	15	4%	21.4	18.0	23.7	29.3	13.4	17.8	16.7	22.3	19.9	26.5	15.5	17.7	19.6	21.8	12.0	15.3	10.0	15.6	13.4	16.7	15.7	12.4	12.4	4.5	17.9	11.2	12.3	17.9	11.1	10.0	14.4	14.4	8.9	6.7	5.6	16.7	15.1	14.0	7.5	8.6	6.4	6.4	10.2	5.1	3.6	6.1	8.5	6.1
	801	Ped - Road masked by stationary vehicle	0	0%	2.3	0.0	1.1	0.0	0.0	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.2	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
	802	Ped - Failed to look properly	2	1%	3.4	9.0	4.5	3.4	2.2	4.5	3.3	8.9	4.4	1.1	1.1	2.2	0.0	5.5	3.3	1.1	2.2	2.2	2.2	7.8	1.1	0.0	2.2	2.2	0.0	0.0	1.1	5.6	1.1	0.0	0.0	2.2	1.1	1.1	1.1	1.1	2.2	1.1	1.1	2.2	0.0	2.6	0.0	2.6	1.2	1.2	3.6	1.2
	803	Ped - Failed to judge vehicle's speed	2	0%	1.1	4.5	2.3	7.9	4.5	3.3	1.1	3.3	5.5	2.2	0.0	1.1	1.1	3.3	3.3	2.2	0.0	2.2	0.0	2.2	1.1	0.0	2.2	0.0	1.1	0.0	0.0	2.2	1.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1	0.0	1.1	0.0	1.3	1.3	0.0	0.0	2.4	0.0	1.2	0.0
	804	Ped - Wrong use of crossing facility	0	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	805	Ped - Dangerous action incarriageway	2	0%	2.3	0.0	1.1	3.4	0.0	3.3	3.3	3.3	1.1	2.2	2.2	1.1	0.0	6.5	2.2	3.3	2.2	0.0	5.6	1.1	2.2	1.1	1.1	2.2	1.1	2.2	1.1	2.2	2.2	1.1	5.5	1.1	1.1	3.3	0.0	2.2	1.1	3.2	2.2	1.1	0.0	0.0	1.3	2.6	2.4	1.2	2.4	2.4
	806	Ped - Impaired by alcohol	2	0%	3.4	1.1	2.3	2.3	1.1	4.5	2.2	3.3	2.2	0.0	0.0	2.2	3.3	0.0	2.2	2.2	0.0	0.0	1.1	3.3	0.0	0.0	2.2	5.6	2.2	2.2	1.1	2.2	1.1	2.2	4.4	2.2	2.2	1.1	1.1	1.1	1.1	2.2	0.0	3.2	1.3	0.0	0.0	2.6	3.6	0.0	2.4	2.4
	807	Ped - Impaired by drugs	0	0%	1.1	0.0	2.3	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	0.0	2.2	0.0	1.1	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
	808	Ped - Careless/Reckless/In a hurry	1	0%	0.0	0.0	3.4	1.1	2.2	0.0	1.1	2.2	1.1	1.1	2.2	0.0	1.1	0.0	0.0	2.2	0.0	0.0	3.3	1.1	0.0	0.0	2.2	2.2	1.1	0.0	0.0	5.6	0.0	0.0	1.1	0.0	0.0	2.2	0.0	2.2	0.0	1.1	1.1	0.0	0.0	1.3	1.3	0.0	3.6	1.2	2.4	1.2
	809	Ped - Ped wearing dark clothes at night	2	0%	6.8	1.1	1.1	3.4	0.0	3.3	1.1	2.2	3.3	0.0	1.1	2.2	3.3	2.2	0.0	3.3	0.0	0.0	3.3	2.2	1.1	0.0	1.1	4.5	2.2	3.4	2.2	3.4	1.1	1.1	3.3	3.3	1.1	0.0	1.1	2.2	2.2	0.0	0.0	3.2	1.3	0.0	0.0	0.0	6.1	0.0	0.0	2.4
	810	Ped - Disability or illness	2	0%	1.1	0.0	3.4	2.3	3.3	2.2	2.2	2.2	0.0	0.0	1.1	1.1	0.0	1.1	2.2	1.1	2.2	2.2	1.1	3.3	1.1	1.1	0.0	2.2	1.1	0.0	3.4	4.5	1.1	0.0	4.4	1.1	3.3	2.2	0.0	2.2	1.1	3.2	1.1	2.2	0.0	0.0	1.3	0.0	1.2	2.4	2.4	3.6
	901	Stolen Vehicle	1	0%	1.1	1.1	0.0	1.1	1.1	0.0	1.1	2.2	1.1	0.0	0.0	0.0	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	1.1	1.1	0.0	0.0	1.3	2.6	0.0	1.2	0.0	1.2	0.0
	902	Vehicle in course of crime	0	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	1.1	1.1	0.0	0.0	0.0	0.0	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	2.2	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
	903	Emergency vehicle on call	1	0%	2.3	0.0	1.1	1.1	0.0	2.2	2.2	3.3	0.0	1.1	6.6	1.1	2.2	0.0	0.0	0.0	0.0	0.0	1.1	2.2	0.0	0.0	0.0	2.2	2.2	0.0	2.2	0.0	0.0	0.0	0.0	0.0	2.2	0.0	1.1	0.0	2.2	1.1	1.1	0.0	0.0	1.3	0.0	1.3	2.4	0.0	0.0	0.0
	904	Vehicle door opened	0	0%	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0	1.1	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
	999	Other	18	5%	37.2	28.2	24.8	18.0	28.9	20.0	31.2	33.4	37.6	15.5	25.4	17.7	24.0	25.1	19.6	17.5	12.3	16.7	7.8	20.1	16.9	10.1	21.3	18.0	17.9	14.5	11.2	17.9	10.0	8.9	12.2	8.9	12.3	11.1	11.1	13.4	14.0	12.9	15.1	9.7	17.9	17.9	10.2	12.8	12.1	3.6	3.6	4.8
	100s	Road Environment Contributed	83	21%	128	76.6	131	201	115	75.7	105	164	108	92.9	87.4	107	109	53.5	87.3	120	81.3	53.5	69.1	131	113	43.8	77.5	129	89.5	32.4	55.9	78.3	57.6	59.9	62.1	93.1	69.1	34.6	49.1	61.3	69	39.9	39.9	86.2	67.6	23	42.1	79.1	44.8	47.2	41.2	31.5
	200s	Vehicle Defects	16	4%	15.8	32.7	18	15.8	30.1	20	30.1	28.9	18.8	19.9	26.5	26.5	13.1	22.9	13.1	17.5	12.3	17.8	8.91	11.1	11.2	19.1	20.2	14.6	23.5	12.3	13.4	10.1	13.3	13.3	23.3	9.98	14.5	17.8	10	15.6	8.62	9.7	10.8	9.7	12.8	8.93	6.38	5.1	7.27	8.48	9.69	6.06
	300s	Injudious Action	114	29%	162	171	184	207	163	129	165	193	191	150	158	160	132	129	116	122	98	86.9	106	148	74.1	84.3	103	103	76.1	89.5	90.6	95.1	70.9	80.9	74.3	108	75.8	69.1	84.7	95.9	83	74.4	65.7	98.1	95.7	60	79.1	93.1	61.8	73.9	95.7	66.6
Grouped Contributory Factors	400s	Driver/rider error or reaction	481	122%	576	634	652	780	569	530	646	673	653	509	538	619	547	584	458	470	382	423	392	479	412	390	418	467	381	437	438	416	449	405	383	480	405	358	423	441	350	417	420	488	421	361	417	445	382	327	408	313
	500s	Impairment or Distraction	65	16%	75.5	77.7	91.3	92.4	83.5	74.6	80.1	74.6	68.6	59.7	83	57.5	40.4	73.1	60	66.6	51.2	51.2	59	65.7	39.3	56.2	67.4	57.3	68.2	76.1	60.4	63.8	57.6	56.5	58.7	61	49.1	59.1	76.9	50.2	45.3	55	78.7	85.1	56.1	75.3	62.5	74	56.9	48.5	81.2	72.7
	600s	Behaviour or inexperience	103	26%	140	151	146	174	144	128	156	164	147	132	140	147	87.3	119	112	106	81.3	89.1	84.7	114	78.6	97.7	85.4	94.4	83.9	104	98.4	99.5	58.7	65.4	72	89.8	72.5	72.5	64.7	85.8	65.7	81.9	55	103	81.6	88	85.5	71.4	76.3	66.6	72.7	71.5
	700s	Vision affected	60	15%	76.6	90.1	95.8	127	82.4	55.7	66.8	132	97.3	69.7	67.5	81.9	80.8	54.6	48	68.8	56.8	45.7	42.3	63.5	53.9	29.2	50.6	75.3	53.7	32.4	48.1	52.6	51	48.8	54.3	70.9	44.6	25.6	26.8	71.3	57.1	30.2	31.3	62.5	37	20.4	29.3	42.1	33.9	27.9	27.9	46
	800s	Pedestrian only (casualty or uninjured)	13	3%	21.4	15.8	21.4	23.7	14.5	22.3	14.5	25.6	19.9	6.64	7.74	9.96	9.82	18.6	13.1	15.3	6.68	6.68	16.7	22.3	6.74	3.37	11.2	21.3	8.95	7.83	10.1	28	7.76	4.43	18.8	11.1	10	13.4	5.57	12.3	8.62	12.9	7.54	12.9	3.83	6.38	3.83	7.65	21.8	6.06	14.5	13.3
	900s	Special	20	5%	40.6	30.4	25.9	20.3	30.1	22.3	34.5	43.4	38.7	18.8	33.2	18.8	27.3	26.2	20.7	19.6	13.4	17.8	10	22.3	20.2	10.1	22.5	21.3	22.4	14.5	14.5	20.1	9.98	8.87	12.2	8.87	15.6	12.3	14.5	14.5	16.2	17.2	18.3	9.7	17.9	20.4	12.8	15.3	15.7	4.85	4.85	4.85

Appendix C: Standard list of Causation Factors (CF) used in STATS19 records

ROAD DEFECTS		IMPAIRMENT OR DISTRACTION		PEDESTRIAN ONLY (CASUALTY OR UNINJURED)	
101	Poor or defective road surface	501	Impaired by alcohol	801	Crossed road masked by stationary or parked vehicle
102	Deposit on road (e.g. oil, mud, chippings)	502	Impaired by drugs (illicit or medicinal)	802	Failed to look properly
103	Slippery road (due to weather)	503	Fatigue	803	Failed to judge vehicle's path or speed
104	Inadequate/Masked signs or road markings	504	Uncorrected defective eyesight	804	Wrong use of pedestrian crossing facility
105	Defective traffic signals	505	Illness or disability, mental or physical	805	Dangerous action in carriageway (e.g. playing)
106	Traffic calming (e.g. speed cushions, road humps, chicane)	506	Not displaying lights at night or in poor visibility	806	Impaired by alcohol
107	Temporary road layout (e.g. contraflow)	507	Cyclist wearing dark clothing at night	807	Impaired by drugs (illicit or medicinal)
108	Road layout (e.g. bend, hill, narrow carriageway)	508	Driver using mobile phone	808	Careless/Reckless/In a hurry
109	Animal or object in carriageway	509	Distraction in vehicle	809	Pedestrian wearing dark clothing at night
VEHICLE DEFECTS		510	Distraction outside vehicle	810	Disability or illness, mental or physical
201	Tyres illegal, defective or under inflated	**BEHAVIOUR OR INEXPERIENCE**		**SPECIAL CODES**	
202	Defective lights or indicators	601	Aggressive driving	901	Stolen vehicle
203	Defective brakes	602	Careless/Reckless/In a hurry	902	Vehicle in course of crime
204	Defective steering or suspension	603	Nervous/Uncertain/Panic	903	Emergency vehicle on call
205	Defective or missing mirrors	604	Driving too slow for conditions or slow vehicle (e.g. tractor)	904	Vehicle door opened or closed negligently
206	Overloading or poorly loaded vehicle or trailer	605	Inexperienced or learner driver/rider	999	Other - Please specify
INJUDICIOUS ACTION		606	Inexperience of driving on the left		
301	Disobeyed automatic traffic signal	607	Inexperience with type of vehicle		
302	Disobeyed Give Way of Stop sign or markings	**VISION AFFECTED BY**			
303	Disobeyed double white line	701	Stationary or parked vehicle(s)		
304	Disobeyed pedestrian crossing facility	702	Vegetation		
305	Illegal turn or direction of travel	703	Road layout (e.g. bend, winding road, hill crest)		
306	Exceeding speed limit	704	Buildings, road signs, street furniture		
307	Travelling too fast for conditions	705	Dazzling headlights		
308	Following too closely	706	Dazzling sun		
309	Vehicle travelling along pavement	707	Rain, sleet, snow or fog		
310	Cyclist entering road from pavement	708	Spray from other vehicles		
DRIVER/RIDER ERROR OR REACTION		709	Visor or windscreen dirty or scratched		
401	Junction overshoot				
402	Junction restart				
403	Poor turn or manoeuvre				
404	Failed to signal/ Misleading signal				
405	Failed to look properly				
406	Failed to judge other person's path or speed				
407	Passing too close to cyclist, horse rider or pedestrian				
408	Sudden braking				
409	Swerved				
410	Loss of control				

Appendix D: Two-way tables of CF analysis

Single carriageway Roads

All Injudicious Action

CF code 307

Travelling too fast for conditions

	pre	post	total
307	1121	23	1144
all other	20874	642	21516
	21995	665	22660

X2 (2, N=22660) = 3.61 p = 0.057

CF code 308

Following too closely

	pre	post	total
308	870	19	889
all other	21125	646	21771
	21995	665	22660

X2 (2, N=22660) = 2.07 p = 0.151

Driver Error

CF code 403

Poor turn or manoeuvre

	pre	post	total
403	1673	66	1739
All other	20322	599	20921
	21995	665	22660

X2 (2, N=22660) = 4.9 p = 0.027

CF code 405

Failed to look properly

	pre	post	total
405	2771	111	2882
All other	19224	554	19778
	21995	665	22660

X2 (2, N=22660) = 9.74 p = 0.002

CF code 406

Failed to judge other person's path or speed

	pre	post	total
406	2387	75	2462
All other	19608	590	20198
	21995	665	22660

X2 (2, N=22660) = 0.12 p = 0.728

CF code 408

Sudden braking

	pre	post	total
408	1036	27	1063
All other	20959	638	21597
	21995	665	22660

X2 (2, N=22660) = 0.61 p = 0.435

CF code 409

Swerved

	pre	post	total
409	579	19	598
All other	21416	646	22062
	21995	665	22660

X2 (2, N=22660) = 0.13 p = 0.722

CF code 410

Loss of control

	pre	post	total
410	1479	34	1513
All other	20516	631	21147
	21995	665	22660

X2 (2, N=22660) = 2.69 p = 0.101

Behaviour or Inexperience

CF code 602

Careless/Reckless/In a hurry

	pre	post	total
602	1674	49	1723
all other	20321	616	20937
	21995	665	22660

X2 (2, N=22660) = 0.05 p = 0.816

Dual carriageway Roads

All Injudicious Action

CF code 307

Travelling too fast for conditions

	pre	post	total
307	413	11	424
all other	13052	464	13516
	13465	475	13940

X2 (2, N=13940) = 0.88 p = 0.349

CF code 308

Following too closely

	pre	post	total
308	695	31	726
all other	12770	444	13214
	13465	475	13940

X2 (2, N=13940) = 1.73 p = 0.188

Driver Error

CF code 403

Poor turn or manoeuvre

	pre	post	total
403	946	32	978
All other	12519	443	12962
	13465	475	13940

X2 (2, N=13940) = 0.06 p = 0.809

CF code 405

Failed to look properly

	pre	post	total
405	2381	102	2483
All other	11084	373	11457
	13465	475	13940

X2 (2, N=13940) = 4.5 p = 0.034

CF code 406

Failed to judge other person's path or speed

	pre	post	total
406	1913	74	1987
All other	11552	401	11953
	13465	475	13940

X2 (2, N=13940) = 0.71 p = 0.401

CF code 408

Sudden braking

	pre	post	total
408	678	28	706
All other	12787	447	13234
	13465	475	13940

X2 (2, N=13940) = 0.7 p = 0.401

CF code 409

Swerved

	pre	post	total
409	401	15	416
All other	13064	460	13524
	13465	475	13940

X2 (2, N=13940) = 0.05 p = 0.821

CF code 410

Loss of control

	pre	post	total
410	734	22	756
All other	12731	453	13184
	13465	475	13940

X2 (2, N=13940) = 0.6 p = 0.438

Behaviour or Inexperience

CF code 602

Careless/Reckless/In a hurry

	pre	post	total
602	699	28	727
all other	12766	447	13213
	13465	475	13940

X2 (2, N=13940) = 0.46 p = 0.498

Appendix E: Additional Safety Analysis

The main body of this report covers the key findings on safety impacts for all study roads, single carriageway roads and dual carriageways respectively. The summarised findings are that:

- Over all study area roads there is evidence of a small statistically significant reduction in collisions since the introduction of the HGV speed limit change. However, this is found to be a sensitive result. There is an unusual pattern in the observed collisions in the final quarter of data, which is sufficient to make the finding significant or not depending on its inclusion in the analysis
- On single carriageway roads there is no statistically significant change in collisions found to date.
- On dual carriageway roads there is no statistically significant change in collisions found to date.
- Of the two separate analyses it does appear that the dual carriageway results are most likely to be leading to the overall statistically significant reduction. The intervention parameter is estimated to be a reduction for dual carriageways and estimated as a small increase for single carriageways, though neither significant.

To conduct further analyses on severity or types of collisions requires the dataset to be further disaggregated, reducing the quarterly collision totals further and making the chances of finding a significant finding more remote. As such, these additional analyses are undertaken in this appendix with the single and dual carriageways considered together to bolster sample sizes as much as possible.

Collision Severity

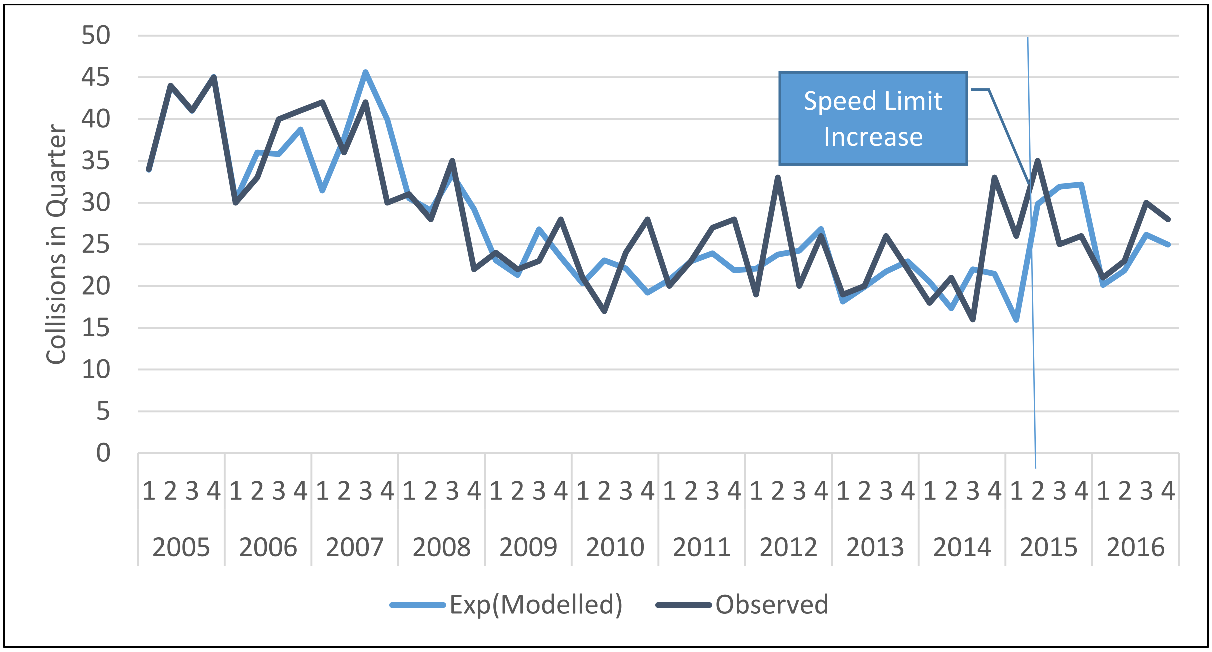
Collision severities have been grouped into two categories; fatal and serious or slight. This is due to recent changes in the way accident severity has been reported, with serious accidents being redefined meaning that some collisions that would previously have been categorised as slight severity are now categorised as serious severity. This means it is not meaningful to compare serious or slight collisions prior to the change to serious or slight collisions after the change as the definition is not consistent. Therefore, they are combined to provide a more robust comparison.

The theory of change points to the fact that higher speeds tend to result in higher severity collisions. It is therefore considered that the most likely impact of increasing the speed limit for HGVs would be an increase in the number of high severity collisions (i.e. those serious and fatal).

Figure E1 shows the quarterly fatal collisions involving HGVs on study roads, whilst Figure E2 shows the same information for combined serious and slight collisions. The seasonality and trend components remain present in each graph. Please note, the fatal collisions graph shows a number of spikes due to the small number of fatal collisions recorded each quarter which makes it difficult to get a smooth trend over time. In contrast, the slight/serious graph shows a more clearly defined trend.

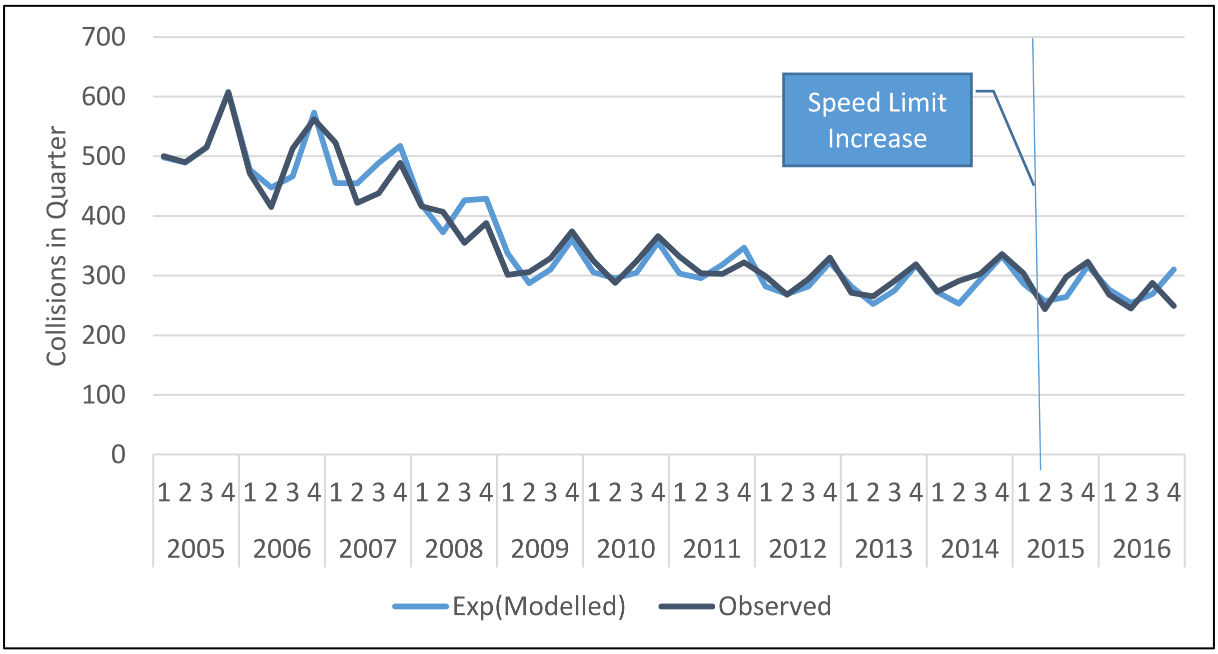
The reduction in collisions over time appears to have stopped from around 2010 for fatal accidents, but continued, albeit at a slower rate, for serious/slight collisions.

Figure E1: Fatal collisions involving at least one HGV, on study roads, per quarter



**Model based on logarithmic values. Those presented in the graph are the exponents to compare to observed.*

Figure E2: Serious/slight collisions involving at least one HGV, on study roads, per quarter



****Model based on logarithmic values. Those presented in the graph are the exponents to compare to observed.***

Time series ARIMA models were fitted to both sets of data using an intervention parameter to measure the change either side of the HGV speed limit increase. The intervention parameter confidence intervals are presented in the table below.

The table shows that there is not statistically significant change in either severity class analysed. As such, it must be concluded there is no perceptible change in severities of collisions due to the HGV Speed Limit increase based on the data available to date.

More specifically it can be seen that

- For fatal collisions, the confidence interval provided by the model is very large (it ranges from a 25.2% decrease to a 42.6% increase in collisions). A wide confidence interval indicates that the model is a poor fit for the observed data. This is unsurprising given the small number of fatal collisions observed in each quarter making the collisions observed per quarter very variable and thus hard to observe any meaningful change. Therefore, we cannot be confident that any change has occurred.
- For slight or serious collisions, the table shows an indication that the number of serious/slight collisions involving at least one HGV has decreased on study roads. However, the confidence interval around this result ranges from a 22.1% decrease to a 7.4% increase in collisions and as such, we cannot be confident that there has been a change in the number of collisions and therefore must accept the null hypothesis of no change.

Severity	Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
Fatal	3.3%	-25.2%	42.6%	×
Serious/slight	-8.5%	-22.1%	7.4%	×

Type of Collisions on Study Roads

The STATS19 collision data contains a number of fields of aspects of each collision including:

- The number of vehicles involved;
- What manoeuvre was being undertaken when the collision occurred (e.g. a right turn);
- What mode of transport the casualties were on (e.g. equestrian);
- Where each vehicle was first struck (e.g. side), or if undamaged;
- Whether each vehicle skidded or overturned; and
- Whether each vehicle left the carriageway or collided with any street furniture.

There are therefore a number of analyses that could be undertaken to consider the impact of the HGV speed limit on collisions. However, many of these events occur very infrequently (e.g. equestrians are involved in very few collisions on the UK road network) and so there is a danger of overreaching the limits of the data or over concluding based on minor changes when analysing some of these factors. As such, care must be taken in analysing this data, and it is important to consider whether there is likely to be a cause and effect relationship between changing vehicle speeds and a change to any specific factor.

Therefore, only the factors that had relevant or interesting outcomes will be discussed in this section. These are as follows: overtaking collisions; shunts and side impacts; and sole HGV or multiple vehicle collisions. All the quarterly collision data used in this section is provided in Appendix B.

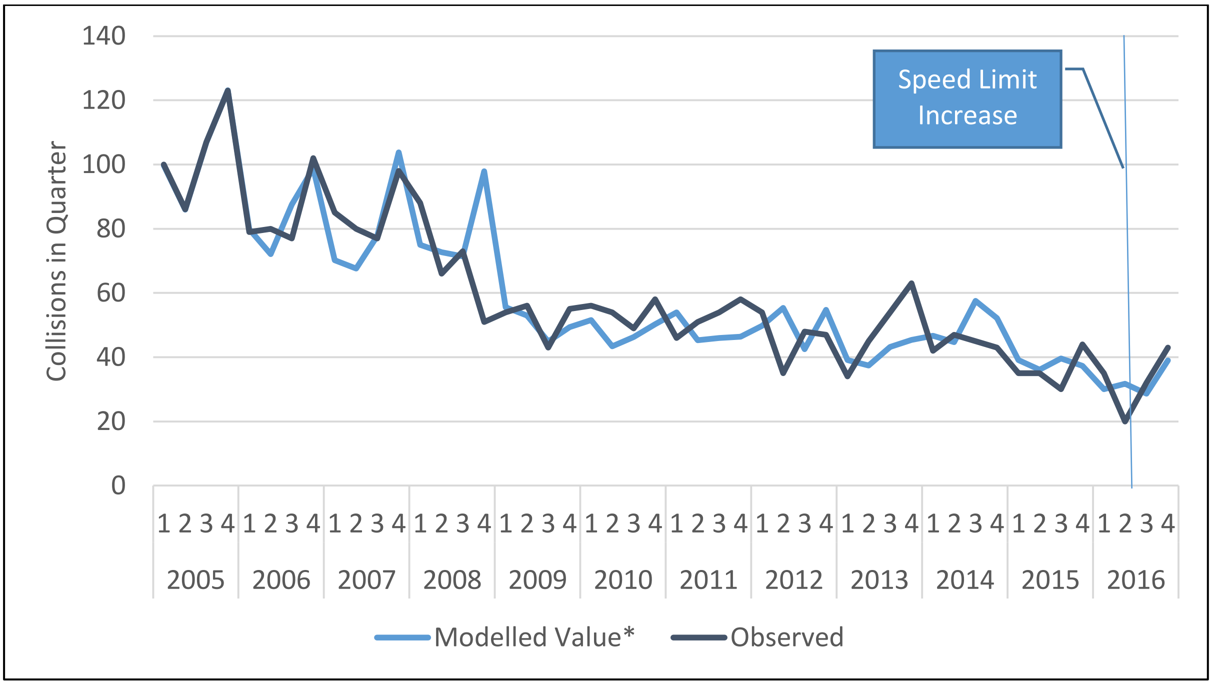
Overtaking Collisions

It is realistic to assume that overtaking could be affected by the HGV speed limit increase. The theory of change tells us that this impact could relate to two counteracting effects occurring:

- HGVs are travelling faster, and therefore the need to overtake is reduced and thus collisions relating to overtaking might reduce; and
- The overtaking manoeuvres that do still occur are now higher risk/higher speed due to HGVs travelling faster. This could result in an increase in overtaking collisions.

The manoeuvre undertaken during a collision is one of the factors recorded on collision record sheets. There are a number of fields relating to overtaking, including offside, nearside and overtaking static vehicles. Due to the small sample, it is considered unhelpful to try to consider each type of overtaking record separately, and thus all overtaking manoeuvres are combined to a single metric for this analysis. In addition, metrics for single and dual carriageways will be considered together due to the small sample size. Figure E3 shows HGV collision data on study roads related to overtaking.

Figure E3: Overtaking collisions involving at least one HGV, on study roads, per quarter



**Model based on logarithmic values. Those presented in the graph are the exponents to compare to observed.*

There are very few collisions per quarter on the study area roads that involve HGVs that have overtaking listed as the key manoeuvre during the collision. In recent years there have been fewer than 60 collisions per quarter, and so it is difficult to measure any change as significant due to the short post-change period and the level of noise from quarter to quarter in the data.

The table below shows the results of an ARIMA model and indicates a wide confidence interval for the intervention parameter (which reflects that the model is not a tight fit). As the model is not a good fit, we cannot be confident in the change observed.

The intervention parameter ranges from a 28.9% decrease to a 46.4% increase, therefore there is insufficient data to suggest that there has been a change and we must accept the null hypothesis of no change.

It is envisaged that as more post-change data accumulates over time, the finding for overtaking collisions will become clearer and more certain.

Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
2.0%	-28.9%	46.4%	×

Shunts and Side Impacts

The HGV speed limit increases could impact on shunt and side impact collisions. Side impact collisions would be likely to occur due to the reasons cited for overtaking collisions earlier, whereas shunt accidents could occur due to:

- HGVs travelling faster, and thus will themselves have longer stopping distances, making them more likely to hit the rear of another vehicle; and
- With HGVs travelling faster, it could be less likely for a vehicle to run into the back of an HGV.

While the collision data does allow the filtering of collisions to front, rear, offside and nearside impacts, the first two and last two of these are combined to create ‘shunting’ and ‘side impact’ collision metrics for this analysis. This has been done to keep the sample in each as high as possible, and thus increase the likelihood of fitting meaningful models to the data. A summary of the two mode outputs (intervention parameters) is provided in the table below.

The table shows no statistically significant changes for either side impacts or shunt type collisions, and thus for now it must be assumed there is no attributable change. More specifically the table shows:

- Side impact collisions are expected to have reduced by around 16.9%. The result is close to significant with the upper confidence interval a 1.2% increase. It will be worthwhile reconsidering this finding at the three-year after evaluation when further data is available to provide move confidence in any changes.
- Shunt impact collisions may have reduced slightly (intervention parameter estimated as a 6.8% reduction), but the results are insignificant and the confidence interval is wide. Care must be taken not to over-conclude on shunt collisions impacts.

Point of Impact	Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
Sides (near or offside)	-16.9%	-31.8%	1.2%	×
Shunt (front or rear)	-6.8%	-21.9%	11.4%	×

Sole HGV or Multiple Vehicle Collisions

The collision statistics provide information regarding the number of vehicles involved in a collision. Considering the theory of change, it is expected that the higher speed limits (and assumed higher speeds) for HGVs could increase the likelihood of HGVs losing control and thus being involved in single vehicle personal injury collisions (either leaving the carriageways, hitting street furniture or other collisions that do not involve other vehicles). In terms of multiple vehicle collisions, it could be expected that faster HGVs (more in line with light vehicle speeds) reduces the speed differential and reduces the need to overtake, both of which would have the effect of reducing collision rates for multiple vehicle collisions.

This section aims to consider the impact of both these scenarios. Single vehicle collisions, where the vehicle is an HGV and on one of the study roads are infrequent events. In recent years only around 23 have occurred per quarter (i.e. one every 4 days). As such, it is hard to estimate the impact of the HGV speed limit increases.

The table below shows the model outcomes for the single vehicle and multiple vehicle models. Neither show a statistically significant change and so it is considered there is not currently evidence to support a change. Specifically, the results show that:

- For **single vehicle** collisions the model is a poor fit and thus gives a very wide confidence interval. This is due to the very low number of these types of collisions leading to it being very difficult to measure change. Little can be drawn from this model.
- For **multiple vehicle** collisions the finding is not significant but is close to being significant. There are initial indications that there may have been a decrease in such collisions. Additional data at the three-year after evaluation may provide further clarity and help narrow the confidence interval.

Number of Vehicles	Intervention Parameter	Low Confidence Interval	High Confidence Interval	Statistically Significant?
One HGV only	-5.8%	-33.1%	32.9%	×
Two or more vehicles (inc. one or more HGV)	-12.9%	-25.3%	1.6%	×

Contributory Factor Analysis

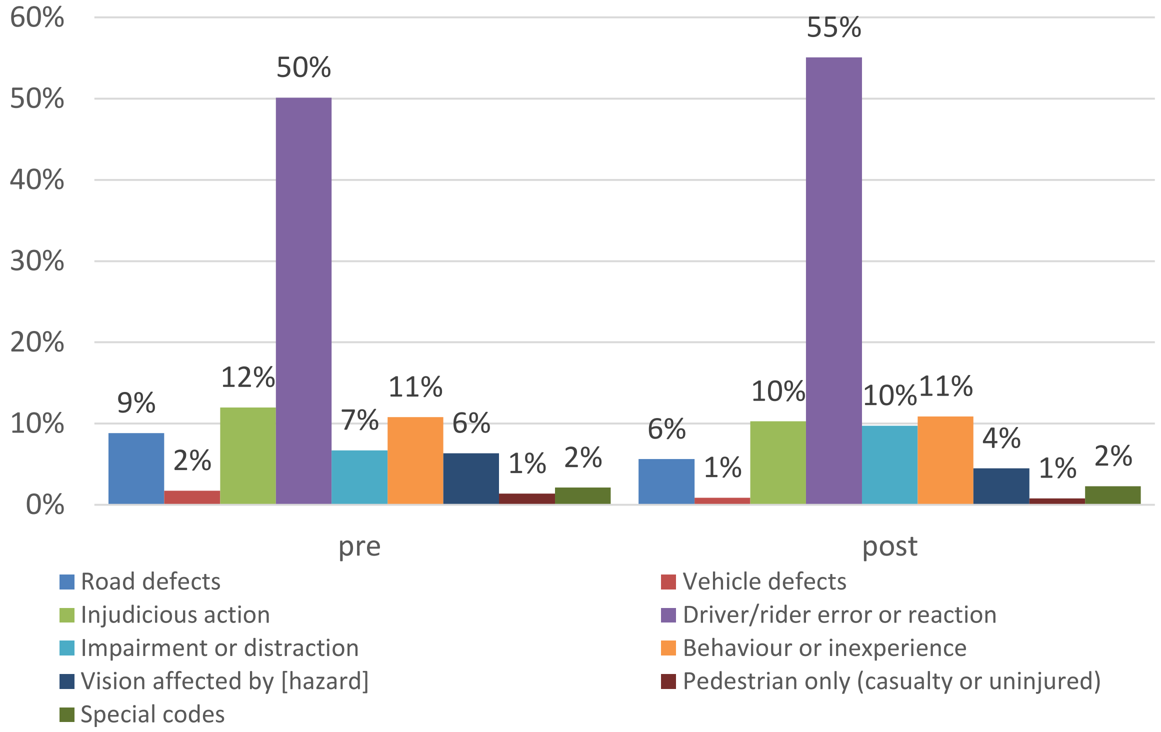
Collision data includes attributions of contributory factors (CF) which are completed for accidents which were attended by a police officer. There are 77 individual CFs from which the attending police officer is able to select up to six as possible influencers to describe the most plausible reasons why the collision occurred based on their judgement and opinion. These CF codes and descriptions are detailed in Appendix C and the nine main categories in which they fit are:

- Road defects;
- Vehicle defects;
- Injudicious action;
- Driver/rider error or reaction;
- Impairment or distraction;
- Behaviour or inexperience;
- Vision affected by [hazard];
- Pedestrian only (casualty or uninjured); and
- Special codes.

CF data is available for 82% of the collisions on the study roads involving at least one HGV; on average, each collision had 2.4 CFs. Analysis of the CF data focused on the factors relevant to this study and were based on the proportions of collisions with these attributes in the periods before and after the HGV speed limit change, rather than the absolute numbers in each period. As these results present the proportion of occurrences rather than the absolute number of occurrences, the small sample of collisions records will not affect the quality of the results.

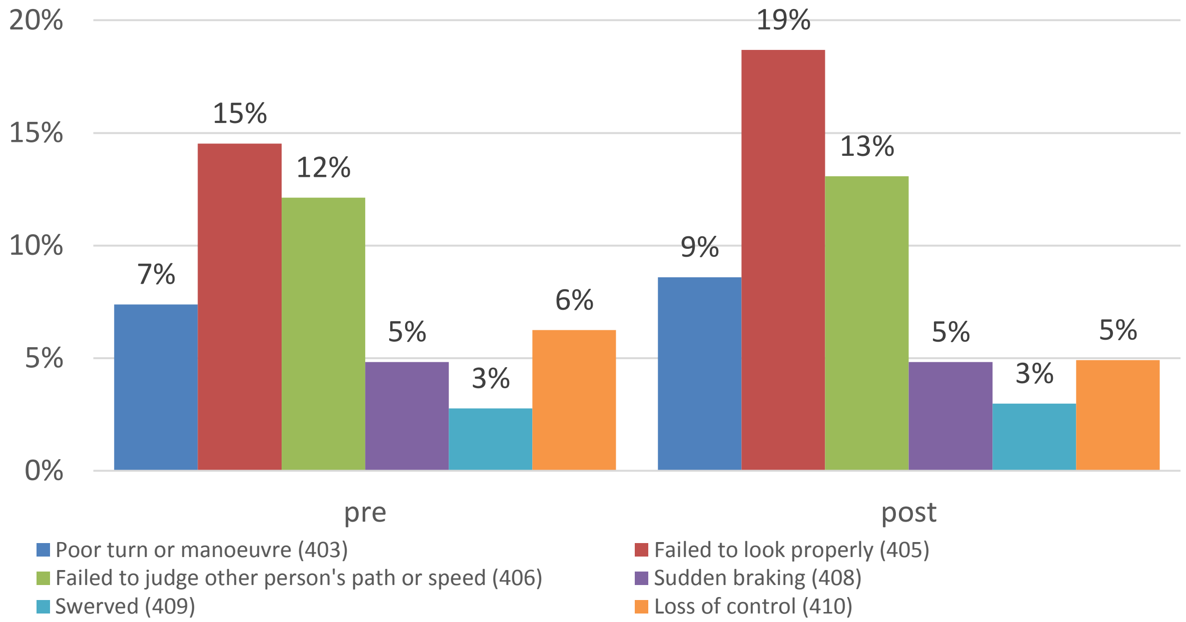
It is important to note that whereas records of collision circumstances, vehicles and casualties are largely objective, CFs are largely subjective. The quality of CF data can therefore be variable as it depends on the skill and experience of the police officer completing the paperwork after the event based on personal observation and interpretation of drivers' and witnesses' statements. Figure E4 shows the proportions of the CFs attributed to all the collisions in the two periods grouped by CF code group.

Figure E4: Contributory Factors for HGV collisions on study roads



It is clear from the graph above that human error forms the majority of CFs attributed to the collisions both prior to and after the speed limit change. Reduction in the proportion attributed to defects in roads of vehicles means a higher proportion attributed to human error.

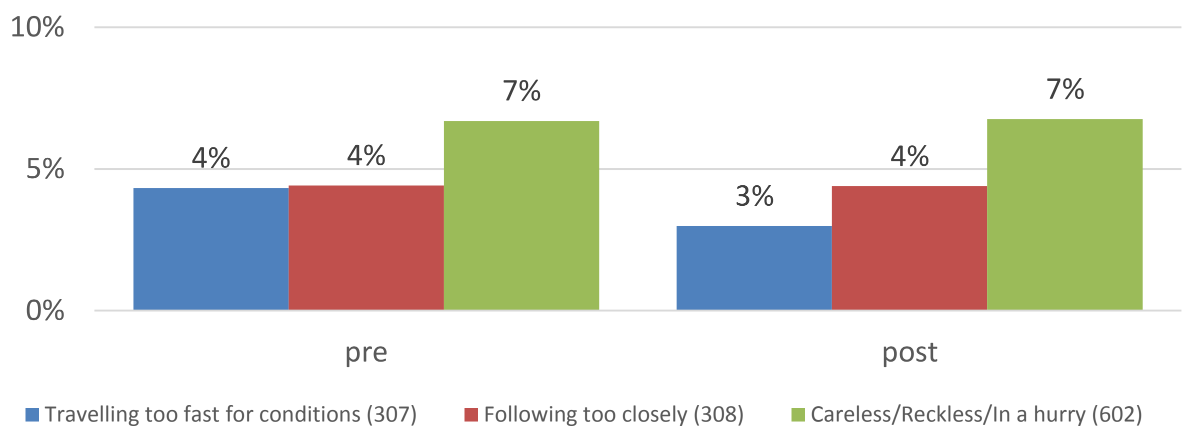
Figure E5: Causation factors: proportions of individual Driver error codes for HGV collisions on study roads



The CFs for actions and behaviour of most relevance to this study were analysed though the use of two-way tables and the null hypothesis of there being no change between the pre-and post HGV speed limit change periods was tested using the chi-square tests. The details of the tests are shown in Appendix D and the proportions of the individual CF codes of particular relevance to this study are shown in Figure E6

The most common injudicious and behaviour error codes are shown in Figure E6. The chi-square test of independence for the three CFs show no significant difference in their proportion between the two periods.

Figure E6 – Causation factors: proportions of individual injudicious actions & behaviour error codes for HGV collisions on single carriageway study roads



Summary of findings

This appendix has provided additional analysis of safety impacts relating to the HGV speed limit increase to supplement main analysis provided in in the main report. The analysis in this appendix combines dual and single carriageway collisions to maximise the chance of observing changes relating to the speed limit when sub-dividing the data to specific types of collisions that are infrequent in nature.

This appendix considered the impact on severity, overtaking, shunts and side impacts, sole and multiple vehicle collisions, in addition to contributory factors. Once run through statistical models no significant changes were found for any of these additional analyses. This isn't to say the HGV speed limit change has not influenced these factors, rather that their infrequency makes it hard to measure or observe the change with confidence.

aecom.com