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

Final Report

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Quality information

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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.
AQMA	Air Quality Management Areas are areas defined as not likely to meet the air quality objectives, and therefore require management.
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 limit for HGVs.
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.
L_{A10}	The standard noise index in the UK, which represents the noise level which is exceeded for 10% of the time
National Transport Model (NTM)	A Department for Transport tool which is a systematic means of comparing alternative national transport or widely used local transport policies. These policies are compared against a range of scenarios taking into account major factors affecting future patterns of travel.
NOx	General term for the air pollutants nitric oxide (NO) and nitrogen dioxide (NO_2).
PCM model	Pollution Climate Mapping model is a collection of environmental models held by the Department for Environment, Food and Rural Affairs (DEFRA)
PM_{10}	Particulate matter of 10 micrometres or less.
Qualitative Research	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. This report outlines the findings of the evaluation of this policy, specifically considering the impact the policy has had on speeds, traffic volume, safety, noise, air quality and the economy.

The report uses data from before and after the policy implementation, alongside qualitative research, to understand change, and where possible looks at whether changes observed can be attributed to the new speed limits.

Qualitative Research

Stakeholder interviews conducted in 2019 reported that awareness of the policy amongst HGV drivers was good and that one of the key benefits of the policy was reduced driver stress and frustration with both HGV drivers and general traffic considered to have benefited.

There was no anecdotal evidence from stakeholders suggesting they had realised an economic benefit from the change, they were more aware of the impact of fuel prices and congestion on the costs of operating an HGV fleet.

Single Carriageway Impacts

DfT data from prior the policy implementation indicated that many HGVs were already exceeding the speed limit of 40 mph on single carriageways. The expectation was that increasing the speed limit to 50 mph would increase the average speed of HGVs and at the same time increase the proportion of HGVs complying with speed limits on single carriageway roads.

Analysis of speeds before and after the policy change show a **statistically significant increase of 1.6 mph in the speed of HGVs, from 44.1 mph to 45.7 mph** confirming the anticipated outcome**.** Contextual analysis of traffic flow and fuel price data suggests that these factors are unlikely to have resulted in an increase in HGV speeds. The analysis therefore supports a conclusion that the policy change has contributed to the increase in HGV speeds on single carriageways.

Dual Carriageway Impacts

Prior to the policy change, the impact of implementing an increased speed for HGVs on dual carriageways was uncertain as DfT speed data indicated HGVs on dual carriageways were travelling at similar speeds to those on motorways where the speed limit for HGVs was 60 mph. On balance it was considered that an increase in speeds was unlikely.

However, analysis of speeds before and after the policy do show a **statistically significant increase of 0.5 mph in the speed of HGVs, from 52.0 mph to 52.5 mph.** An analysis of speeds on motorways (where there has been no change in the HGV speed limit) has been carried out and this indicates no change in the speed of HGVs. The analysis therefore supports a conclusion that the policy change has contributed to the observed increase in HGV >7.5t speeds on dual carriageways.

Environment

It was forecast that the new speed limits could impact on both noise and air quality. Specifically, ex-ante forecasts expected HGVs on single carriageways to increase their speed which was estimated to have small negative impacts on both noise and air quality. The new speed limits were not expected to change noise or air quality on dual carriageways, as the speed limit change was not expected to result in a change in observed speed.

The noise evaluation found that while there are small noise increases up to around 0.6dB, only as much as 0.2dB of this change is due to HGVs. Further, evidence from locations where the speed limit has not changed also show increases in noise of 0.8dB, and increases in HGV noise of 0.2dB. As such, the changes observed are entirely within the range that could have been expected without the new speed limit. Further, even if attributable to the new policy, the changes are so small as to be imperceptible. The report finds no attributable change in noise due to increasing the HGV speed limit.

A detailed air quality assessment was not possible as there was no suitable data in locations known to have air quality sensitivities. Nonetheless, a review of the scale of change that could be expected on air quality (focusing on CO_2, PM_{10} and NOx) based on average volume and speed findings across the study roads was undertaken. These demonstrated that the likely change in each of these emissions range from a 0.3% decrease to a 0.3% increase. All these changes are considered negligible and too small to be detectable at roadside receptors. As such, the report finds that there is no evidence of a change in air quality due to the HGV speed limit change.

Safety

There were logical reasons to believe safety could improve or worsen as a result of the speed limit change. It could worsen, as higher speed vehicles increase the likelihood of loss of control incidents or higher speeds increase the severity of any collisions that do occur. It could improve, as the policy brings light and heavy speeds closer to one another and therefore could reduce dangerous overtaking or driver frustration. The ex-ante forecasts projected a slight increase in collisions, on the balance of these two competing factors.

A detailed analysis of collision data was undertaken, focusing on collisions involving at least one HGV on study roads. Statistical models were used to test for changes in collision numbers, while controlling for background changes in collisions. Separate tests were conducted for single carriageways and dual carriageways, in addition to a number of other types of collision that the new speed limit could logically affect.

The study found no evidence of a change in collisions due to the policy. This is true for both the statistical models of single and dual carriageways respectively.

Economic Evaluation

Prior to the policy change, journey time savings and vehicle operating costs for business were predicted on the basis of increased average speeds of HGVs on single carriageway roads. In economic terms, these savings were expected to translate into benefits and the 2014 DfT assessment calculated these at £224.6m (for a central case) in the period to 2031 (2010 prices).

In 2019 the DfT ran an updated economic assessment using the current National Transport Model and based on the speed changes observed as part of this evaluation. This update calculated benefits of £225.8m in the same period (2010 prices).

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 third and final report, presenting the concluding outputs of analysis including the environmental and economic impacts, and covering the first three years of operation of the new speed limits.

1.1 Evaluation Approach

1.1.1 Evaluation Aims

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:** qualitative research has been used alongside the quantitative techniques used in the impact evaluation to obtain information on first order impacts such as stakeholder awareness and perceptions of the policy.
- **Single Carriageway Impacts:** has the speed limit increase resulted in a measurable change to HGV (and other vehicle) speeds on single carriageways and are there any impacts on traffic volumes. Additional contextual analysis on fuel prices has been included to look at the potential for these to contribute to any observed speed changes;
- **Dual Carriageway Impacts:** has the speed limit increase resulted in a measurable change to HGV (and other vehicle) speeds on dual carriageways and are there any impacts on traffic volumes. Additional counterfactual analysis of motorway speeds has been included, as the policy change does not apply on these roads;
- **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;
- **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; 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.

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

- **Year 1:** work was undertaken in 2016 and included qualitative interviews with HGV drivers, non-HGV drivers and residents. An impact evaluation covering safety and speeds was also undertaken. The impact evaluation used approximately 9 months of ex-post data covering the period from April to December 2015.
- **Year 2:** work was undertaken in 2017 and 2018 and consisted of an update of the impact evaluation work from Year 1 using approximately a year's worth of additional ex-post data (broadly covering 2016); and

- **Year 3:** the work was undertaken in 2019 and included some additional qualitative work consisting of interviews with stakeholders, including operators and freight associations. The impact evaluation work on safety and speeds was updated using approximately a year's worth of additional ex-post data (broadly covering 2017). The Year 3 work included the addition of an environmental impact evaluation (covering noise and air quality) and an economic evaluation of the policy change using outputs from the National Transport Model.

1.1.2 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 (or with a speed limit of 50 mph or above on single carriageways and 60 mph on dual carriageways) 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 brief description of the approach taken in each part of the evaluation is provided below. Further detail is included in the sections which follow and in the report appendices.

- **Qualitative Research:** discussions with freight operators, the DfT, local authorities and freight associations to establish longer term impacts of the policy and supplement the short term impacts identified in the 2016 qualitative discussions.
- **Single Carriageway and Dual Carriageway Impacts (Speeds):** traffic speeds and flows provided by the DfT are the primary data source for the speed analysis work. 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.
- **Impact Evaluation - Environment:** the traffic speed and flow data provided by the DfT are also used for both air quality and noise analysis. For air quality, no suitable data source was located within an AQMA and so general changes across all sites are used to indicate the impact. For noise, the locations are grouped into road types for analysis, using motorways as a control group for comparison.
- **Impact Evaluation - 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.
- **Economic Evaluation:** the National Transport Model was used to estimate quantified economic benefits of the policy change by applying the ex-ante and ex-post speed data used in the impact evaluation to HGVs within the model.

1.1.3 Theory of Change

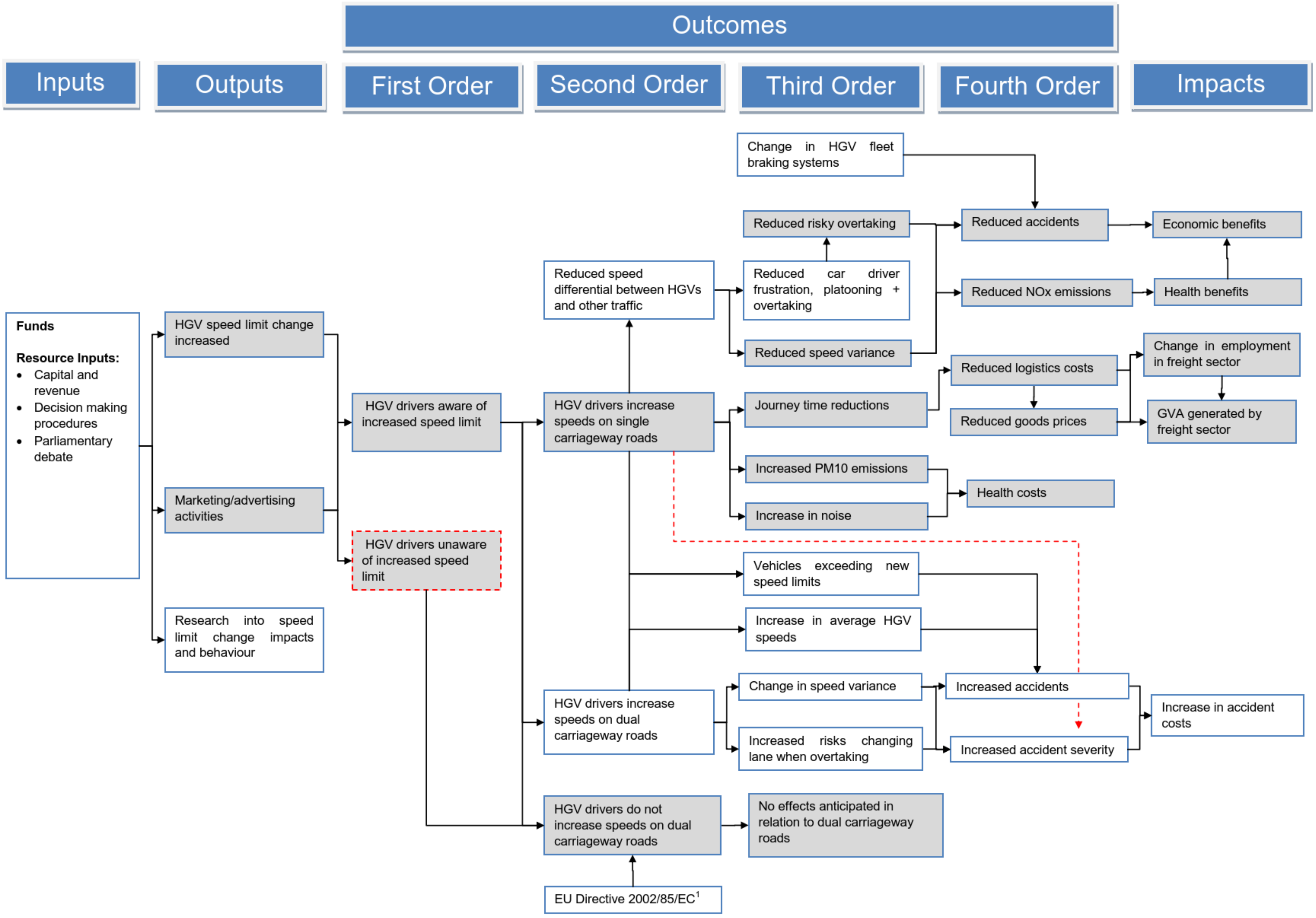
The evaluation design needed to address the range of issues within each of the core anticipated impact areas, maximising the use of existing datasets and enhancing this with bespoke qualitative and quantitative data collection. A central challenge within the evaluation was the need to determine the contribution of the speed limit change and other contextual factors to observed 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 formed the central analytical thread of the evaluation. Many of the anticipated impact areas 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 form the basis of the economic evaluation, updating the DfT's initial impact assessments published in 2014; 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 was 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 was reviewed and tested during all three years of ex-post analysis.

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. The outcomes metrics are tested against the intervention logic in later sections of the report, allowing a review and update of the logic mapping (to produce an ex-post version) based on the evidence available in Year 3.

Figure 1-1: HGV Speed Limit Increase Ex-Ante Logic Map



Possible unintended consequence

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

1.2 Structure of the Report

The remainder of the report is structured as follows:

- Section 2: Qualitative Research;
- Section 3: Single Carriageway Impacts;
- Section 4: Dual Carriageway Impacts;
- Section 5: Environmental Impacts;
- Section 6: Safety Impacts;
- Section 7: Economic Evaluation; and
- Section 8: Conclusions.

2. Qualitative Research

Main Findings from Qualitative Research

- All strategic stakeholders interviewed as part of the evaluation (such as the DfT, local authorities and freight associations) were aware of the speed limit change. Many interviewed in year 3 felt that awareness amongst the general public had reduced since the initial implementation of the policy.
- There was a mixed perception amongst consultees on the extent to which HGV drivers were operating within the previous 40mph limit for single carriageways. However, there was consensus that they were likely to now operate to the higher limit of 50mph, where local road conditions permitted.
- Reduced driver stress and frustration were considered by stakeholders as one of the key benefits of the policy change, with both drivers of HGVs and general traffic considered to have benefited.
- Local Authority officers interviewed had seen no change in HGV speeds since April 2015, although no specific monitoring had been undertaken. They also stated that there had been no perceived change in the frequency of complaints received regarding noise or emissions from HGVs as a result of the policy.
- None of the consultees felt that HGV routeing patterns had been changed as a result of the new limits.
- HGV operators noted that no journey time benefits had been experienced to-date, as road sections affected by the increase in speed limits represented a small proportion of overall journey distance and traffic conditions were felt to have worsened over the assessment period.
- There was no anecdotal evidence from stakeholders by the end of year 3 of economic benefits of the speed limit change, either in terms of fuel costs or journey time savings.
- Some consultees noted the ability of HGVs to now travel at or close to the optimum speed (52 mph), thereby minimising emissions. However, no evidence of change was provided or referred to and some consultees anticipated increased levels of braking and accelerating which could offset any such benefit.

2.1 Introduction

A series of interviews were undertaken in 2016 and 2019 to establish the short and longer-term response of different stakeholder groups to the change in HGV speed limits. The consultation was designed to determine how different groups have adapted their procedures and behaviours to the revised speed limits. Focus group discussions and a driver questionnaire were also conducted in 2016 but were not repeated as part of this longer-term assessment of the impacts of the speed limit change. A total of six interviews were conducted in 2019: one with a local authority, three with freight associations, one with a national haulage business and one with a local haulage business. This section of the report outlines the qualitative research questions and key findings. Details of the methodology and an example discussion guide are provided in Appendix A.

2.2 Qualitative Evaluation Questions

The key objectives of the qualitative research were to:

- Establish the level of awareness amongst HGV and non-HGV drivers about the change in speed limits;
- Establish how HGVs and other road users have responded to the change in HGV speed limit policy, such as changing their route choices; and
- Establishing the perceived benefits and costs of the new speed limits.

To achieve this, the following set of evaluation questions were established during the scoping phase:

- Are HGV drivers aware of the change in speed limit?
- If so, have HGV drivers altered their driving (on single-carriage roads and dual-carriage roads) in response?
- Have HGV firms made any changes to their policies/procedures/processes in response to the increase?
- Have HGV firms made any changed to their preferred routes as a response to the change?
- Have HGV firms perceived any benefits as a result of the change?
- Have HGV firms perceived any costs or negative impacts as a result of the change?
- What external/independent factors have influenced traffic speeds and flow since implementation of the speed limit changes?
- Are other drivers aware of the change in speed limit?
- If so, have they altered their driving (on single-carriage roads and dual-carriage roads) in response?
- Has the level of driver frustration or drivers' inclination to overtake HGVs on single carriageway roads changed following the speed limit increase?
- Have Local Authorities and Highway Authorities perceived any changes as a result of the speed limit increase?
- Have residents near to affected single and dual carriageway roads perceived any changes as a result of the speed limit increase?
- Have there been any changes to the types of accidents occurring on affected roads and their contributory factors?
- Have Local Authorities or Highway Authorities made any changes (such as the introduction of local speed limits) as a result of the speed limit increase?

2.3 Results: Qualitative Research

The results of the qualitative research are presented below under the following headings:

- Awareness of the policy change;
- Response to the change;
- Benefits of the change;
- Costs of the change; and
- External factors.

2.3.1 Awareness of the Policy Change

This section considers levels of awareness of the speed limit change amongst HGV operators and other stakeholders, and the key methods by which different groups were made aware of the change.

The stakeholder organisations which took part in the qualitative research were all aware of the change in HGV speed limits on both single and dual carriageway roads prior to being contacted for this evaluation, with the majority also having been aware that a change was proposed ahead of the DfT consultation on the proposals in November 2012[1]. The majority of Trade Association representatives interviewed had been involved in the development of the policy ahead of the public consultation and some publicised the policy change to their members at the time. Conversely, the majority of the HGV operators who took part in the qualitative research had not been involved in the DfT consultation and found out about the change at or near the time the policy came into force via word of mouth, the media or trade press.

For the HGV operators interviewed, the change in speed limits had been communicated to their drivers through a variety of means including:

- Updating company policy and training;
- Holding toolbox talks / workshops; and
- Social media.

Stakeholders felt that awareness of the policy change amongst the general road users would be very low, although it was stated that speed awareness and young driver training courses do now include training on this policy change. Local authorities indicated that they had not undertaken any specific public awareness campaigns in relation to the policy change.

2.3.2 Response to the Change

This section analyses the impacts stakeholders perceived the policy to have had in relation to HGV speeds, routeing and driving behaviour. All qualitative research stakeholders were questioned to see whether or not they had perceived any impacts as a result of the policy change.

HGV Speeds – Single Carriageways

All stakeholders interviewed held the view that some HGV drivers would have broken the previous speed limit (40mph) on single carriageway routes. Many therefore saw the revised limit as a formalisation of previous driving habits, rather than an increase in absolute terms.

HGV operators interviewed in 2016 indicated that their drivers would now be taking account of the new speed limits; however, drivers are instructed to obey speed limits but also to reflect local conditions when choosing a safe driving speed. The operators interviewed felt that on the majority of single carriageway roads, road conditions were the key factor limiting HGV speeds, rather than the speed limit per se, and there would be few routes where HGVs could achieve the new speed limit for significant periods of time.

Some operators interviewed in 2016 indicated that there was some initial inertia amongst HGV drivers in their behaviour response to the new speed limit, with drivers continuing to drive to the previous 40mph limit. The different speed limits which apply

[1] https://www.gov.uk/government/consultations/examining-the-speed-limit-for-heavy-goods-vehicles-over-7-5-tonnes-on-single-carriageway-roads

in England and Scotland have also led to some confusion, necessitating the provision of additional signage at the border to resolve this issue.

The Local Authority interviewed in 2016 had not noticed any change in speeds of HGVs on their roads, although specific monitoring had not been undertaken. They also indicated that many local authority roads have specific local speed limits, meaning that there are few routes where national speed limits applied, limiting the locations where the policy impacts would occur. Observed increases in local speeds were generally considered to relate to changes in local conditions, rather than a change in policy. These issues highlight the importance of local context on speeds and driving behaviour.

HGV Speeds – Dual Carriageways

It was noted by a range of stakeholders that the majority of HGV drivers using dual carriageway routes are driving within the new 60mph limit due to speed limiters (limiting speed to 56mph) being in place within their vehicles. This was identified by stakeholders as an EU requirement, with Brexit identified as having the potential to impact upon this requirement (and hence dual carriageway HGV speeds) in the future.

HGV Routeing

None of the stakeholders interviewed in 2016 and 2019 were under the impression that HGV routeing patterns had been changed as a result of the new limits, with some HGV operators indicating that the speed limit changes would generate very minor journey time savings for most HGV journeys, meaning that it was not worthwhile altering vehicle routeing. Other factors such as fuel efficiency, safety and height and weight restrictions were considered significant factors determining route selection for operators alongside journey times.

The local authority interviewed had not observed any changes in the levels of HGVs using different routes. No increase in public complaints in relation to HGV volumes on specific routes had been observed following the speed limit changes. Other factors such as resurfacing were identified as more significant causes of resident complaints in relation to increased noise from HGVs.

Driving Behaviour

Stakeholders interviewed felt that car drivers are now more tolerant of HGVs as they are able to travel at higher speeds, particularly on single carriageways.

No HGV operators reported any changes in policies regarding rest periods, as practical factors regarding the journey in question were considered the key factors in determining the selection of rest locations. Associations indicated that those companies using software to determine rest locations might have been influenced by the change.

2.3.3 Benefits of the Change

This section outlines the perceived benefits of the introduction of higher speed limits on both single and dual carriageways. All of the benefits mentioned within this section have come from opinions or evidence provided by the stakeholders, which have been grouped into the following categories:

- Journey quality benefits;
- Economic benefits;
- Environmental benefits; and
- Safety benefits.

Journey Quality Benefits

The largest benefit of the policy identified by HGV operators was the reduction in driver stress for HGV drivers resulting from fewer conflicts between HGVs and general traffic, particularly on single carriageway roads. Other stakeholders also identified a reduction in stress and road rage amongst general traffic as a significant benefit of the policy change. Associations felt that the policy had had a wider beneficial reputational impact for haulage firms and the freight industry as a whole due to a reduction in the delays caused to general traffic by HGVs.

Economic Benefits

HGV operators stated that although speeds have increased in some instances, no economic benefits relating to time savings had been noted to-date.

Whilst some stakeholders perceived that there may be additional minor benefits to the amount of fuel used by HGVs resulting from the change, the HGV operators consulted had not perceived any change in fuel costs or vehicle operating costs which could be attributed to the policy.

Environmental Benefits

Stakeholders noted that the optimum travel speed for an HGV to minimise carbon emissions is around 52 mph and therefore the increased speed limits on both single and dual carriageway roads will support a reduction in carbon emissions. With HGVs being able to travel closer to the optimum speeds for longer it was considered that there was potential that HGVs will emit fewer emissions.

None of the consulted authorities had identified any significant changes in air quality since the implementation of the policy. However, local authority monitoring tends to focus on AQMAs and these tend to be located in urban areas and therefore not on routes where national speed limits apply.

Safety Benefits

Local Authorities indicated that to-date they were aware of no specific road safety impacts as a result of the change in speed limits. Local Authorities indicated that safety training for new drivers and those taking speed awareness courses had been updated to reflect the policy change.

HGV operators identified that the policy had improved perceptions of safety on single carriageway routes, through reducing conflict with other drivers wishing to or attempting to overtake HGVs. This was considered beneficial in helping to reduce driver stress levels in some instances. They had observed that cars are not overtaking as much due to the reduced differential between HGV speeds and other traffic.

2.3.4 Costs of the Change

This section outlines the perceived costs identified from the introduction of higher speed limits on single and dual carriageways. All the costs mentioned within this section have come from opinions provided by the stakeholders. Similarly, to the benefits section the impacts have been grouped into the following categories:

- Economic costs;
- Environmental costs;
- Safety costs; and
- Other costs.

Economic Costs

The Local Authorities interviewed suggested that in the long term, and as a result of increased HGV speeds, there may be increased road maintenance costs. This was because HGVs travelling at higher speeds will exert increased pressures on the road, causing more surface damage. However, no evidence was available to quantify the potential contribution of HGVs to maintenance.

Environmental Costs

As mentioned in the benefits section, the optimum speed for most HGVs in terms of minimising emissions is ca. 52mph. Stakeholders felt that the increased speed limits will support more HGVs in travelling closer to this speed; however, any benefit may be outweighed by the increased levels of braking and accelerating needed, leading to additional carbon emissions. This impact was felt to be most significant on single carriageway roads.

No changes in local air quality or noise were considered attributable to the policy change, although these issues are generally located in urban areas, where national speed limits do not apply.

Associations considered that the policy had the potential for a negative impact for rail freight, which could have associated environmental impacts, although no downturn in rail freight had been experienced to-date.

Safety Costs

In the 2016 consultation stakeholders identified the potential that increased HGV speeds could contribute to accidents, as some other road users may attempt riskier overtaking manoeuvres. It was also suggested that those drivers who would previously have chosen to overtake will potentially continue to do so. None of the interviewed stakeholders in 2019 identified this concern.

Other Costs

Rail freight associations in both 2016 and 2019 were concerned that the policy, if proven to significantly impact upon road haulage costs, may result in a change in the relative cost balance between road and rail freight in favour of road freight. They indicated that current trends show positive growth in both road and rail freight, indicating that this concern has not significantly impacted on the financial viability of rail freight to date.

2.3.5 Contextual Factors

Alongside the change in HGV speed limits a number of contextual factors have the potential to influence traffic speeds, flows and the other impacts discussed in this evaluation. Interviewees were asked to identify what factors they considered to have influenced these attributes since the introduction of the new speed limits in April 2015. This section outlines any external factors which may have contributed to any of the above impacts of the speed change which have been noted by those interviewed.

Economic Factors

The majority of those interviewed suggested that economic growth was one of the largest contextual factors influencing traffic flows and therefore speeds at present. Almost all the stakeholders and individuals interviewed felt that levels of congestion have increased since the policy was implemented, with one HGV operator identifying a 5.5% decrease in the average speeds of its fleet over the past four years.

Operators also felt that a larger percentage of the strategic road network was undergoing road works and the growth in use of average speed restrictions had further reduced average vehicle speeds.

Subsequently, it was considered that this would impact the speeds at which HGVs are able to travel and potentially mask any increases in free-flow average speeds resulting from the policy.

Some stakeholders identified a continuation in the shift in the balance of goods vehicle classes on British roads, which was identified in the 2016 consultation, with the numbers of HGVs remaining static and LGVs increasing. This shift was being driven by changing consumer demands including a continued increase in online shopping and home deliveries.

Stakeholders identified that fuel prices in the United Kingdom have dropped considerably since the policy was introduced in April 2015, which in turn makes the cost of transporting goods by road cheaper. This has been combined with a continued freeze in the level of fuel duty. The rail freight associations suggested that this fuel duty freeze may have widened the cost gap between rail and road freight, increasing the propensity to transport goods by road due to rail access charges growing in line with the Retail Price Index.

One HGV operator identified that some rail freight lines were now at full capacity, such as within the Midlands, and that this might be restricting rail freight growth, leading to a growth in HGV trips.

Technology

Vehicle technologies, both in HGVs and other vehicles, are continuously evolving, helping to avoid accidents and promote safer driving practices. Stakeholders identified that EU legislation came into force in November 2015 stipulating that all new HGVs have to be built with Autonomous Emergency Braking (AEB), with the aim of reducing the number of accidents and the level of severity. Similar technologies are available in cars and although not mandatory are becoming increasingly common.

Telematics systems are available to allow HGV operators to closely monitor driver behaviour and performance and are becoming increasingly relevant. The operators indicated that these technologies were used as part of ongoing driver training to avoid instances of speeding. Automated routeing software is also available to allow operators to choose the quickest, least congested and cheapest routes to their destinations utilising live data in some instances.

Other

HGV operators felt that the availability of driver welfare facilities had reduced, with fewer locations now available where drivers could park overnight or with food and drink facilities. This could impact upon the choices of stopping locations for drivers.

2.4 Qualitative Research Summary

This section has presented the results of a series of stakeholder consultations into the implementation of the national speed limit change for HGVs. It has concluded that there was a high level of awareness of the change among stakeholders. The perception among local authority respondents was that there has been little change in HGV speeds, with no observed evidence of a worsening situation in terms of air quality or noise.

There was no reported change in HGV operator or driver routeing or policies beyond those relating to speed limits as a consequence of the speed limit change. A reduction in driver stress and frustration, for both drivers of HGVs and general traffic, were mentioned as key benefits of the policy change.

3. Single Carriageway Impacts

Main Findings from the Single Carriageway Impact Evaluation

- The average speed of HGVs >7.5t on 60 mph single carriageway roads has increased by 1.6 mph (44.1 to 45.7 mph) with analysis suggesting that the policy change in April 2015 is a contributory factor to this increase;
- The average speed of light vehicles has increased by 0.3 mph (47.9 to 48.2 mph) since the policy change;
- Small reductions in the variance of vehicle speeds have been observed since the policy change. These were evident principally at higher flow rates (a maximum of 1.2 mph in the 900 – 1,000 vehicle per hour flow band).
- 18% of observed HGVs >7.5t exceeded the increased 50 mph speed limit for this vehicle type on 60 mph single carriageway roads. Prior to the HGV speed limit increase 9% of vehicles exceeded 50 mph. The proportion of HGVs exceeding the posted speed limit has decreased by 67% (falling from 85% to 18%) since the policy change.

3.1 Single Carriageway Introduction

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

The DfT Single Carriageway Impact Assessment[2], produced as part of the evidence base for implementing the policy change, did not produce forecasts of changes in the speeds of HGVs >7.5t, but tested a lower and upper range 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 3-1 shows the lower and upper speed ranges 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 two to three fatal accidents and four to nine serious accidents per annum across affected roads.

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

[2] - 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 3-1: HGV free-flow speed inputs for NTM single carriageway impact assessment (mph)

Scenario	Single carriageway A-roads		Single carriageway B-roads		Justification
	Artic.	Rigid	Artic.	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 (+1.74)	46.09 (+0.58)	46.09 (+1.74)	46.09 (+0.58)	Observed free-flow speed of 2-axle Rigid HGVs
Option 1 - upper	49.09 (+4.74)	49.09 (+3.58)	47.85 (+3.50)	47.85 (+2.34)	Free-flow speed of cars as modelled in the NTM

Source: DfT Single Carriageway Impact Assessment (2014)

3.1.1 Single Carriageway 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. The qualitative research 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 Year 3 qualitative work confirmed that the policy was still understood amongst stakeholder groups.

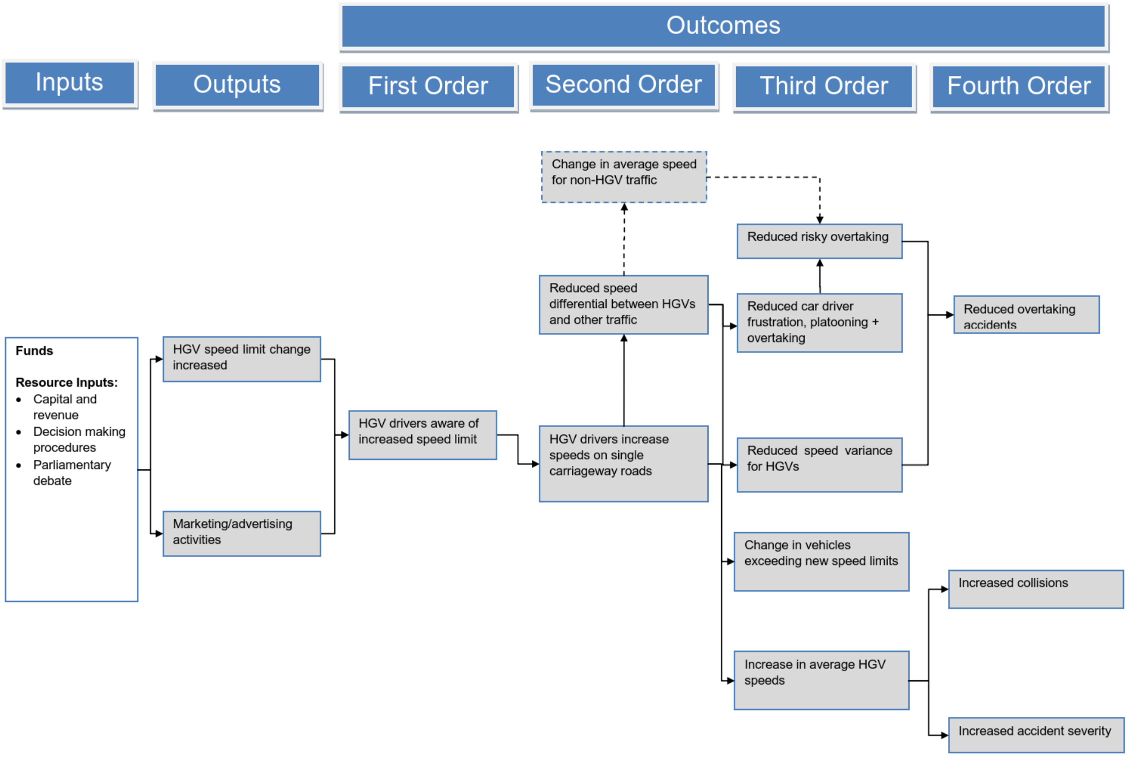
The intervention logic indicated an expectation that average HGV speeds would increase on single carriageways due to the speed limit increase. This expectation reflected the average speeds of HGVs in the baseline period (44.1 mph), which were above the ex-ante 40 mph limit. The ex-ante DfT 2014 Impact 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 was for non-HGV average speeds to increase as a result of a reduction in platoons of vehicles behind 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, providing an indication of traffic growth over time across England and Wales. Whilst it is possible that the policy change could have influenced traffic volumes and / or routeing, this impact is very difficult to measure or separate from other drivers of traffic growth. The qualitative work, particularly discussions with HGV operators, also suggested the policy had not impacted HGV routeing decisions.

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 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 3-1 shows the ex-ante logic mapping pathway for single carriageway roads.

Figure 3-1: Ex-Ante Logic Mapping Single Carriageway Pathway



The remainder of this section sets out the results of the Year 3 Impact Evaluation analysis as they apply to single carriageway roads, covering:

- Average speeds;
- Speed variance;
- Proportion of vehicles exceeding speed limits; and
- Contextual factors.

3.2 Analysis of Average Speed Impacts for Single Carriageway Roads

3.2.1 Single Carriageway Speeds Evaluation Questions

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

- Have average speeds for HGVs >7.5t significantly changed on affected roads following the increase in speed limit?

3.2.2 Single Carriageway Speeds Key Metric Analysis

The analysis of average speeds was based upon traffic speed and flow 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 B.

The following vehicle classifications have been used to present the analysis results within this report:

- Light vehicles: cars and light goods vehicles (less than 3.5 tonnes); and
- HGVs: rigid with three or more axles and all articulated HGVs. All vehicles in this class are > 7.5 tonnes and therefore affected by the policy change.

Rigid 2-axle HGVs include vehicles in both the 3.5t-7.5t and >7.5t weight classes. It is not possible to distinguish between these two weight classes within the data used in the evaluation and so the results for this vehicle class are not reported in this section. However, the results for rigid 2-axle vehicles are provided in Appendix C. 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.

The data used in the ex-ante and ex-post periods were as follows:

- Two years of data have been used for the ex-ante period: April 2013 to March 2015; and
- Three years for the ex-post period: April 2015 to March 2018.

In the baseline period, 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 45.7 mph, **an increase of 1.6 mph in the speed of HGVs**. 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. A small increase in light vehicle speeds (cars and LGVs) was also recorded (47.9 to 48.2 mph). Table 3-2 summarises these results for HGVs and light vehicles. Figure 3.2: provides plots of average speeds by vehicle type and flow band for the ex-ante and ex-post datasets.

Table 3-2: Average Speed Analysis Results for 60 mph Single Carriageways

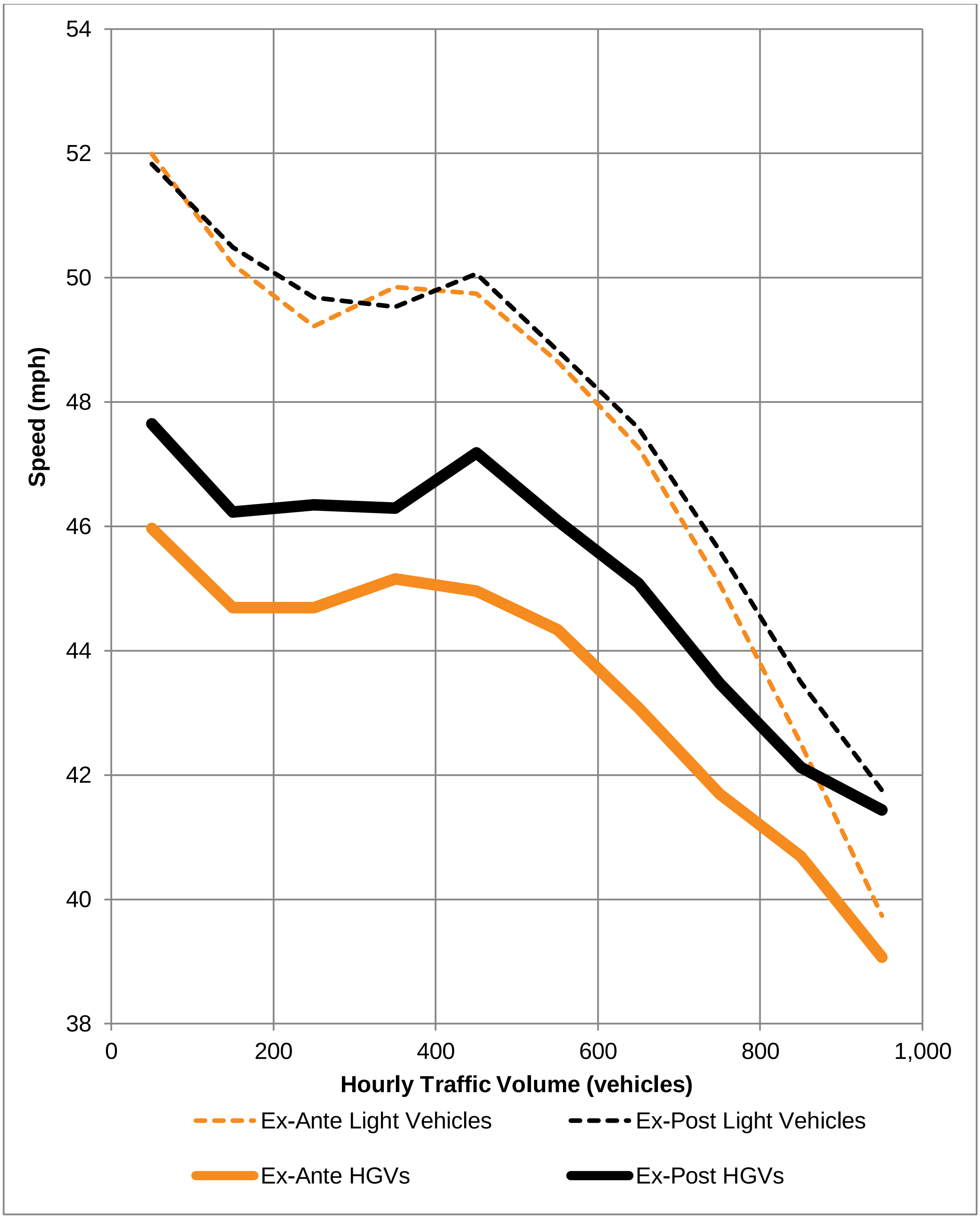
Vehicle Class	Pre-Limit-Increase Average Speed (mph)	Post Limit-Increase Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)
Free Flow (0 – 100 vehicles per hour)			
Light vehicles	52.0	51.8	-0.16 [-0.18 to -0.15]
HGVs	46.0	47.6	+1.68 [+1.65 to +1.71]
All Flows (0 – 1,000 vehicles per hour)			
Light vehicles	47.9	48.2	+0.24 [+0.23 to +0.25]
HGVs	44.1	45.7	+1.59 [+1.56 to +1.63]

The 95% confidence intervals (presented in Table 3-2) 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 do not assess the accuracy of the measuring devices themselves (DfT automatic traffic counters). However, the counters are subject to routine maintenance every six months, during which the functioning of the equipment is thoroughly checked.

Figure 3.2: Average Speed Analysis Results for 60 mph Single Carriageways



3.3 Analysis of Speed Variance Impacts for Single Carriageway Roads

3.3.1 Single Carriageway Speed Variance 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 platoons behind slower moving HGVs 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 was expected to reduce the variance in speeds between vehicle types.

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 were:

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

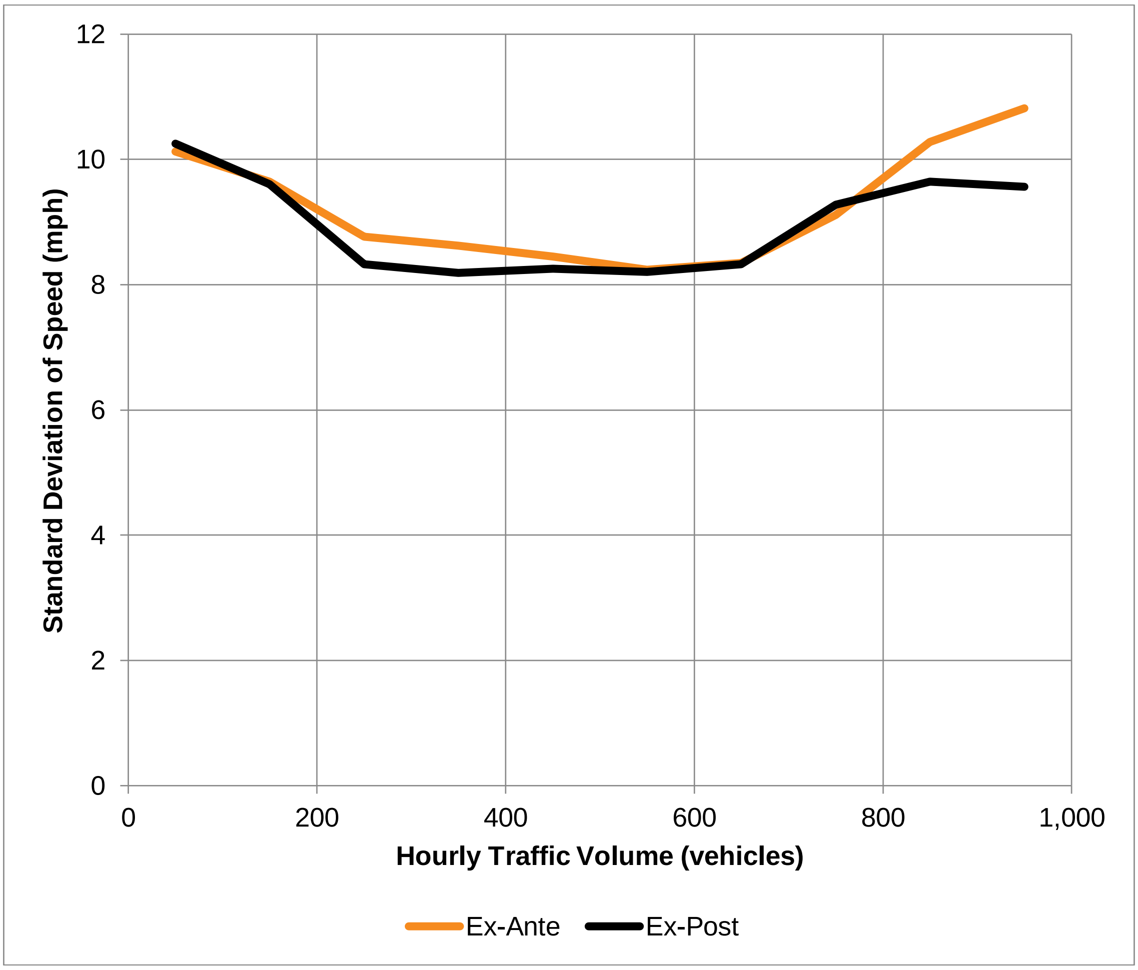
3.3.2 Single Carriageway Speed Variance Key Metric Analysis

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 3-3 plots the standard deviations for the ex-ante and ex-post datasets by flow band.

The ex-post variance in vehicle speeds is generally at the same level or lower than the variance in the ex-ante dataset. These differences are generally small, with the largest difference emerging at higher levels of flow, particularly above 800 vehicles per hour. This fits with the assumptions of the intervention logic, that light vehicles are increasingly likely to be in a platoon of vehicles where the leading vehicle is an HGV as flows increase.

- **The results indicated that there were some reductions in speed variance on single carriageways and that the pattern of variance over the full range of flows fits the expected results according to the intervention logic**.
- **However, the reductions in variance are small (a maximum of 1.2 mph in the 900 – 1,000 vehicle per hour flow band) and the data is not sufficient to attribute this change directly to the policy change.**

Figure 3-3: Standard Deviations of Speeds on 60 mph Single Carriageways



[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.

3.4 Proportion of Vehicles Exceeding Speed Limit for Single Carriageway Roads

3.4.1 Single Carriageway HGV Speeding Evaluation Questions

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

- 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 Single Carriageway HGV Speeding Key Metric Analysis

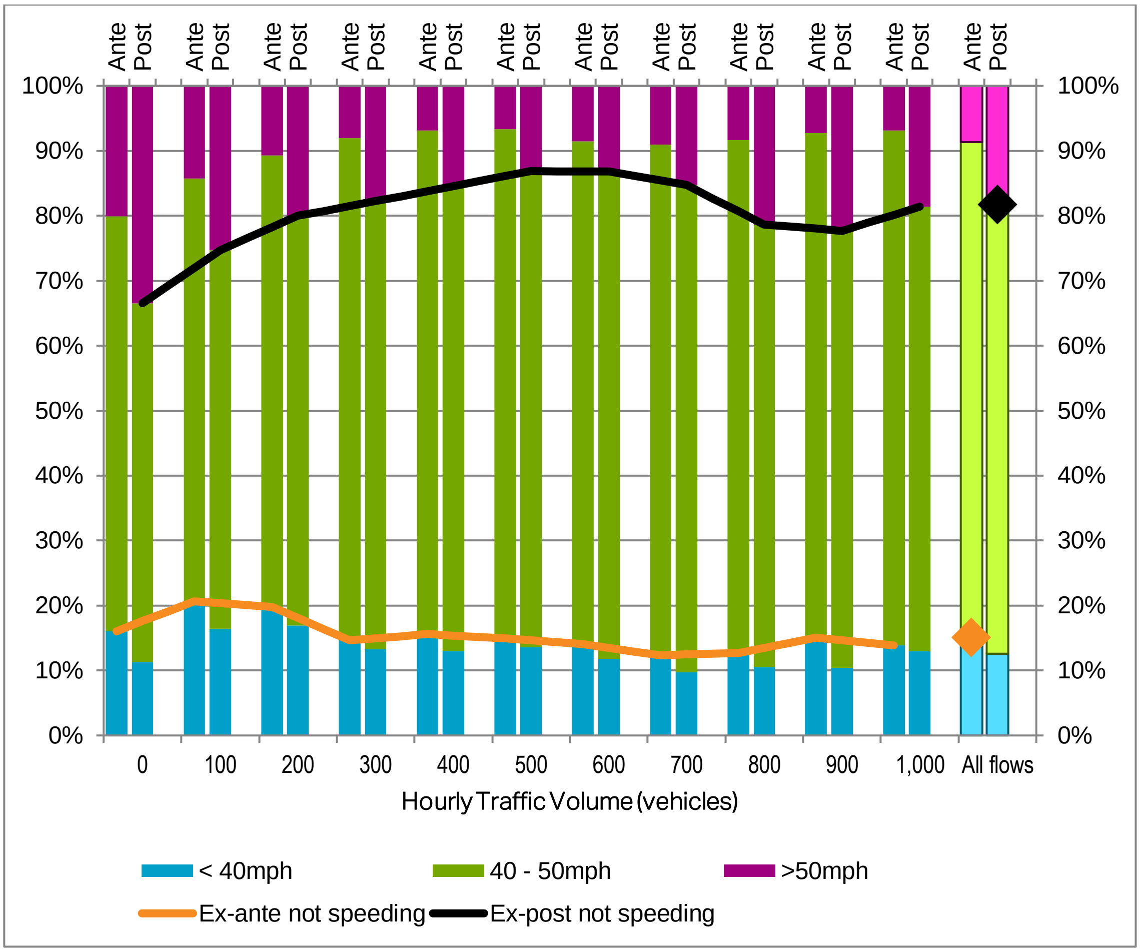
This analysis is built on the core dataset used for analysing average vehicle speeds. On this basis, statistical confidence in the results is in line with the average speed analysis and can be considered robust in terms of presenting the observed data. The analysis groups all vehicle observations into 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 3-4 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; 18% across all flows, compared with 85% in the ex-ante data.

At low flows, the percentage of HGVs exceeding 50 mph in the ex-post data is 34%, which is 14 percentage points more than the equivalent percentage in the ex-ante data. 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 18% averaged across all flow levels). 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 legal speed limit (falling from 85% to 18%).**
- **The reduction in the proportion of vehicles exceeding the legal speed limit can be robustly attributed to the policy change as this is directly a result of the higher speed limit of 50 mph for HGVs. Furthermore, the reduction is present despite an increased proportion of HGVs exceeding 50 mph in the ex-post data.**

Figure 3-4: Proportions of HGVs by Speed Band and Hourly Flow



3.5 Single Carriageway Contextual Factor Analysis

3.5.1 Single Carriageway Contextual Evaluation Questions

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

- 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:

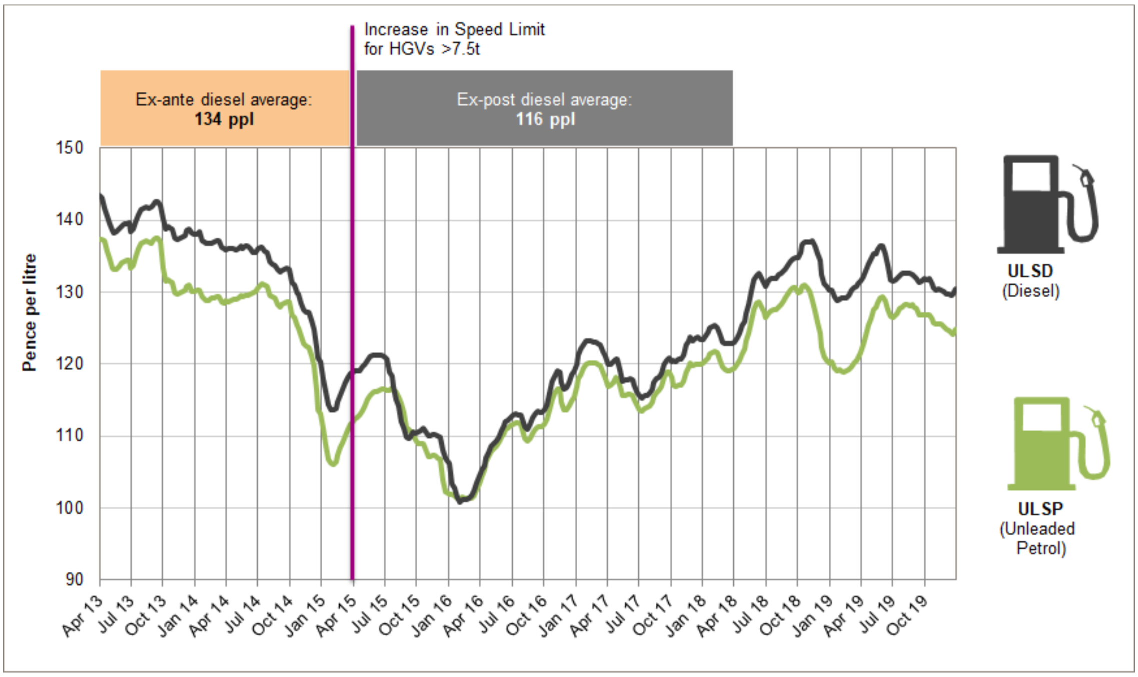
- Weekly UK fuel prices, as a measure of the key direct cost of operating a vehicle. Whilst fuel is only one component of vehicle operating costs, it is typically the largest one and information of cost trends are readily available; and
- Traffic flows in Great Britain by vehicle type and road type, 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.

3.5.2 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 3-2 plots both diesel and petrol weekly average pump prices covering the period from the beginning of April 2013 to the end of December 2019. At the beginning of the ex-ante study period (April 2013 – March 2015) diesel prices were in excess of 143 pence per litre, dropping as low as 114 pence per litre in early 2015 prior to the introduction of the revised speed limits in April. On average, ex-ante diesel prices were 134 pence per litre. Diesel prices in the ex-post study period (April 2015 – March 2018) were lower, with a minimum of 101 pence per litre in early 2016 and a maximum of 125 pence per litre in early 2017. On average, ex-post diesel prices were 116 pence per litre, 13% lower than the ex-ante average.

Figure 3-2: Weekly UK Fuel Prices from Apr 2013 to Dec 2019



Source: Department for Business, Energy and Industrial Strategy[4]

[4] https://www.gov.uk/government/statistical-data-sets/oil-and-petroleum-products-weekly-statistics

Given the discussion above, the impact of higher fuel prices in the ex-ante period should be considered. For example, freight operators could have made greater efforts to save fuel in the ex-ante period to offset the higher pump prices. The qualitative research with freight operators did not produce any evidence that HGV driving speeds have been altered to save fuel; however, they did note the lower fuel prices since the policy was introduced and there was some indication that marginal fuel savings may have been achieved since the policy change.

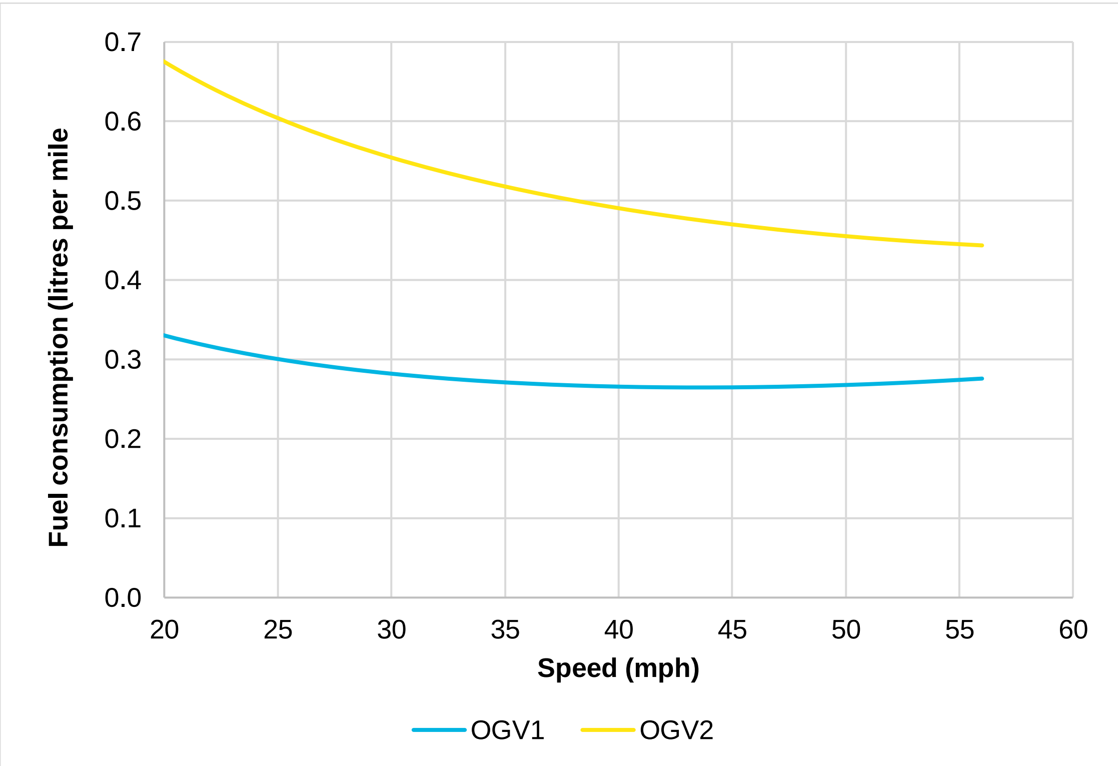
In order to consider the potential impact of fuel prices on operator costs it was necessary to consider the fuel consumption characteristics of HGVs. The TAG Data Book[5] contains fuel consumption parameters (which allow the calculation of consumption in litres per km) for a range of vehicle types, the relevant types for this study were:

- OGV1: consisting of rigid HGVs up to 26 tonnes (containing a proportion of vehicles impacted by the policy change); and
- OGV2: consisting of rigid HGVs over 26 tonnes and all articulated HGVs (containing entirely vehicles impacted by the policy change).

Figure 3-3 shows the assumed fuel consumption curves for OGV1 and OGV2 vehicle classes based on the TAG Data Book parameters. This highlights that the fuel consumption for OGV2 vehicles is generally expected to improve as speeds increase and fuel consumption for OGV1 vehicles is fairly consistent over the range of speeds expected on single carriageway roads affected by the policy (the fuel consumption of OGV1 vehicles at 50 mph is less than 1% higher than the fuel consumption at 40 mph).

- **Based on these analyses, it seems unlikely that fuel prices have played a role in changes in HGV speeds across the study period.**

Figure 3-3: Comparison of OGV1 and OGV2 Fuel Costs by Speed



Source: TAG Data Book May 2019

[5] DfT, TAG Data Book, May 2019, V1.12, Table A1.3.8

3.5.3 Traffic Flows

National traffic flow data published by the DfT[6] 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; and
- **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.

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 3-4 and Figure 3-5 show traffic growth for 2008 to 2018, first by vehicle type and then by road type. In both cases the data is indexed (with 2008 traffic levels equating to 100%).

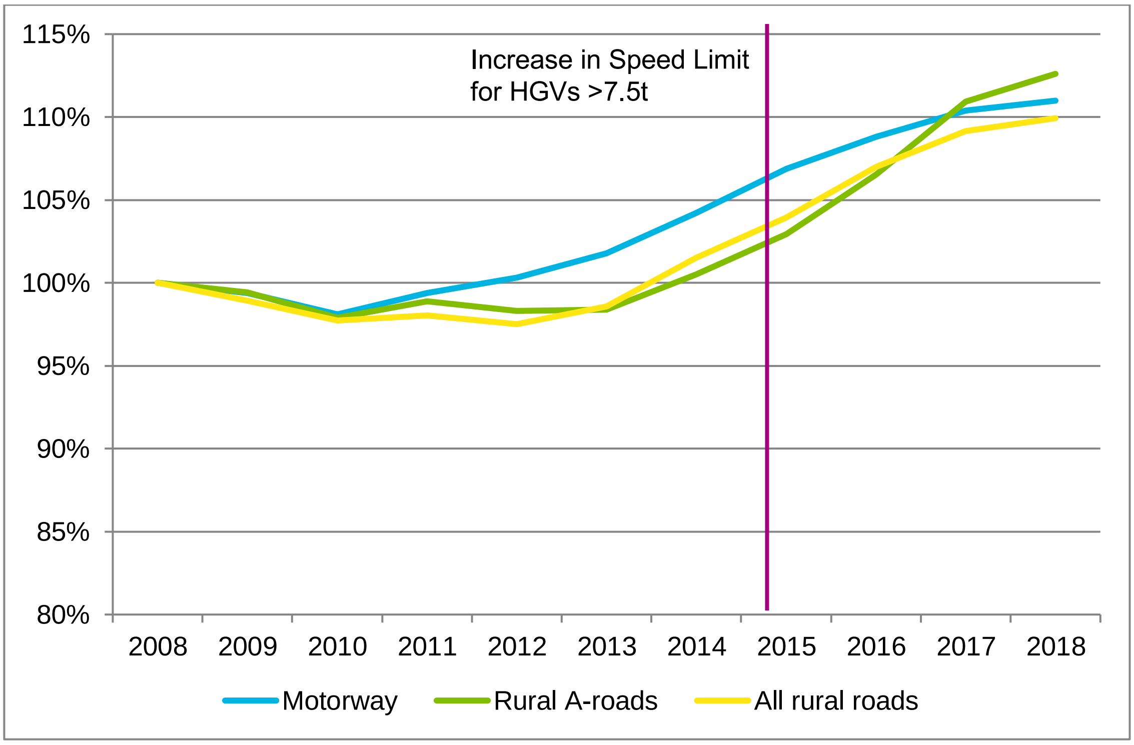
Both figures illustrate that in the period covered by this evaluation (April 2013 to March 2018), traffic flows have been increasing across vehicle types and road types. Traffic growth by road type has remained relatively consistent in the period from 2013 to 2018.

[6] https://www.gov.uk/government/collections/road-traffic-statistics

Figure 3-4: Indexed Traffic Growth by Vehicle Type 2008 – 2018 (2008 = 100%)

Source: DfT Traffic Statistics[7]

Figure 3-5: Indexed Traffic Growth by Road Type 2008 – 2017 (2008 = 100%)



Source: DfT Traffic Statistics

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.

[7] https://www.gov.uk/government/collections/road-traffic-statistics

Almost all stakeholders interviewed for the qualitative research felt that levels of congestion (generally correlated with traffic flow) have increased since the policy was implemented with one HGV operator quoting a reduction in its average fleet speed over the past four years as evidence of this.

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 on the single carriageway roads in this evaluation. The following conclusions have therefore been drawn:

- **The observed increases in HGVs >7.5t speeds on single carriageway roads are very unlikely to be due to a reduction in traffic flows. The increase in traffic flows may have dampened 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);**
- **Both the average speed and contextual analyses support the conclusion that the policy change has contributed to the increase in HGV speeds on single carriageways.**

3.5.4 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 1.6 mph increase in ex-post HGV speeds on single carriageways, and corresponding, smaller increases in 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 the two individual years of data in the ex-ante and three years in the ex-post periods corroborates the results with good correlation between the individual 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) in section 4 makes it possible to state robustly that the observed increase in HGV >7.5t speeds on single carriageways has contributed to the policy change.**

4. Dual Carriageway Impacts

Main Findings from the Dual Carriageway Impact Evaluation

- The average speed of HGVs >7.5t on 2-lane 70 mph dual carriageway roads has increased by 0.5 mph (52.0 to 52.5 mph) and that this is at least partly attributable to the policy change;
- Speeds of light vehicles have increased by 0.1 mph (65.0 to 65.1 mph) since the policy change;
- Small reductions of the variance of vehicle speeds have been observed since the policy change, these are evident principally at higher flow rates (a maximum of 2 mph in the 13,00 to 1,400 vehicle per hour per lane flow band).
- 81% of HGVs >7.5t exceeded 50 mph on 2-lane dual carriageway roads prior to the speed limit change and 83% exceeded this figure after the speed limit change. The proportion of HGVs speeding has decreased by 74% (falling from 81% to 7%) since the policy change.

4.1 Dual Carriageway 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[8], 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 would not change. This section discusses the findings from the impact analysis as it applies to dual carriageway roads.

4.1.1 Dual Carriageway 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. The qualitative research 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, but all stakeholders interviewed in 2019 indicated that their organisations were aware of the policy (although some perceived that awareness amongst the general public has reduced since the implementation of the policy).

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;
- 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

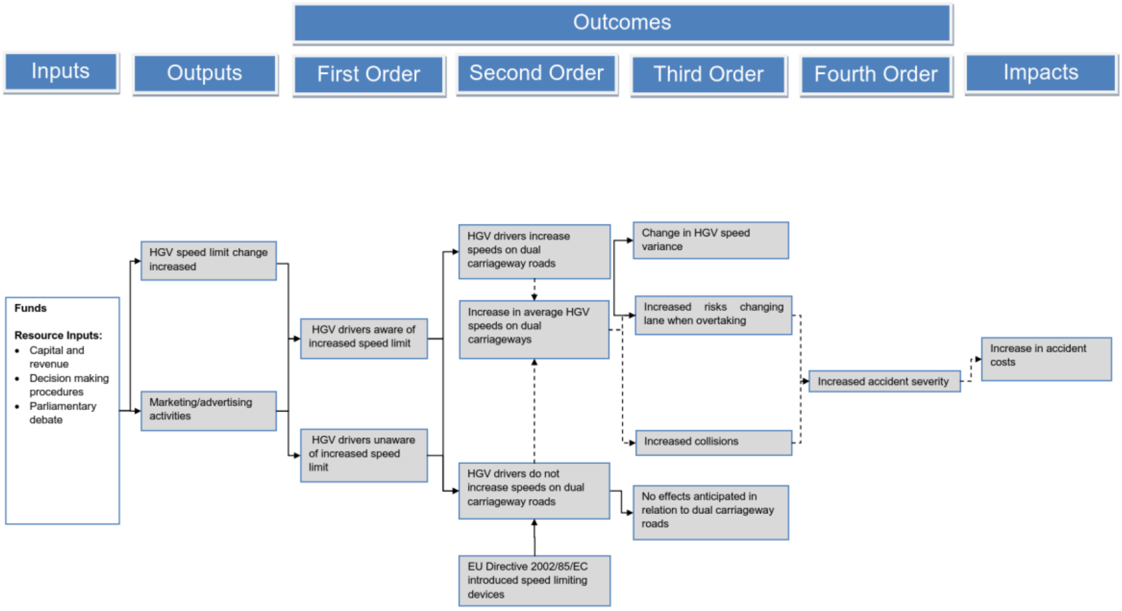
[8] - Department for Transport (2014); Impact Assessment: Raising the Speed Limit for HGVs over 7.5 tonnes on dual carriageway roads in England and Wales

- That a comparison of HGV speeds on dual carriageways and motorways prior to the policy change[9] 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 intervention logic pathway for safety impacts was neutral based on the fact that a change in speeds was considered unlikely. However, an alternative pathway existed which identified potential increases in collisions and the severity of collisions if an increase in the speed of HGVs did occur on dual carriageways.

Figure 4-1 shows the ex-ante logic mapping pathway for dual carriageway roads.

Figure 4-1: Ex-Ante Logic Mapping Dual Carriageway Pathway



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

4.2 Analysis of Average Speed Impacts for Dual Carriageway Roads

4.2.1 Dual Carriageway Speeds Evaluation Questions

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

- Have average free-flow speeds for HGVs over 7.5t significantly changed on affected roads following the increase in speed limit?

4.2.2 Dual Carriageway Speeds 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 speeds and a classification of vehicle type. A full detail of the methodology applied can be found in Appendix B. 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; and
- HGVs: rigid with three or more axles and all articulated HGVs. All vehicles in this class are > 7.5 tonnes and therefore affected by the policy change.

The results for 2-axle rigid vehicles are again provided in Appendix C. 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.

The same evaluation periods were used for dual carriageways:

- Two years of data have been used for the ex-ante period: April 2013 to March 2015; and
- Three years for the ex-post period: April 2015 to March 2018.

In the baseline (April 2013 – March 2015), the average speed of HGVs on dual carriageways, where the national speed limit applied, was 52.0 mph across all flows[10] (Table 4-1). Analysis of the datasets showed an ex-post (April 2015 – March 2018) average speed of 52.5 mph, **an increase of 0.5 mph in the speed of HGVs**. A small increase in light vehicle speeds (cars and LGVs) was also observed (0.2 mph). Figure 4-2 provides plots of average speeds by vehicle type and flow band for the ex-ante and ex-post datasets.

[10] 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.

Table 4-1: Average Speed Analysis Results for 2-Lane 70mph Dual Carriageways

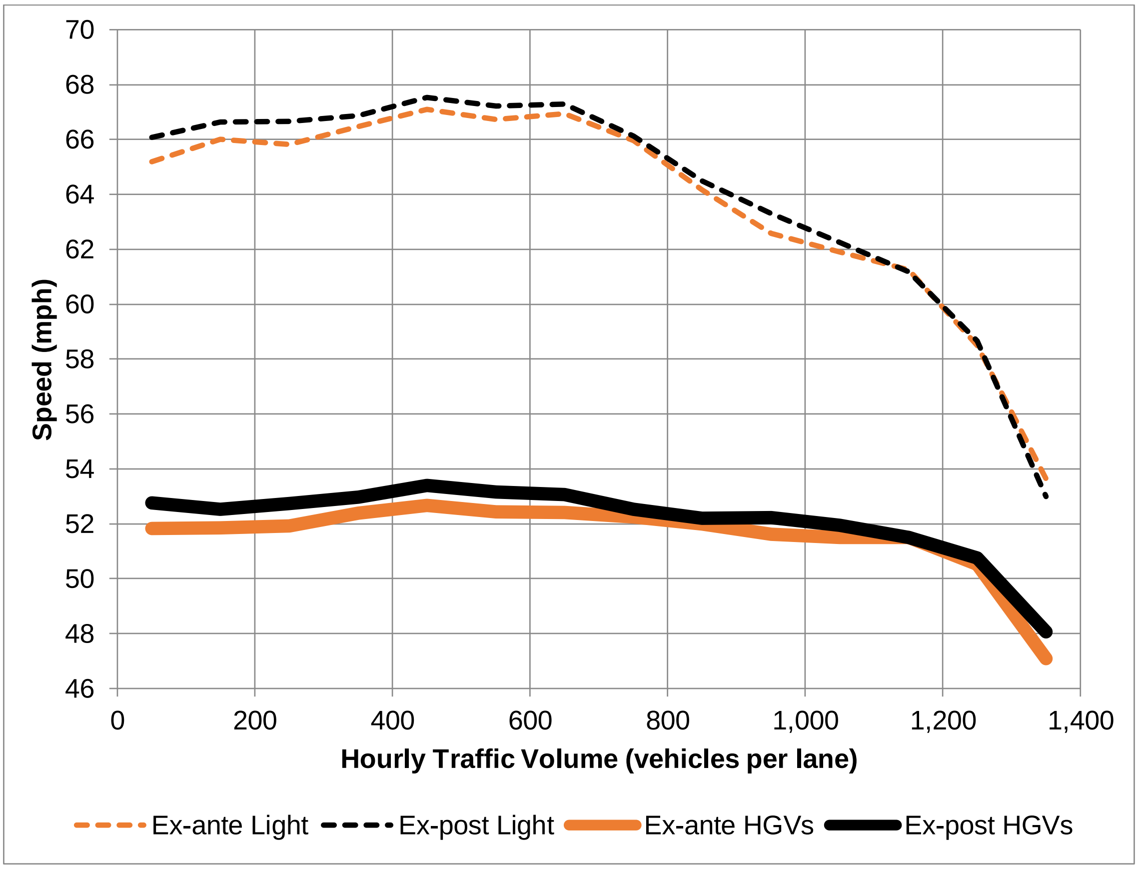
Vehicle Class	Pre-Limit-Increase Average Speed (mph)	Post Limit-Increase Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)
Free Flow (0 – 400 vehicles per hour per lane)			
Light vehicles	66.1	66.7	+0.60 [+0.59 to +0.61]
HGVs	52.0	52.8	+0.73 [+0.71 to +0.75]
All Flows (0 – 1,400 vehicles per hour per lane)			
Light vehicles	65.0	65.1	+0.15 [+0.14 to +0.16]
HGVs	52.0	52.5	+0.48 [+0.46 to +0.51]

The 95% confidence intervals (presented in Table 4-1) 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.**

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 4-2: 2-lane 70 mph dual carriageway speeds by flow band & vehicle type



4.3 Analysis of Speed Variance Impacts for Dual Carriageway Roads

4.3.1 Dual Carriageway Speed Variance Evaluation Questions

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

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

4.3.2 Dual Carriageway Speed Variance Key Metric Analysis

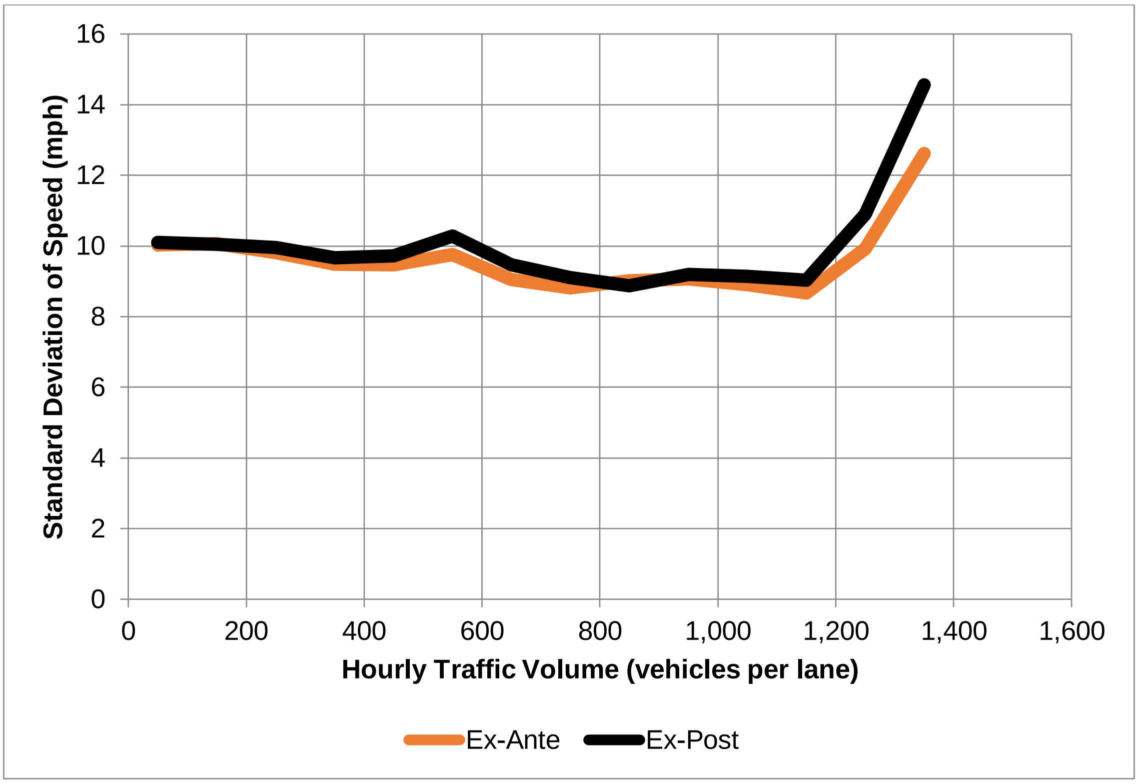
The analysis of variance makes use of the same dataset as the analysis of average vehicle speeds, with variances supplied as part of the dataset received from the DfT. The results of the variance analysis are presented in terms of the standard deviation of average speeds by flow band, which has units of mph[11]. Figure 4-3 plots the standard deviations for the ex-ante and ex-post datasets.

The ex-post variance in vehicle speeds is generally at the same level or lower than the variance in the ex-ante dataset. As with the single carriageway results, these differences are generally small, with the largest differences emerging at higher levels of flow from about 1,200 vehicles per hour per lane (the maximum difference measured is 2 mph in the 1,300 to 1,400 vehicle per hour per lane flow band). On two-lane dual carriageways, these conditions reflect reasonably high lane occupancy, where vehicle speeds will often be constrained by those of the vehicles in front. The reduced speed variance in the ex-post dataset at these flows could therefore reflect the reduced speed differential between HGVs and other traffic as a result of the policy change.

- **The results indicate that there are some possible reductions in speed variance on dual carriageways. However;**
- **The reductions in variance are generally small and the data is not sufficient to attribute this solely to the policy change.**

[11] 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.

Figure 4-3: Standard Deviations of Speeds on 2-lane 70 mph Dual Carriageways



4.4 Proportion of Vehicles Exceeding Speed Limit for Dual Carriageway roads

4.4.1 Dual Carriageway HGV Speeding Evaluation Questions

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

- 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?

4.4.2 Dual Carriageway HGV Speeding Key Metric Analysis

This analysis is, as per single carriageways, built on the core dataset used for analysing average vehicle speeds[12]. 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,

[12] 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.

errors in the calibration of vehicle speed limiters could result in vehicle speeds exceeding 56 mph by a small margin;

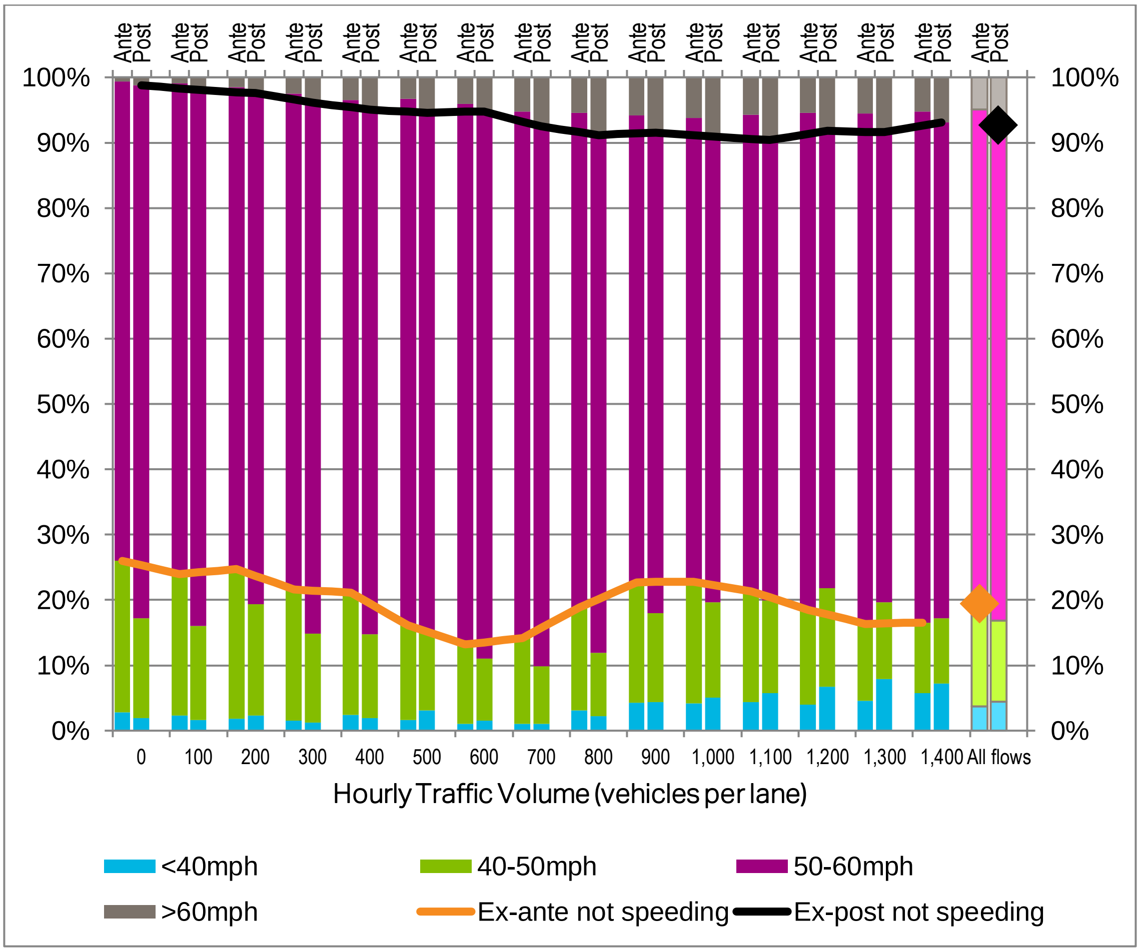
- On downhill sections of road, it is possible for vehicles to exceed the limited speed;
- A small proportion of vehicles may be operating without or with malfunctioning / disabled speed limiters; and
- Vehicle classification errors (non-HGVs classified as HGVs) will also account for some speeds in excess of 60 mph in the data.

Figure 4-4 displays the proportions of HGVs>7.5t 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.

Prior to the policy change 81% of observed HGVs >7.5t were exceeding 50 mph, this figure has risen to 83% following the policy change. However, as would be expected given the increased speed limit,

- **There has been a reduction in the proportion of HGVs >7.5t exceeding the legal speed limit (falling from 81% to 7%).**
- **The reduction in the proportion of vehicles exceeding the legal speed limit can be robustly attributed to the policy change as this is directly a result of the higher speed limit of 60 mph for HGVs.**

Figure 4-4: Proportions of HGVs by Speed Band



4.5 Dual Carriageway Contextual Factor Analysis

4.5.1 Dual Carriageway Contextual Evaluation Questions

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

- 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. Based on the analyses of fuel prices and the profile of HGV fuel consumption it seems very unlikely that changes in fuel price are linked to any observed changes in HGV speeds on dual carriageways. Both the quantitative and qualitative data suggest that traffic flows have increased on average since the policy was implemented and typically increases in flows result in decreases in average vehicle speeds. The impact of traffic flows is therefore considered unlikely to have contributed to any observed increases in HGV speeds on dual carriageways.

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 analysis 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.

4.5.2 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 4-2 and Figure 4-5 show 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.

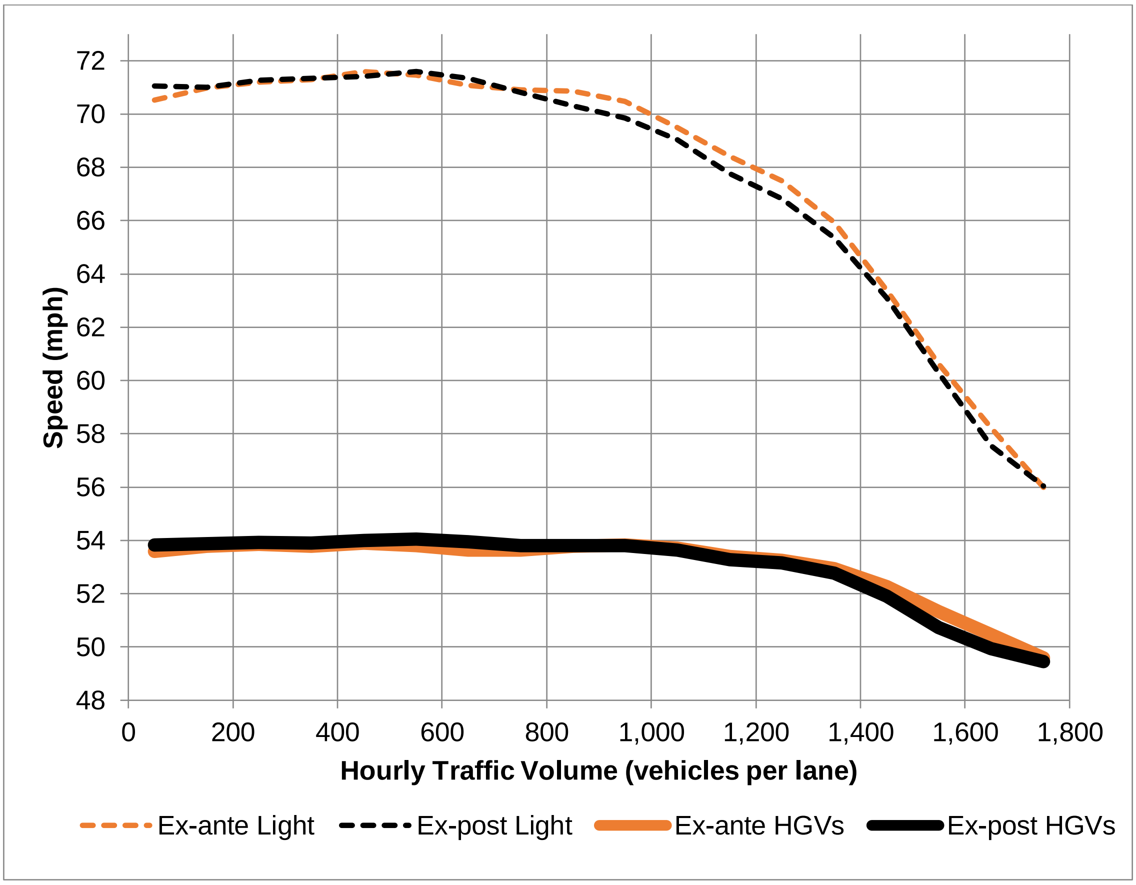
- **This result supports the conclusions of the average speed analysis for both dual carriageways and single carriageways where evidence of increased HGV speeds was found and attributed to the policy change as applied to those road types.**

There were small measured reductions in the average speeds of light vehicles (-0.56 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.

Table 4-2: 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	71.2	+0.10 [+0.09 to +0.12]
HGVs	53.8	53.9	+0.13 [+0.12 to + 0.13]
All Flows (0 – 1,800 vehicles per hour per lane)			
Light vehicles	69.0	68.4	-0.56 [-0.57 to -0.55]
HGVs	53.5	53.5	-0.02 [-0.03 to -0.01]

Figure 4-5: Motorway average speeds by flow band & vehicle type



4.5.3 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 0.5 mph increase in ex-post HGV speeds on 2-lane dual carriageways.

Analysis of the two years of data for the ex-ante and the three years for the ex-post periods corroborates the results with good correlation between the individual 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) supports a conclusion that the policy change has contributed to the observed increase in HGV >7.5t speeds on dual carriageways.**

5. Environmental Impacts

Main Findings from the Environmental Impact Evaluation

Air Quality

- It has not been possible to test the impact of the policy at sites sensitive to changes in Air Quality, due to there being no available data at sites located near AQMAs.
- A test has been conducted on the general change in emissions based on the typical traffic volumes and user class segmentation. This found that the scale of change of vehicle emissions of NOx, PM_{10} and CO_2, based on the speed changes observed, would result in changes less than 0.5% at the carriageway level. It is therefore unlikely that the policy changes have had an impact on pollutant concentrations at roadside receptor locations.

Noise

- Data for a number of road types (single, dual, at gradient etc) were analysed for noise changes. Motorways were used to compare the study road impacts against, as motorways were not subject to the policy change and thus could be used to reflect background changes in noise.
- All road types showed the increase in speed limit for heavy vehicles has not led to a perceptible change in noise level over a typical 18-hour day or during individual hours at night. The findings all showed less change than the control site, leading to the conclusion that the policy has not led to a perceptible change in noise.

5.1 Air Quality Impacts

This section considers the Air Quality impacts of the policy.

The DfT 2014 impact assessment of the policy to increase National HGV speed limit in England and Wales included consideration of air quality impacts. The assessment anticipated that no measurable change was likely on dual carriageways given that HGVs were generally already travelling above the speed limit (53mph) and are subject to speed limiters. On single carriageways an increase in the average speed of HGVs was assessed as likely and this was expected to lead to a decrease in NOx emissions, as emission factors for the national fleet indicated that HGVs would be travelling at more efficient speeds for NOx production. The same emission factors predicted an increase in PM_{10} and CO_2 emissions at the higher speeds. A more detailed dive into the impact assessment findings for air quality is provided at the start of Appendix D.

5.1.1 Air Quality Theory of Change

Changes to air quality were anticipated to be a fourth order outcome of the policy implementation, with anticipated reductions in emissions following increases to HGV speeds and associated reductions in the variance of speeds within the overall traffic stream.

In the ex-ante logic map benefits were anticipated in terms of NOx emissions on single carriageways based on the perception that HGVs on these roads would increase their average speed and NOx emissions generally reduce for HGVs as speeds increase. Whilst vehicle emission curves show reductions in NOx as a result of increasing speeds, these reductions vary by the Euro standard of the engine and are typically small.

No changes to vehicle emissions were predicted for dual carriageways, as it was expected that there would be no speed change. However, as HGV speed increases have been observed on this road type it is considered possible that changes to emission levels attributable to the policy have occurred.

5.2 Air Quality Results

5.2.1 Summary of Evidence of Change in Emissions from Air Quality Beta Testing

During the year one evaluation, beta tests were conducted to understand the potential methodology that could be adopted to measure air quality impacts as a result of the HGV speed limit change. The full beta test approach and outcomes are also provided in Appendix D for completeness and to demonstrate the methodology in action. Below is a summary of the findings.

The DfT impact assessment for speed limit changes on single carriageways published in 2014 identified the following:

"The change in speed limit for HGVs >7.5t was estimated to result in an increase from the current average speed for all HGVs on single carriageways of 45mph to between 46 and 49mph. At the higher end of the speed increase (49mph) there was a subsequent reduction in NOx emissions resulting from HGVs travelling at slightly more efficient engine speeds, when compared with emission rates at 45 mph. For PM_{10} emissions, although some vehicle types are operating more efficiently at increased speeds, other types are above their most efficient speed. This resulted in an overall increase in PM_{10} emissions. The model also indicated that faster HGV journeys result in small increases in HGV traffic which will have knock-on effects for other vehicles trying to occupy the same road capacity. There may be links where gradient or traffic conditions allow most heavy vehicles to travel at or above the raised 50mph HGV speed limit. The increase in speeds resulted in a modelled increase in fuel consumption and a subsequent increase in CO_2 emissions."

During the one year after evaluation, beta testing was completed on one site. Analysis of automatic traffic count data in 2014 and 2015 was found to be in line with the findings of the DfT impact assessment. The overall change in average annual daily speed with both carriageways combined was an increase of 0.9 mph. There had been an 8% reduction in NOx emissions, a 1% reduction in PM_{10} emissions and a 2% increase in CO_2 emissions when 2015 emission data were compared with the results for 2014. This resulted in a slight reduction in annual mean NO_2 concentrations and a negligible change in PM_{10} concentrations. It could not be established if this could be attributed to the HGV speed limit increase, the reduction in HGV flow and increase in LGV flow, or the incremental improvement in fleet emission rates.

5.2.2 Air Quality Final Evaluation Analysis

For this final year evaluation it has been identified that there are no DfT automatic traffic counts sites near to rural single or dual carriageways with air quality constraints. The consideration of each possible site is considered in the "Site Selection" section of Appendix D indicating why each site was not suitable. As such, it is not possible to undertake the beta testing methodology for any specific sites to understand the impacts as part of this study.

However, what follows is a best effort to understand the likely scale and impact of any changes, based on what is known about changes in speed and the roads that are likely to be affected.

AQMA source data[13] indicated that 95% of the 564 AQMAs designated in England and Wales are attributed to road transport sources (98% in Wales). 30% of these road transport related AQMA are located within 200 metres[14] of A and B roads within Rural areas[15]. Many of these are on roads with speed limits of 30 or 40 mph and within communities of less than 10,000 population designated as rural but with urban traffic conditions where the national speed limit does not apply. It is not possible to identify which of the designated AQMAs are near to single and dual carriageways which might be subject to change as a result of the increased National HGV speed limit in England and Wales; however, it is expected to be considerably less than 30%.

Evaluation of Average Speed Impacts on Emissions

In Sections 3 and 4 the traffic data recorded at the DfT monitoring sites were analysed to determine whether the increased National HGV speed limit in England and Wales had changed average free-flow speeds for HGVs over 7.5t on affected roads on single and dual carriageways. The findings of this analysis have been used to illustrate whether the changes in speed could affect air quality.

There are many traffic related variables that can influence emissions. To consider whether the change in speeds observed in this report are having an impact on emissions a number of assumptions are therefore made as follows:

- No change in annual average daily traffic (AADT) between the ante and post periods;
- No change in traffic composition between the ante and post periods;
- No change in traffic composition between the single and dual carriageway;
- Flow on the dual carriageway is twice that on the single carriageway;
- All emission factors calculated in 2018 to compare the effect of speeds only. (Reductions would be observed between 2013 and 2017 as a result of improved emissions each year through fleet renewal); and
- The speed change attributed to HGVs over 7.5t affects the whole of the Heavy Goods Vehicle composition (encompassing all vehicles >3.5 tonne including Rigid and Artic Heavy Goods Vehicles and Buses or Coaches).

The latest analysis of Road Traffic Estimates: Great Britain 2018[16], published in May 2019, was used to derive the following average attributes for the example rural road.

- The average daily traffic flow on rural A roads in 2018 was 12,200 AADT; and
- Out of the 99.9 billion vehicle miles travelled on rural roads in 2018, 6.3% were completed by lorries.

To allow the changes in average speeds and resulting emissions to be examined it was assumed that the typical rural single carriageway road had a flow of 12,200 AADT and

[13] Defra UK AIR_ Information Resource- Summary AQMA data. Available from [https://uk-air.defra.gov.uk/aqma/summary]
[14] HA207/07 established that only properties and Designated Sites within 200 metres of roads affected by the project need be considered.
[15] Urban areas comply with the DfT definition of an urban area with a population of 10,000 or more as detailed in census data associated with each MSOA. The rest of the UK and Wales are classified as rural.
[16] Road Traffic Estimates: Great Britain 2018, DfT, 2019, Available from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/808555/road-traffic-estimates-in-great-britain-2018.pdf]

6.3% HGV, and a dual carriageway road has a flow of 24,400 AADT and 6.3% HGV. The inputs are summarised in Table 5-1 below.

Table 5-1: Average Speed Impacts - Emissions Test Inputs

Road information	Speeds in mph			Flow
Single carriageways	**Pre**	**Post**	**Change**	**AADT**
LV	47.9	48.2	+0.2	11,431
HGV	44.1	45.7	+1.6	769
Total typical road				***12,200***
Dual carriageway	**Pre**	**Post**	**Change**	**AADT**
LV	65.0	65.1	+0.2	22,863
HGV	52.0	52.5	+0.5	1,537
Total typical road				***24,400***

These inputs were used in the EFT v9.0 and the resulting emissions of NOx, PM_{10} and CO_2 derived from the changes in average speed for LDV and HDV, were evaluated. Table 5-2 shows the results for NOx emissions.

Table 5-2: Average Speed Impacts – NOx Emissions Test Results

Road information	NOx Emissions, kg/yr			
Single carriageways	**Pre**	**Post**	**Change**	**% Change**
LV	1,466	1,469	+3	+0.2%
HGV	268	259	-9	-3.4%
Total typical road	***1,734***	***1,728***	***-6***	***-0.3%***
Dual carriageway	**Pre**	**Post**	**Change**	**% Change**
LV	3,930	3,941	11	+0.3%
HGV	460	456	-4	-0.9%
Total typical road	***4,390***	***4,397***	***7***	***+0.2%***

The change in speed for the light vehicles of +0.2 mph resulted in a 0.2% increase in emissions on single carriageways, whereas the change in speed of +0.2 mph on dual carriageways resulted in a 0.3% increase in emissions. The speeds are much higher on the dual carriageway (65.0 to 65.1 mph) than on the single carriageway (47.9 to 48.2 mph), so the smaller increase in speed results in a larger increase in emissions regardless of the total flow.

Emissions from heavy goods vehicles were 3.4% lower with the speed increase of 1.6 mph on single carriageways, indicating heavy vehicles are travelling at speeds which allow the engine to work more efficiently and reduce the average total emission per vehicle. On dual carriageways, the change in speed of +0.5 mph resulted in a 0.9% reduction in emissions.

When the emissions from heavy and light vehicles are combined, the overall emissions from a typical single carriageway are reduced by 0.3% and for a dual carriageway the overall emissions are increased by 0.2%. The criteria for examining changes in speed which could potentially affect air pollutant concentrations at sensitive receptors is a change of 10 kph (6.2 mph) or more, in accordance with Design Manual for Roads and Bridges (DMRB). **These small changes in speed are considered unlikely to result**

in a measurable change in concentrations of nitrogen dioxide at roadside receptors.

Table 5-3 shows the results for PM_{10} emissions. The estimated emissions of PM_{10} are not affected by the changes in average speed for light or heavy vehicles.

Table 5-3: Average Speed Impacts – PM_{10} Emissions Test Results

Road information	PM_{10} Emissions, kg/yr			
Single carriageways	**Pre**	**Post**	**Change**	**% Change**
LV	104	104	0	0.0%
HGV	30	30	0	0.0%
Total typical road	***134***	***134***	***0***	***0.0%***
Dual carriageway	**Pre**	**Post**	**Change**	**% Change**
LV	220	220	0	0.0%
HGV	59	59	0	0.0%
Total typical road	***279***	***279***	***0***	***0.0%***

Table 5-4 provides the results for CO_2 emissions. The change in speed for the light vehicles of +0.2 mph resulted in a 0.2% increase in emissions on single carriageways, and the change in speed of +0.2 mph on dual carriageways resulted in a 0.1% increase in emissions. Changes in emissions of CO_2 are in proportion to changes in speeds.

Table 5-4: Average Speed Impacts – CO_2 Emissions Test Results

Road information	CO_2 Emissions, t/yr			
Single carriageways	**Pre**	**Post**	**Change**	**% Change**
LV	546	547	1	+0.2%
HGV	204	205	1	+0.5%
Total typical road	***750***	***752***	***2***	***+0.3%***
Dual carriageway	**Ante**	**Post**	**Change**	**% Change**
LV	1,292	1,293	1	+0.1%
HGV	425	426	1	+0.2%
Total typical road	***1,717***	***1,719***	***2***	***+0.1%***

Emissions from heavy goods vehicles were 0.5% higher with the speed increase of 1.6 mph on single carriageways. For dual carriageways the change in speed of +0.5 mph resulted in a 0.2% increase in emissions. When the emissions from heavy and light vehicles were combined, the overall emissions from a typical single carriageway increased by 0.3% and for a dual carriageway the overall emissions increased by 0.1%.

5.2.3 Air Quality Impact Conclusion

It has not been possible to evaluate whether the increase in the national HGV speed had an impact on carbon emissions and air pollutants (NOx and particulate matter) at specific locations due to a lack of data. It was established that none of the DfT automatic traffic counts are near to rural single or dual carriageways with poor air quality.

However, it was established that 30% of the AQMAs in England and Wales are near to rural single and dual carriageways. Many of these roads will be subject to speed limits of 30 and 40 mph, so the number which might be affected by changes as a result of the increased National HGV speed limit in England and Wales were small.

Assuming typical traffic volumes and a typical breakdown of user classes, analysis was conducted to estimate the change in emissions of NOx, PM_{10} and CO_2. This analysis found that all changes were estimated to be less than 0.5% at the carriageway level, as a result of the change in average speeds for light and heavy vehicles with the National HGV speed limit in place. **As such, it is unlikely that the changes in average speeds of LV and HGVs identified in this report would result in any changes in pollutant concentrations at roadside receptor locations.**

No statistically significant effect on air quality as a result of the increased National HGV speed limit change in England and Wales was established.

5.3 Noise Impacts

During the year one evaluation, tests were conducted to understand the potential methodology that could be adopted to measure noise impacts as a result of the HGV speed limit change. This section outlines the results of those initial tests, then provides a full analysis of the noise impacts of the policy.

5.3.1 Noise Theory of Change

Changes to noise were anticipated to be a third order outcome of the policy implementation, with anticipated increases in noise as a result of vehicles increasing their speeds. This was in turn linked to a fourth order impact for health. This only applied to single carriageway roads, given that it was not expected that the policy would change vehicle speeds on dual carriageways.

5.4 Noise Results

5.4.1 Summary of previous tests

During the one year after methodology analysis, a single carriageway site was analysed in the beta test and this showed that the changes in noise over the standard 18 hour noise assessment period were 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 of appraisal. Noise effects for individual hours during the night were slightly larger than during the standard 18-hour day, but the results still showed negligible changes in noise.

The beta testing showed that analysis of noise levels can be undertaken with the data available, and that results were in line with the appraisal as outlined in the impact assessment.

5.4.2 Methodology

The noise calculation methodology adopted 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.

The data used for analysis contains a breakdown of vehicle counts in the following categories:

- All vehicles
- Light Vehicles (<3.5t)
- Rigid 2-axle vehicles
- Other Heavy vehicles (>3.5t)

For the analysis, the total number of heavy vehicles is taken as the total of Rigid 2-axle vehicles and Other Heavy vehicles. This is a slight mis-match with the description of heavy vehicles in the noise section of the DMRB, which takes 3.5t as the cut off for a heavy vehicle. Because of this, the analysis has *over estimated* the number of heavy vehicles at each site and therefore *over estimates the change in noise level*. We can therefore consider the results in this report to be conservative.

The traffic data counts were accompanied by a list of dates for a number of sites where data should be excluded. This is for reasons such as roadworks being present and therefore the flows and speeds would not be representative of typical conditions. With these dates and sites filtered, the noise assessment was undertaken.

5.4.3 Site Selection and analysis

The sites for which data was obtained have been split into groups depending on their characteristics. This was done to ensure the impact of the policy could be interpreted in different contexts and relative to changes on other roads where the policy is not in force. The highest sample group is single carriageway roads with 60mph speed limit in rural areas where the road is generally flat. Eight sites were selected that fit this description, which is the most important when considering the theory of change expected that may experience a change in noise. Smaller groups of other types of road were selected, such that differences between types of road can be identified.

Table 5-5 shows the description of each category of road and the number of sites used from that category. The road that was used in the beta test fell into Category A.

Table 5-5: Road Categories for Analysis

Category	Description	Number of sites
A	Single carriageway, speed limit 60mph, level road, through rural areas	8
B	Single carriageway, speed limit 50mph	3
C	Single carriageway, road with gradient	4
D	Dual carriageway, speed limit 70mph	3
E	Single carriageway bypass around village	2
F	Single carriageway, through a community	3
G	Dual carriageway bypass around village	3 (5)
Z	*Control sites (motorway, no speed limit change)*	*4 (8)*

*For the three sites in category G the data comprises one site with two-way traffic data, and two sites where the data is split into separate carriageways, giving five data sets for the analysis.

For the four sites in category Z the data is split into separate carriageways, giving eight data sets for the analysis.

For all other sites the traffic data comprises one dataset for each site, with two-way traffic, and the number of datasets is the same as the number of sites.

Data has been used from the following years for each site:

- Before policy change – 01/04/13 to 31/03/15
- After policy change – 01/04/17 to 31/03/18

For each category the average traffic data has been calculated across the periods (2 years for pre-change and 1 year for post-change), and from this the Basic Noise Level (BNL) has been calculated. The noise evaluation considers both the standard 18-hour weekday daytime period (06:00 to 00:00, Monday to Friday) and also the hourly flows over the individual night time hours (midnight to 6am) where the proportion of heavy vehicles is typically highest.

The pre-change and post-change noise levels have been compared to assess the change resulting from the change in speed limit. Variation between sites has also been checked across the sites in the same category.

In the following tables in this section, the noise calculation comprises two parts. The first step is to calculate an initial noise level based on the traffic flow, shown in the tables as "Average Flow BNL" with the dB number being the L_{A10},18hr noise level at 10m from the nearside carriageway. The second step calculates a correction to take account of both the traffic speed and the proportion of heavy vehicles, shown as "Spd/HGV Correction". The total noise level is the addition of the flow noise level with the speed and heavy vehicle correction, shown as "Total Noise Level", with the dB number being the L_{A10},18hr noise level.

5.4.4 Final Evaluation Analysis

Comparison data set

A summary of the results from the comparison roads (Motorways) is provided in Table 5-6. These roads are to act as a comparison set to contextualise findings on study roads. Motorways were not subject to the policy change, but have similar vehicle speeds and so can be used to understand likely background changes in HGV noise.

Table 5-6: Comparator (Motorway) Road Analysis

Time Period	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Spd/HGV Correction (dB)	Average Total Noise Level (dB)
Category Z Roads						
2013-2015	30,447.3	11.0	108.9	73.9	5.1	79.0
2017-2018	33,951.2	11.7	110.0	74.4	5.3	79.7
Comparison	**3,503.9**	**0.7**	**1.1**	**0.5**	**0.2**	**0.7**

The table of comparator data shows that there has been a 0.2dB increase in HGV noise at sites not subject to the policy change. Further, these sites have observed a 0.7dB increase in total noise (due to all factors). This provides context to the calculations to follow on study roads, as it provides an understanding of the general level of change that could be observed in the absence of a policy change.

Single carriageway roads

A summary of the results from single carriageway roads (Categories A, B, C, E and F) is presented in Table 5-7.

Table 5-7: Single Carriageway Road Analysis

Time Period	Average Flow	Average % Heavy vehicles	Average Speed	Average Flow BNL (dB)	Average Spd/HGV Correction (dB)	Average Total Noise Level (dB)
Category A Roads: Single carriageway, speed limit 60mph, level road, through rural areas						
2013-2015	11,958.5	9.3	78.2	69.9	2.4	72.3
2017-2018	13,810.9	9.4	77.4	70.5	2.3	72.8
Comparison	**1,852.5**	**0.1**	**-0.8**	**0.6**	**-0.1**	**0.5**
Category B Roads: Single carriageway, speed limit 50mph						
2013-2015	7,022.0	7.0	74.4	67.6	1.6	69.2
2017-2018	7,406.6	8.0	74.8	67.8	1.8	69.6
Comparison	**384.6**	**0.9**	**0.4**	**0.2**	**0.2**	**0.4**
Category C Roads: Single carriageway, road with gradient						
2013-2015	9,182.5	10.6	72.0	68.7	2.1	70.8
2017-2018	10,309.7	10.6	73.7	69.2	2.2	71.4
Comparison	**1,127.2**	**0.1**	**1.7**	**0.5**	**0.1**	**0.6**
Category E Roads: Single carriageway bypass around village						
2013-2015	21,272.8	8.2	76.0	72.4	2.0	74.4
2017-2018	23,029.1	7.9	75.1	72.7	1.9	74.6
Comparison	**1,756.3**	**-0.3**	**-1.0**	**0.3**	**-0.1**	**0.2**
Category F Roads: Single carriageway, through a community						
2013-2015	7,833.5	7.1	77.1	68.0	1.9	69.9
2017-2018	8,486.4	7.5	77.6	68.4	2.0	70.4
Comparison	**652.9**	**0.4**	**0.6**	**0.4**	**0.1**	**0.5**

These results show that the recorded changes in traffic flows, speeds and heavy vehicles have no perceptible change on noise levels. Of the change in total noise that is present (between 0.2 and 0.6dB increase), it is the increase in average flow that is mostly responsible for these changes.

Normalising the change in flow shows that changes in speed and proportion of heavy vehicles only gives between a negligible decrease in noise of 0.1dB up to a negligible increase in noise of 0.2dB depending on the category of road. While overall noise is higher, HGV noise only shows negligible change.

Individual night time hours show no perceptible increase in noise level. As with the daytime, it is the change in flow that is the main contributor to any variations in noise level. A table of the night time hours is presented in Appendix E.

Overall, the changes of noise on single carriageways are all less than the comparator set, increasing the confidence that the changes observed are not due to the policy.

Dual carriageway roads

A summary of the results from dual carriageway roads (Categories D and G) is presented in Table 5-8.

Table 5-8: Dual Carriageway Road Analysis

Time Period	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Spd/HGV Correction (dB)	Average Total Noise Level (dB)
Category D Roads: Dual carriageway, speed limit 70mph						
2013-2015	37,463.9	11.2	105.1	74.8	4.8	79.6
2017-2018	42,314.0	11.8	106.1	75.4	5	80.4
Comparison	**4,850.1**	**0.7**	**0.9**	**0.6**	**0.2**	**0.8**
Category G Roads: Dual carriageway bypass around village						
2013-2015	31,245.4	12.3	100.4	74.0	4.6	78.6
2017-2018	33,513.6	12.6	97.9	74.4	4.5	78.9
Comparison	**2,268.2**	**0.2**	**-2.5**	**0.4**	**-0.1**	**0.3**

These results show that the recorded changes in traffic flows, speeds and heavy vehicles have no perceptible change on noise levels. Of the change in noise that is present (between 0.3 and 0.8dB increase), it is the increase in average flow that is mostly responsible for these changes.

Normalising the change in flow shows that the changes in speed and proportion of heavy vehicles gives between a negligible decrease in noise of 0.1dB up to a negligible increase in noise of 0.2dB depending on the category of road. As with the single carriageway roads, while overall noise is higher, HGV noise only shows negligible change.

Individual night time hours show no perceptible increase in noise level. As with the daytime, it is the change in flow that is the main contributor to any variations in noise level. A table of the night time hours is presented in Appendix E.

Overall, the changes in noise on dual carriageways are all less than the comparator set, increasing the confidence that the changes observed are not due to the policy.

5.4.5 Noise Impact Conclusions

The analysis in this section has shown that the increase in speed limit for heavy vehicles has not led to a perceptible change in noise level over a typical 18-hour day or during individual hours at night.

The findings for road types affected by the HGV speed limit change are lower than for the control sites which are not subject to any change in speed limit, and thus reflect background variation in noise.

The study roads show an increase in total noise up to 0.8dB, though this appears to be entirely driven by traffic volume rather than traffic speed. The change that can be attributable to HGV speed changes is between a negligible decrease in noise of 0.1dB and a negligible increase in noise of 0.2dB.

Overall, the work has shown that the change in speed limit for heavy vehicles has not given rise to a perceptible change in noise, and the increase observed is due to traffic volume, rather than HGV speed, and so is not likely to be attributable to the policy.

Finally the change is found to be within the level of change found on other roads not subject to the policy, adding further confidence that the policy has had no impact on noise.

6. Safety Impacts

Main Findings from the Safety Impact Evaluation

- Statistical analysis of collision data from 2005 to 2017 (inclusive) was conducted for all study roads, single carriageway study roads and dual carriageway study roads respectively. For all three no statistically significant change in collisions was found.
- Slight and serious severity collisions do show a statistically significant reduction in collisions. Statistical analysis were undertaken on a number of subsets of collisions that may be sensitive to the policy change (such as collision severity or vehicle movements) but no statistically significant change in collisions was found.
- Across all analyses the findings indicate no evidence to suggest that the policy has impacted safety, based on 33 months of ex-post data available.

6.1 Safety Impacts Introduction

This section of the report considers what impact, if any, the HGV speed limit increases had on safety. To undertake this analysis, collision data (using the recognised STATS19 recording format) from the DfT have been provided, covering the whole of England and Wales from the start of 2005 to the end of 2017. This meant that there were roughly 10 years of ex-ante data and approximately 33 months of ex-post data to analyse in order to measure any impacts. As this is the final evaluation report, this is the final set of data that the HGV speed limit's safety impact will consider.

6.1.1 Safety Impacts Theory of Change

The anticipated safety impacts of the policy change were complex. The intervention logic indicated potential contrasting outcomes which the analysis aimed to unpick. For both single and dual carriageways, the intervention logic indicated that an increased speed limit may result in increased speeds and in turn an increased chance of loss of control collisions, or potential increases in collision severity even if collision numbers do not change.

However, the interplay with other road users can point to differing impacts. The intervention logic also indicated that increased HGV speeds were likely to be more consistent with light vehicle speeds. This would result in fewer conflicts, less need to overtake and reduced driver frustration. All of these factors could result in fewer collisions.

The intervention pathway therefore pointed at both potential increases for collision frequency and severity and potential decreases for frequency. It was uncertain how these two competing impacts would balance.

6.2 Impact Assessment Safety Findings

The DfT conducted two impact assessments into the impact of the HGV speed limit change on Single Carriageways (January 2014[17]) and Dual Carriageways (September

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/336315/hgv-single_-carriageway-impact-assessment.pdf

2014[18]). These studies outline the estimated impact of the policy change, building upon studies from Transport Research Laboratory (Summersgill, 2009) and University College London (Heydecker, 2013) into the potential impacts of HGV speed limit changes. The two studies that fed into the impact assessments both note that predicting the impact on safety is very difficult given the lack of evidence around such an intervention. While there is substantial evidence on the impact of speed on safety, there is little on how closing a speed differential between user classes (i.e. where light vehicles have a higher speed than heavy goods vehicles) affects safety.

The key findings of the 2014 impact assessments were:

- **Single Carriageways**
    - Prior to the change there is a large speed differential between HGVs at a limit of 40mph and other vehicles at a limit of 60mph. HGVs over 7.5t are found to exceed the speed limit prior to the policy change (typically travelling at 45mph), this large speed differential is considered to generate congestion, and cause issues with overtaking and driver frustration.
    - The impact on safety is considered likely to have two effects in opposing directions. The overall outcome will be the residual of the balance of the two. Increasing the HGV speed limit is considered likely to reduce the likelihood of overtaking (mitigating a safety risk) but may also increase the risks associated with the overtaking events that do occur (as they are now conducted at higher speeds) and increasing the general risk for HGVs which are now travelling faster and thus have less time to react.
    - The impact assessment is clear that firm conclusions are difficult, but the impact is estimated as a worsening of safety with an additional 2-3 fatal collisions and an additional 4-9 serious collisions per annum.
- **Dual Carriageways**
    - Prior to the change HGVs had a speed limit 10mph lower than other vehicles and was set at 50mph. Evidence showed that in reality, the average speed of HGVs over 7.5t on dual carriageways was already 53mph (above the speed limit), in line with the average on motorways where the speed limit was already 60mph. As such, the impact assessment considers that changing the dual carriageway speed limit to 60mph will not change HGV vehicle speeds (as they are unlikely to go faster than they do on motorways) rather it will make their current speeds fall within the limit.
    - As there is not a predicted change in speeds, the study concludes that there is no reason to expect that the intervention will have any impact on safety either.

The analysis in this section considers what the ex-post evidence on safety impacts shows, and considers how these relate to forecasts where appropriate.

[18] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/336308/consultation-impact-assessment.pdf

6.3 Collision Data

6.3.1 Hypothesis Test

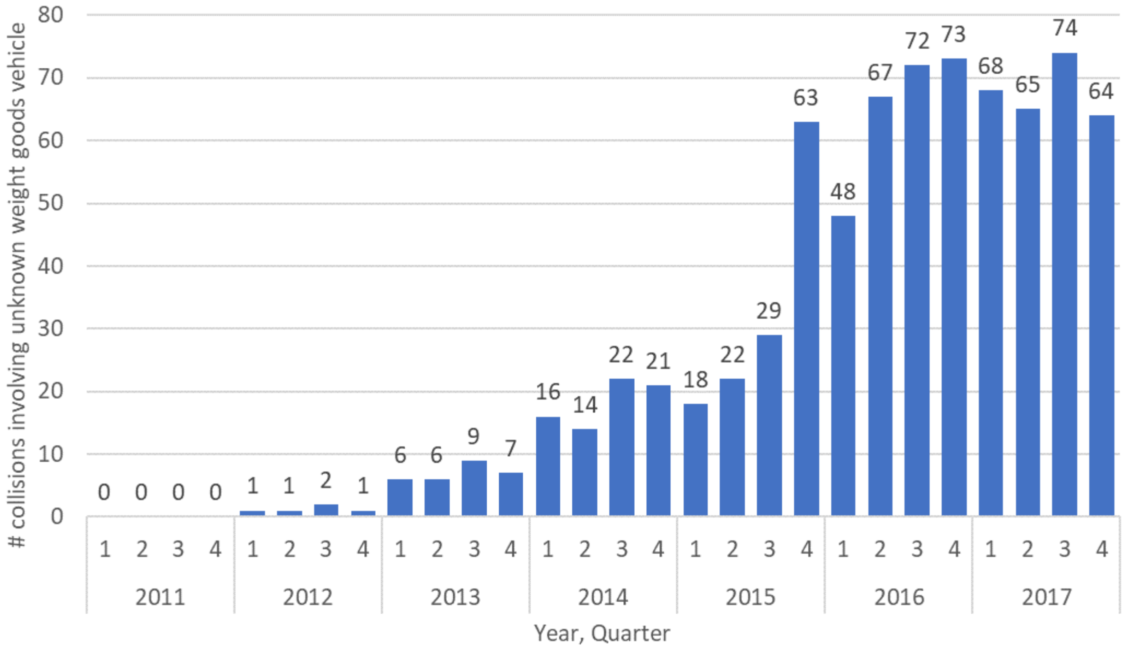
Throughout this section, all statistical models are designed to test the null hypothesis that “the number of HGV collisions has neither increased nor decreased since the implementation of the policy”.

Where a statistically significant result is found we reject the null hypothesis. The magnitude and sign (positive or negative) of the intervention parameter tells us whether the policy has resulted in an increase or a decrease in collision numbers.

6.3.2 Exploratory observations on collision data

The 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. According to the collision statistics there has been an increasing number of goods vehicles being classed as of “unknown weight” in recent years. This issue appears to have begun in 2012 (prior to this there were no unknown weight goods vehicles) and increased year on year since. This is shown in Figure 6-1. Clearly, if some of these were goods vehicles in excess of 7.5 tonnes (i.e. subject to the speed limit increase) then ignoring these collisions could influence our reporting on the results of the policy.

Figure 6-1: Number of collisions in study area, by quarter, involving a goods vehicle of unknown weight



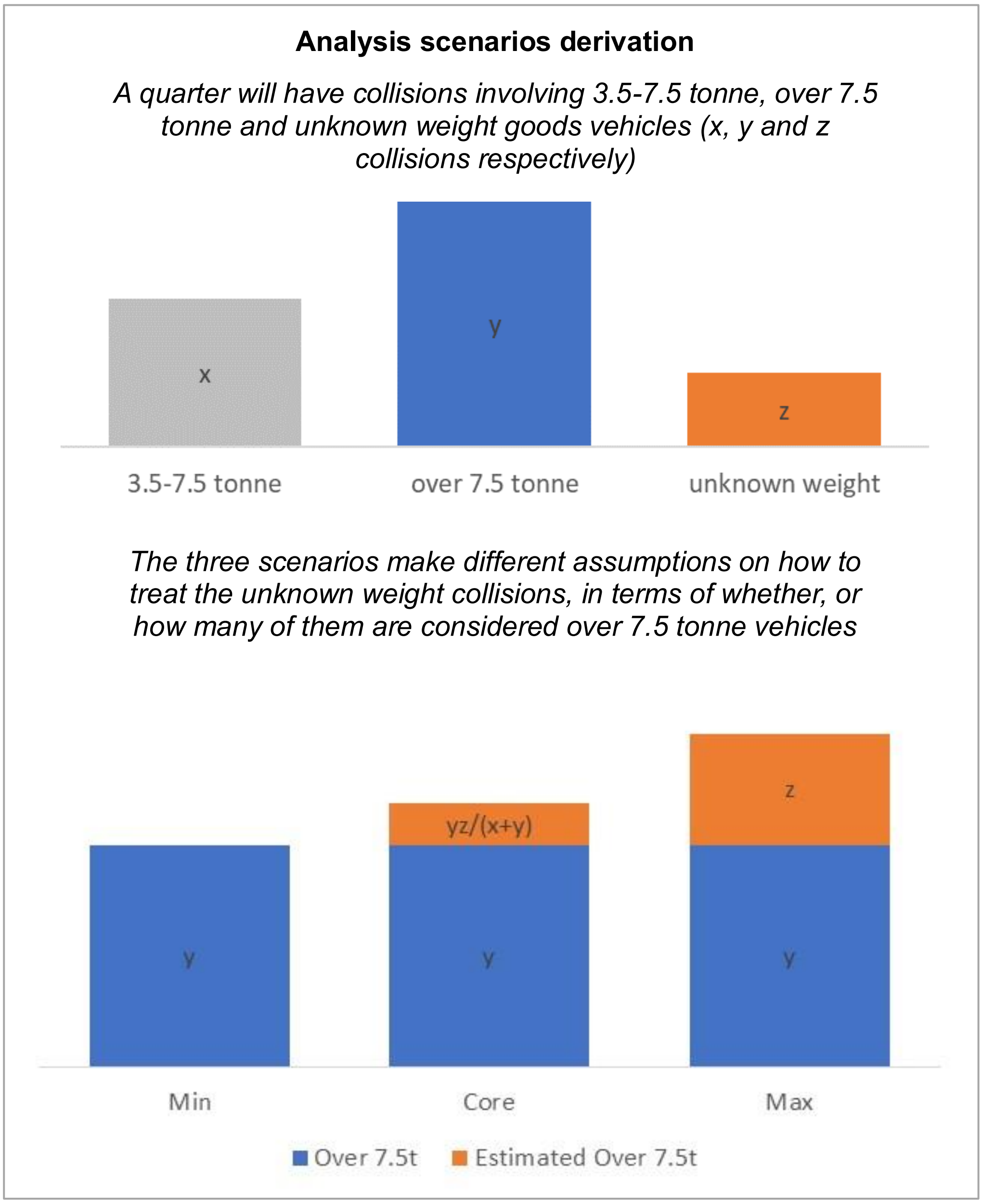
Source: STATS19 Collision Data from data.gov.uk

The analysis of collisions when disaggregated to HGVs subject to the speed limit increase considered a core scenario, and two sensitivity tests as follows (and as shown diagrammatically in Figure 6-2.

- Minimum HGVs: this considered just those collisions that were known to involve HGVs subject to the speed limit increase as they were classified as over 7.5 tonnes. This represented the minimum number of collisions of interest each quarter;

- Core Scenario: this was the best estimate for the collisions that involved an HGV subject to the speed limit increase. It was all those known to be over 7.5 tonnes plus a proportion of those goods vehicles of unknown weight based on the ratio of 3.5-7.5 tonne goods vehicles to over 7.5 tonne vehicles; and
- Maximum HGVs: this considered the highest possible number of collisions of interest each quarter. All unknown weight goods vehicles were assumed to be over 7.5 tonnes and thus are included as well as all those known to be over 7.5 tonnes.

Figure 6-2: Unknown weight goods vehicles; proposed derivation of scenarios



In general, the conclusions of this report are based on the core, most likely, scenario. However, the sensitivity tests provided some assurances to the best and worst possible interpretations of the data and thus add confidence to the findings.

The collision data from the DfT included 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). One of the key issues in the safety analysis was maintaining sufficient sample size to draw meaningful conclusions and balancing this with a desire to delve into the data to find what types of collisions were affected (if any) by the speed limit change. Figure 6-3 provides a summary of how the full dataset was subdivided and how the sample size reduced as the dataset is further disaggregated.

Figure 6-3: 2017 Quarterly average collision data sample sizes at each level of disaggregation (rounded averages)

All England & Wales Collisions
30,717

On Study Roads
(A, B, or C roads that are Dual 60/70 mph OR Single 50/60 mph)
3,884

Involving an HGV >7.5t
238

Single Carriageway
145

Fatal	Serious	Slight
13	**37**	**96**

Dual Carriageway
92

Fatal	Serious	Slight
7	**19**	**67**

Involving an unknown weight goods vehicle, proportion of which are likely to be >7.5t
68

Source: STATS19 Collision Data from data.gov.uk

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 238 per quarter (potentially with some of the 68 unknown weight goods vehicles in addition) across both single and dual carriageways. The figure reduced further to 145 and 92 on just single and dual carriageways respectively. Once the data is split further to severities (see Figure 6-3), movements or other disaggregates, sample size become small to the point of no meaningful conclusions being likely.

As such, the consideration of trends or sub-divisions in the data was 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 was why statistical modelling techniques (ARIMA modelling with intervention parameter) have been used to understand whether there is confidence in the changes observed.

6.4 Safety Impacts Evaluation Questions

The following set of safety related evaluation questions 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, analysis either focused on disaggregating to a carriageway type or to another metric. This meant that when considering the impact on severity, manoeuvres or other metrics this was conducted with collisions from both single and dual carriageways to maximise sample size.

Summary tables of the data for all study roads, single and dual carriageway roads are included in Appendix F. Analysis on some metrics such as collision severity, type, point of impact and number of HGVs involved are presented separately in Appendix G.

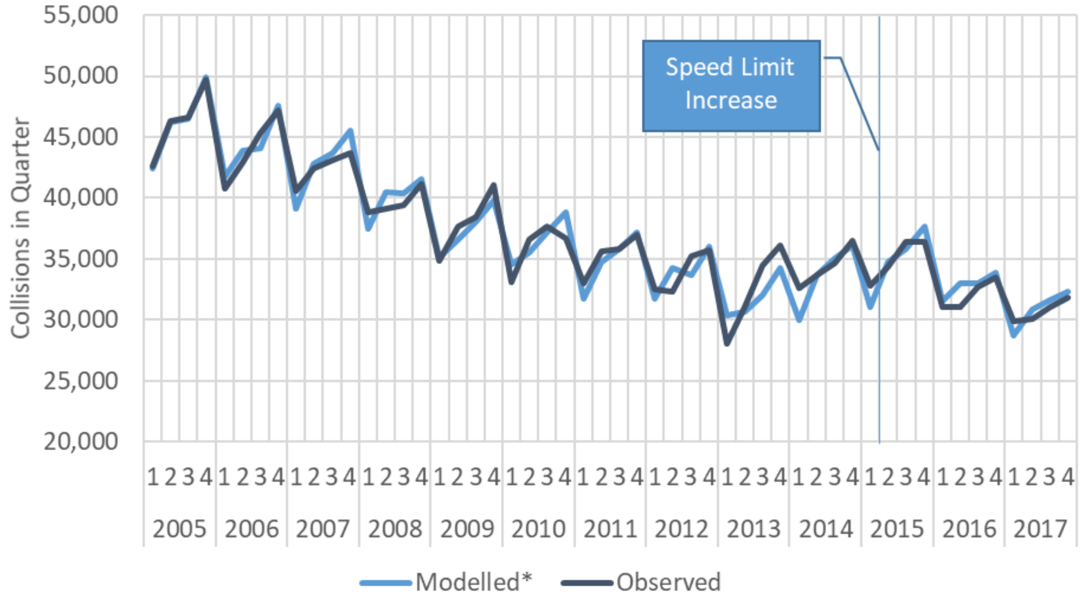
The approach to answer the evaluation questions uses quarterly collisions numbers, which have been analysed using a time series modelling approach[19] which estimates the effect of the intervention (the introduction of the HGV speed limit increase) from 2015 Q2 onwards. The statistical modelling approach provides an intervention parameter and confidence interval for this parameter, which have been used to measure the magnitude of the change in collisions since the HGV speed limit change and the confidence we have in this collision change.

6.5 All England and Wales Collisions

To provide some context to collision changes on study roads, the study first looked at the profile over time of collisions on all roads (not just study roads) in England and Wales. Figure 6-4 shows the total collisions on all roads in England and Wales by quarter between 2005 and 2017. 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 (2012 onwards) the annual decline seems to have plateaued.

[19] 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 6-4: All collisions on England and Wales roads per quarter



Source: Observed data from STATS19 Collision Data from data.gov.uk

**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 policy coming into use. Logarithmic values were used in order to ensure the statistical approach used produced the best fitting model possible.

Table 6-1 shows the outcome of this model which found no statistically significant change in collisions since the HGV speed limit change. This finding was expected since HGV collisions on study roads were only a small subset (less than 1% as shown in Figure 6-3) of all accidents in England and Wales, so any changes in collisions due to the policy were unlikely to be observed in these figures, and are explored in more detail in the next sub-section of this report.

Table 6-1: Model outputs for All collisions in England and Wales

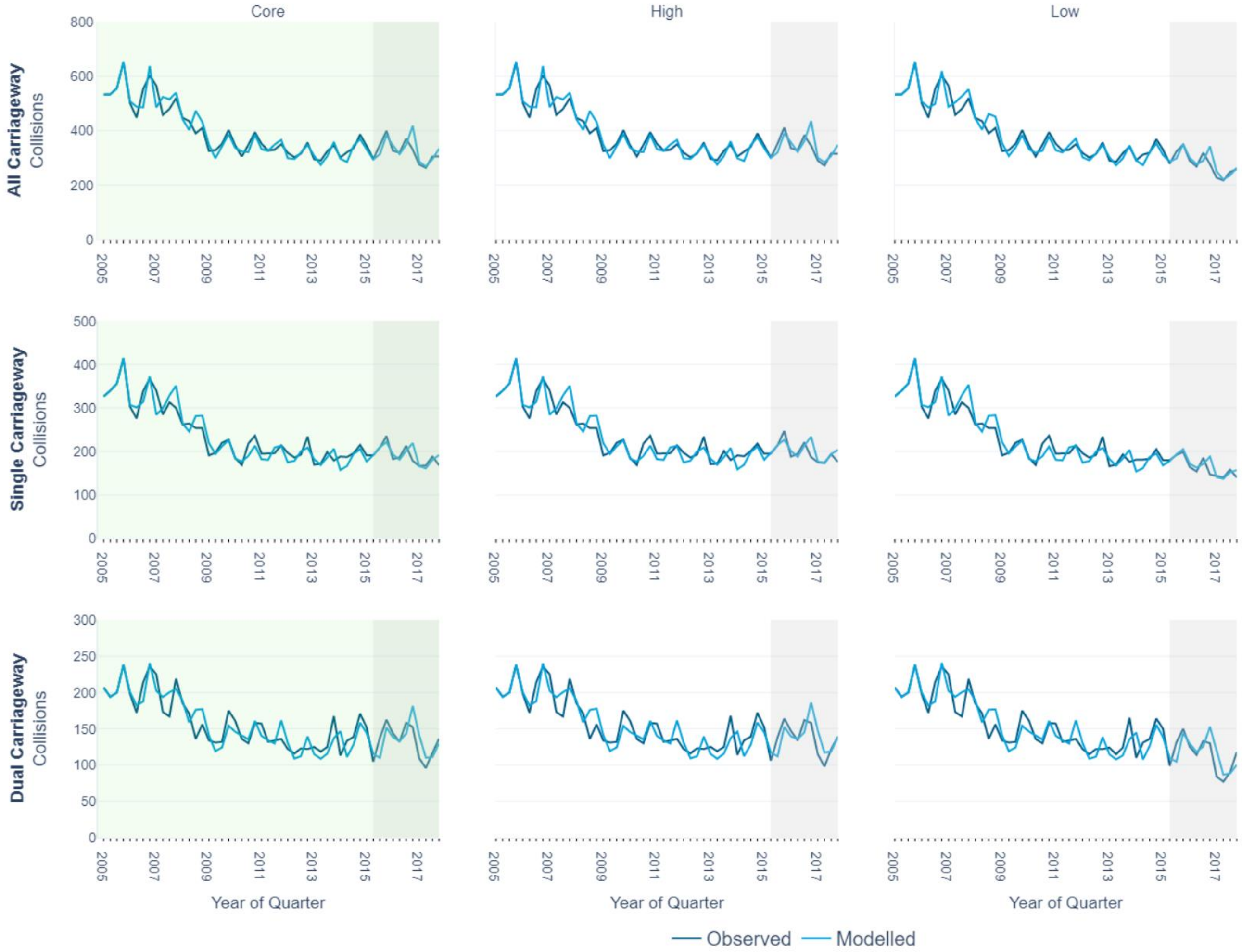
Intervention Parameter	Low Confidence Interval	High Confidence Interval	p-value	Statistically Significant?
2.5%	-4.1%	9.6%	0.464	No

Note: The p-value is the probability of obtaining test results at least as extreme as those observed due to chance.

6.5.1 HGV Collisions on Study Roads

The primary question relating to safety in this study related to whether there had been a change in collisions involving an HGV as a result of the speed limit change. This related to whether there was evidence of change in HGV collisions across all study roads, but also whether any change was consistent between single carriageways and dual carriageways. Figure 6-5 shows the observed and modelled values for all scenarios (Core, Low and High) and all road classifications (all, single and dual carriageways).

Figure 6-5 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*

All graphs present quarter to quarter variability as the seasons have an impact on collision numbers. This variability becomes harder to model when the analysis is focused on just dual or single carriageways as the lower sample sizes exacerbate the fluctuations.

A time series statistical model was fitted to the data for each scenario and each road classification, using an intervention parameter to measure the change, if any, since the HGV speed limit increase was implemented. The low and high scenario tests are included here to provide a sensitivity test, though the core scenario is the focus of this study. The findings of the models are presented in Table 6-2.

Table 6-2: Model outputs for HGV collisions on all study roads

Scenario	Intervention Parameter	Low Confidence Interval	High Confidence Interval	p-value	Statistically Significant?
All Study Roads					
Min	-7.5%	-20.7%	7.9%	0.322	No
Core	-10.4%	-22.9%	4.2%	0.153	No
Max	-9.3%	-21.9%	5.3%	0.201	No
Single Carriageways					
Min	4.9%	-10.0%	22.2%	0.512	No
Core	7.8%	-8.3%	26.7%	0.364	No
Max	5.8%	-8.5%	22.3%	0.448	No
Dual Carriageways					
Min	-22.4%	-40.5%	1.1%	0.060	No
Core	-19.8%	-37.6%	3.1%	0.085	No
Max	-18.6%	-36.3%	4.0%	0.100	No

Table 6-2 shows no statistically significant evidence of a change in collisions on all roads, single or dual carriageway roads. Furthermore, the low and high sensitivity tests showed the same, meaning that there can be confidence that the recent issue with rising numbers of unknown weight goods vehicles in the data was not influencing the finding. **The overall conclusion was therefore that the introduction of a higher speed limit for HGVs has demonstrated no significant change in the number of collisions at the 95% confidence level, based on collision data for the 33 months following the change in speed limit.**

Looking more closely at the results, the overall impact (across all carriageway types) was pointing towards a slight reduction in collisions (the high confidence interval is only marginally above zero); a finding that may become significant when more data is available.

While the findings are all not statistically significant at the 95% confidence level, crucially, the results were sufficient for there to be confidence that there has been no detrimental impact on safety. The expectation was that the policy would result in an increase in collisions along single carriageways and no change in collision numbers along dual carriageways. Given the analysis shows that no statistically significant increase in collisions has occurred this can be considered a positive outcome for the policy change.

6.5.2 HGV Collisions by Road Type

Single Carriageway

On single carriageway roads, the statistical model found no statistically significant evidence of change in collision numbers since the change in policy. Table 6-2 shows that the best estimate of the intervention parameter was for a 7.8% increase in collisions. The 95th percentile confidence interval ranged from a decrease of 8.3% to an increase of 26.7% and so there is insufficient confidence that the speed limit change has worsened or improved safety on single carriageway roads. Given the impact assessment predicted a worsening safety outcome along single carriageways this can be considered a positive result for the policy.

The logic map presented in Figure 3-1 identified a reduction in HGV collisions as a potential outcome resulting from HGV speed increases along single carriageway roads. This speed increase was expected to lead to a reduction in risky overtaking due to a reduced speed differential between HGVs and other traffic. HGV speeds have increased by approximately 1.6mph since the policy introduction. However, the fact that there was no observable change in collisions suggested that any decrease in dangerous overtaking did not been significant enough to reduce the number of collisions. Analysis of collision type, including overtaking, is presented in Appendix G.

Dual Carriageway

The results for dual carriageway roads, though also not significant, differ from those for single carriageways. The best estimate for the intervention parameter was for a 19.8% reduction in collisions. However, the range of the 95% confidence interval was large (between a decrease of 37.6% and an increase of 3.1%). The high confidence limit was close to zero, indicating that although there was significant uncertainty on the magnitude of the intervention parameter, the likelihood is that it is negative, i.e. that there has been some reduction in collisions. The p value of 0.085, suggests this observed reduction is unlikely to be due to chance.

The logic map in Figure 4-1 predicted that if HGV speeds increased the number and severity of collisions increased; in the instance that speeds do not change, no effects on collisions were anticipated by the impact assessment. Though HGV speeds have been seen to increase on dual carriageways since the policy introduction, this increase has been marginal. At the 95% confidence level, no significant change in collisions has occurred which follows given the minor increase in speeds, however the indication of a decrease in collisions observed from the model results is not explained in the logic map. Though not highlighted in the logic map, the need for overtaking on dual carriageway roads would also decrease resulting from the reduced speed differential between HGVs and other road vehicles. This reduced need to overtake may be driving the reduction in HGV accidents along dual carriageway roads.

6.5.3 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, single and dual 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.

Using a 95% confidence level it was shown that across all study roads and when considering single and dual carriageway roads separately there has been no significant change in collisions involving at least one HGV. It was noted that the high confidence interval for dual carriageways was only slightly greater than zero, implying that a reduction in collisions was likely, just not at the 95% confidence level.

For single carriageways the impact assessment predicted an increase of 2-3 fatal collisions and 4-9 serious per annum in HGV collisions, a prediction also supported by the logic map. This study has found no evidence to support this and it can be concluded that the policy has not had a detrimental impact on safety along single carriageway roads.

Considering dual carriageways, the logic map highlights the potential for an increase in HGV speeds to cause a detrimental safety impact. Predicting no increase in speeds would be observed the impacts assessment concludes that there would be no impact on safety. This study has found an increase in HGV speeds along dual carriageways of 0.5mph, despite this the results point to a decrease in collisions which, though not stated in the logic map may result from a smaller speed differential between HGVs and other vehicles and hence less overtaking. Less overtaking reduces the need for lane changes along dual carriageways and hence removes a point of conflict between vehicles.

No differences in significance were observed between the core, high and low scenarios for single carriageways or dual carriageways and the aggregated dataset. Given this and that the estimate for intervention parameter remained relatively consistent between scenarios. It can be concluded that the changing number of unknown HGVs is not influencing the findings.

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

7. Economic Evaluation

Main Findings from the Economic Evaluation

- The economic impact evaluation calculates a net present value for the policy of £225.8m over the period from 2015 – 2031;
- The benefits are principally comprised of business user time savings (£162.2m) and business user vehicle operating costs (£44.7m non-fuel and £9.2m fuel);
- A comparison of the impact evaluation with the 2014 impact assessment shows good correlation. The central (best) scenario of the 2014 assessment is considered the best comparator and has a very similar net present value (£224.6m) to the impact evaluation.

7.1 Economic Evaluation Introduction

This section of the report discusses the impact of the policy change on the economy. National Transport Model (NTM) scenarios have been developed using outturn data from the speeds impact evaluation to produce an economic evaluation.

In 2014 the DfT undertook a full economic impact assessment of an increase of the speed limit for HGVs >7.5t on single carriageway roads using the NTM and indicated a net benefit in the range £130.9m to £356m, with a best estimate of £224.6m over an eighteen year appraisal period. The majority of these benefits were travel time and vehicle operating cost benefits for HGV operators.[20]

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 baseline 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 was 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 by DfT in 2014 to measure the impact of the speed limit change assuming that HGV speeds did increase on dual carriageways. 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.

7.1.1 Economic Evaluation Theory of Change

Economic changes are considered long term impacts in the causal pathway analysis as they require both awareness and behaviour change outcomes to have taken place before freight businesses will be able to benefit from any reduced costs associated with journey time benefits and/or more efficient fleet operation.

The ex-ante logic maps considered that the policy change would be likely to lead to economic benefits in terms of time savings based on the speed of HGVs increasing on

[20] All figures in 2010 prices discounted to 2010. Safety impacts from the 2014 analysis have been removed from the totals for consistency with the 2019 economic impact evaluation.

single carriageway roads. Journey time savings have the potential to reduce operator costs in terms of driver time and through the increased range/flexibility of delivery routes within a specific timeframe.

The Theory of Change for dual carriageways generated two pathways depending on whether meaningful increases in HGV speeds were observed. The speeds impact evaluation has demonstrated a small increase in the speeds of HGVs on dual carriageways and following the logic of the discussion above, the Theory of Change predicted some economic benefits in terms of time savings as a result of increased HGV speeds on dual carriageways.

Changes would be difficult to measure directly as cost impacts for operators are likely to be small on an individual journey basis and will be not be attributed directly to changes resulting from the policy. There are also other factors influencing vehicle speeds on roads which make direct measurement complex.

The qualitative research largely confirmed this view, with HGV operators not perceiving any economic benefits relating to time savings to-date. There was a view among stakeholders that there may have been minor benefits in terms of the amount of fuel used, but HGV operators did not perceive any change in their fuel costs or operating costs attributable to the policy. Almost all the stakeholders and individuals interviewed felt that levels of congestion had increased since the policy was implemented, with one HGV operator identifying a 5.5% decrease in the average speeds of its fleet over the past four years. Operators also felt that a larger percentage of the strategic road network was undergoing road works and the growth in use of average speed restrictions had further reduced average vehicle speeds.

Adopting an appraisal-based methodological approach to test the Theory of Change therefore has a number of advantages over using ex-post data:

- It allows the policy change to be compared to a counterfactual, based on the ex-ante observed speeds of vehicles calculated as part of this study. Use of the counterfactual allows the influences of some contextual factors, such as congestion resulting from increased traffic flows, to be offset as these influences will be represented in both the modelled counterfactual and the model of the policy change;
- The use of the National Transport Model allows the results of the speeds impact evaluation to be applied directly so that the modelling is testing the observed changes across all study roads; and
- By using the National Transport Model, the approach is consistent with the DfT ex-ante impact assessments and allows for comparison with the results of the original assessment.

Accordingly, the economic evaluation is based upon a comparison of the ex-ante impact assessments with updated impact assessments run using the National Transport Model.

7.2 Analysis of the Economic Impacts

7.2.1 Economic Evaluation Questions

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

- Using the parameters of from the impact evaluation, what would the net present value for the policy be?
- How does this compare to the net present value from the impact assessment?
- What are the main reasons for any differences in costs or benefits relative to the impact assessment?
- What are the remaining uncertainties associated with the revised net present value figure?

7.2.2 Economic Appraisal Approach

The 2019 impact assessments produced by the DfT used outturn data from the speeds impact evaluation in order to set the parameters of the speed flow curves within the NTM. Speed flow curves are the mechanism used to calculate the speed of vehicles within the model depending on road type, vehicle type and traffic flow. The 2019 impact assessments have been undertaken so as to be as consistent as possible with the 2014 ex-ante specification; however, it has been necessary to make changes in some areas. These are detailed in Table 7-1.

Table 7-1: Comparison of Ex-Ante and Ex-Post NTM Impact Assessments

	2014 Ex-Ante	2019 Ex-Post
Road types	Changes to speeds were applied on Trunk Single, Principal Single and B-roads.	In addition to the ex-ante road types, changes were applied on Trunk Dual and Principal Dual road types reflecting the increased observed HGV speeds on dual carriageways.
NTM version	Version 2	Version 2 recalibrated. This updated model has a revised base year of 2015 as well as updates to parameters including speed emission curves and TAG Data Book inputs.
Appraisal period	2014 – 2031 (18 years)	2015 – 2031 (17 years)

For the ex-ante appraisal, the DfT produced estimates covering a range of potential increases to HGV speeds on single carriageways. The lower bound of the range was defined as the existing average speed of 2-axle rigid HGVs in 2014 as around two thirds of these vehicles weigh less than 7.5t and therefore already had a speed limit of 50 mph on single carriageway roads. Their speed was therefore assumed to be a good estimate of the speed other HGVs would consider driving if the speed limit was increased (this assumption was run in the NTM with low growth in vehicle numbers applied).

The upper bound was defined by the average speed of cars and light goods vehicles as it was considered highly unlikely that HGV drivers would choose to drive faster than those vehicles on average (this assumption was run in the NTM with high growth in vehicle numbers applied). The central scenario was an average of the low and high scenarios in terms of vehicle speeds and with central growth in vehicle numbers applied.

Whilst there have been some observed speed increases for light vehicles following the policy change these have not been included in the updated impact assessment in order to maintain consistency with the ex-ante approach. Within the NTM, heavy vehicle speeds are calculated using a speed for free-flow conditions which is then maintained until the heavy vehicle speed intersects with the speed flow curve for general traffic, after which heavy vehicle speeds are set to that speed (the heavy vehicle category in the NTM includes HGVs but also buses and coaches). The specifications applied within the NTM are shown in Figure 7-2. These were calculated based on a volume-weighted average of Rigid 2-axle HGVs and HGVs > 7.5t as this best represents the heavy vehicles class modelled within the NTM.

Table 7-2: Heavy Vehicle Free Flow Speeds Used in the 2019 Impact Assessment

Speeds (mph)	Trunk and Principal Dual	Trunk Single	Principal Single	B Roads
Ex-Ante (counterfactual)	55.5	46.9	46.9	44.3
Ex-Post	56.3	48.1	48.1	45.9

7.2.3 Economic Appraisal Results

The results of the economic impact evaluation are presented in Table 7-3 alongside the results from the ex-ante impact assessment.

Table 7-3: Results of NTM Economic Appraisal

2010 prices discounted to 2010 (£m)		Ex-Ante Impact Assessment			Ex – Post Impact Evaluation
		Low	Central	High	
Time Savings	**Business Users**	95.3	173.9	280.1	162.2
	Other Users	0.2	-0.4	2.7	0.8
Fuel & Vehicle Operating Costs	**Business Users – Fuel**	-4.0	-13.5	-22.4	9.2
	Business Users – VOCs	19.9	32.0	45.7	44.7
	Other Users	-0.2	-0.2	-0.5	0.0
Indirect Taxation Revenues		15.0	26.3	40.1	-16.7
Wider Economic Impacts		11.1	19.2	30.3	21.6
Environmental Impacts		-6.2	-12.5	-20.0	4.1
Implementation Costs		-0.1	-0.1	-0.1	-0.1
Total Net Present Value		**130.9**	**224.6**	**356.0**	**225.8**

Source: DfT Impact Assessments using National Transport Model

The economic impact evaluation indicated that the policy will provide substantial economic benefits, with a net present value (NPV) estimate of £225.8m in 2010 prices over the assessment period of 2015 - 2031. The main component of these benefits is business journey time savings totalling £162.2m (72% of the total). Vehicle operating costs for business users also make a substantial contribution of £44.7m to the NPV (20% of the total).

The calculated NPV is considered a good estimate of the order of magnitude of likely benefits of the policy given that the National Transport Model has been used to undertake the assessment and that the largest benefits (time savings and vehicle operating costs) can be directly linked to the increase of HGV speeds in the model representing the policy change.

However, there remain uncertainties around the results, at least partly due to differences between the categories used in the evaluation and those defined in the NTM:

- The heavy vehicles category in the NTM includes all HGVs and other heavy vehicles and is much broader than the categories analysed in the evaluation, HGVs >7.5t and 2-axle rigid vehicles;
- The representation of heavy vehicle speeds in the NTM is limited. A free flow speed is defined and this speed is applied at increasing flow levels until the heavy speed intersects with the light vehicle curve, at which point the speed of heavy vehicles tracks light vehicle speeds.
- Many of the road types defined in the NTM represent average conditions across roads with a range of speed limits, so the observed speeds used as inputs into the

model will be applied across some roads where the policy change does not apply; and

- The impact of the policy change on other vehicles has not been modelled and so it is possible there are smaller-scale benefits for light vehicles which are not quantified within the results.

7.2.4 Comparison of Ex-Ante & Ex-Post Economic Assessments

The central growth scenario provides the best comparison for the updated 2019 impact assessment, although as different models, assumptions and methodologies apply, comparisons should focus on the magnitude of benefits rather than a direct comparison of figures. Whilst the assumed increase in HGV speeds is higher (around 3 mph) than the observed 1.6 mph increase, it had central traffic growth assumptions applied and was considered the best representation of potential economic benefits in 2014.

Table 7-3 showed that there was generally a good correlation between the benefits of the 2014 impact assessment and the 2019 impact evaluation. There are some exceptions, but these are explained by changes to the NTM parameters made between the two assessments:

- Increased speeds resulted in increased fuel use as a result of the policy in the 2014 assessment, but new vehicle fuel consumption curves have been implemented in the model since then. These generally show better fuel consumption for heavy vehicles as speeds increase and this is reflected in the vehicle operating costs (fuel) benefits shown in the impact evaluation results;
- There are reduced indirect taxation revenues predicted by the impact evaluation and this is linked to the above statement as the lower taxation is a result of predicted reduced fuel consumption and the resulting loss of duty for the Treasury; and
- Finally, there are anticipated emission benefits for the impact evaluation as emissions curves are directly related to fuel consumption curves in the NTM and the expected reduction in fuel use delivers a corresponding reduction in CO_2 emissions. The reverse is true for the 2014 impact appraisal where fuel use was forecast to increase.

7.2.5 Summary of Economic Impact Evaluation

The results of the 2019 economic evaluation indicated that there will substantial business time savings and vehicle operating costs for HGV operators as a results of the increased speed limit for HGVs >7.5t on single and dual carriageway roads. Fuel use is predicted to decrease as a result of the policy and so there is a corresponding reduction in indirect taxation revenues forecast by the evaluation. The overall net present value is calculated as £225.8m over the period from 2015 – 2031.

A comparison of the impact evaluation with the 2014 impact assessment shows good correlation (when accounting for updates made to the parameters within the NTM in the intervening period). The central (best) scenario of the 2014 assessment is considered the best comparator and has a very similar net present value to the impact evaluation (£224.6m).

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8. Conclusions

This report has set out the results from the third and final 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 the economy.

Results in the final report covered the full range of evaluation activities undertaken through the project including qualitative research, speeds and safety impacts through a quantitative impact analysis of data, environmental impacts and economic evaluation using the National Transport Model. Figure 8-1 shows the ex-ante logic map annotated with evidence from the evaluation. This highlights the following results:

8.1 Conclusions: Single Carriageways

- Awareness of the policy change amongst HGV drivers was good based on the Year 1 and Year 3 qualitative research;
- Based on the results of the speed impact evaluation, the average speed of HGVs has increased by 1.6 mph (from 44.1 to 45.7 mph) since the implementation of the policy in April 2015;
- The average speed of light vehicles has also increased by 0.3 mph (from 47.9 to 48.2 mph) since the implementation of the policy;
- The policy change to increase the maximum speed limit for HGVs from 40 to 50 mph on single carriageway roads is therefore considered to be a contributory factor in the observed increase in HGV average speeds;
- It is possible that the policy change has reduced speed variance on single carriageways by a small amount, particularly at higher flow levels. This corresponds with the theory of change for the intervention due to the expectation that increased HGVs will result in a reduced range of traffic speeds;
- 18% of HGVs >7.5t now exceed the 50 mph speed limit for this vehicle type on 60 mph single carriageway roads (prior to the HGV speed limit increase in 2015 this figure was 9%); and

8.2 Conclusions: Dual Carriageways

- The Year 1 qualitative work with HGV drivers indicated that awareness of the policy change amongst HGV drivers was mixed, but by Year 3, stakeholders were confident the policy was fully understood within the industry;
- Based on the results of the speed impact evaluation, the average speed of HGVs on dual carriageways has increased by 0.5 mph (from 52.0 to 52.5 mph) since April 2015 and the policy change is considered a contributory factor in this increase;
- The average speed of light vehicles has also increased by 0.1 mph (from 65.0 to 65.1 mph) since the implementation of the policy;
- It is possible that the policy change has reduced speed variance on dual carriageways by a small amount, particularly at higher flow levels;
- 81% of HGVs >7.5t exceeded 50 mph on 2-lane dual carriageway roads prior to the speed limit change in 2015 and 83% exceeded this figure after the speed limit change.

8.3 Conclusions: Environment

Environmental analysis revealed no statistically significant effect on air quality and no perceptible change in noise level over a typical 18-hour day or during individual hours at night. This was true for both single and dual carriageways.

Any small changes in noise identified were largely due to other factors and well within levels of background change. At worst, the policy change has increased HGV noise by 0.2dB, and is thus imperceptible.

8.4 Conclusions: Safety

Intervention logic mapping indicated that there are logical reasons that could lead to increased collisions (due to increased speeds) or decreased collisions (due to fewer conflicts, reduced need for overtaking, reduced frustration). The impact assessment estimated a small increase in collisions.

Statistical models comparing 10 years of ex-ante data with 33 months of ex-post collision data points to no evidence of a change in collisions for HGV collisions on all study roads, single carriageway roads or dual carriageway roads.

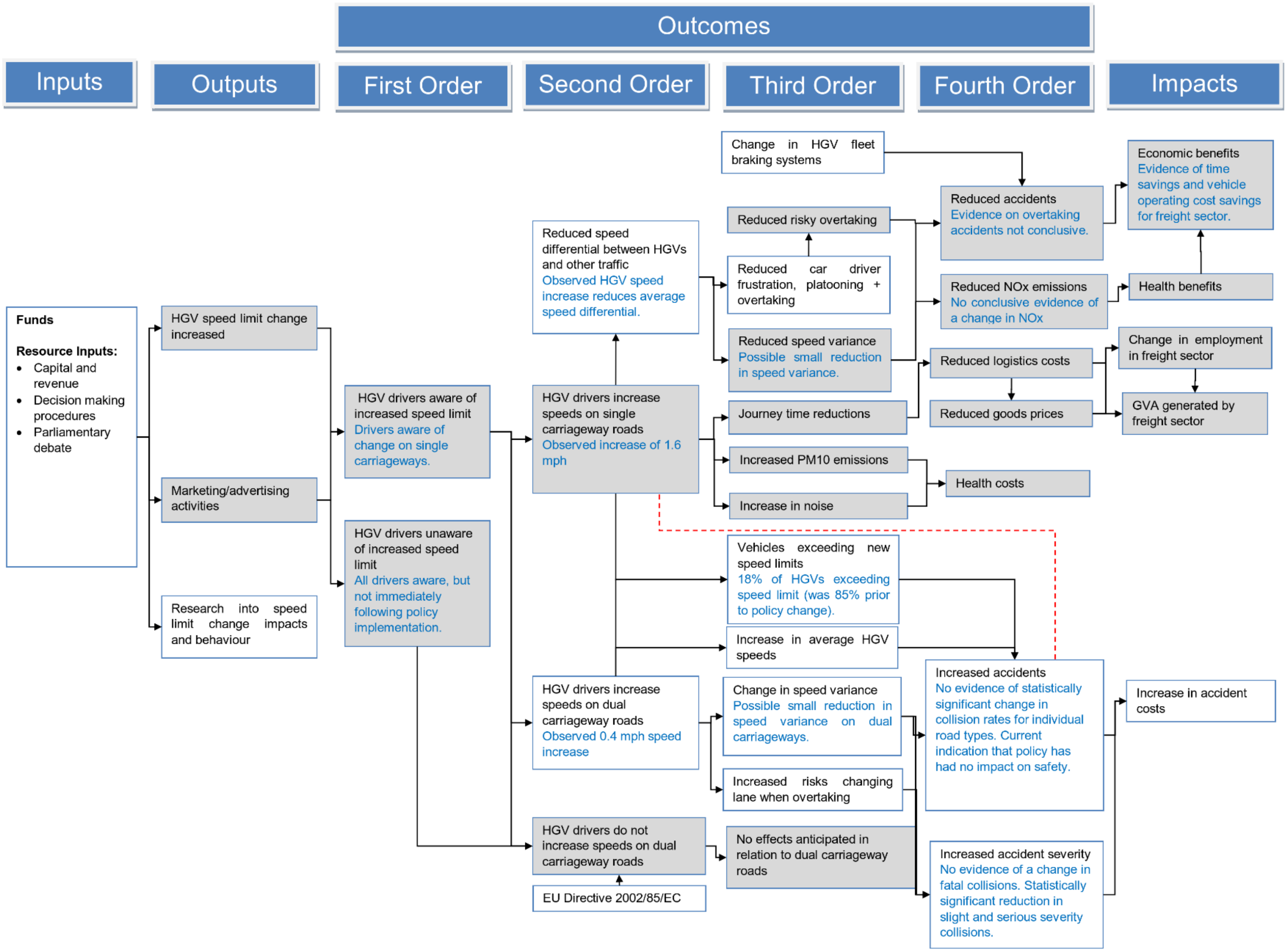
A number of sensitivity tests were conducted testing other subsets of collisions such as severities, manoeuvres and points of contact. All findings were not statistically significant, with the only significant finding a reduction in collisions that are slight or serious across all study roads.

Overall the study concludes there is no impact to safety as a result of the policy.

8.5 Conclusions: Economy

- The economic impact evaluation calculates a net present value for the policy of £225.8m over the period from 2015 – 2031;
- The benefits are principally comprised of business user time savings (£162.2m) and business user vehicle operating costs (£44.7m non-fuel and £9.2m fuel);
- A comparison of the impact evaluation with the 2014 impact assessment shows good correlation. The central (best) scenario of the 2014 assessment is considered the best comparator and has a very similar net present value to the impact evaluation.

Figure 8-1: Annotated Ex-Ante Logic Map



9. Appendices

Appendix A: Qualitative Research Methodology and Example Discussion Guide

Methodology

A list of stakeholders for interview was identified as part of the 2016 scoping phase of the study. This list was refreshed in 2019 to account for known changes in the individuals in the identified roles as well as changes to organisational structures. The stakeholders were split into two types: direct and indirect. Direct stakeholders are those who are anticipated to be directly influenced by the policy change (e.g. HGV operators), indirect are higher level stakeholders who would not be influenced on a day to day basis, but may have identified or responded to the indirect impacts of the change (e.g. local or strategic highway authorities).

Consultation

Aligned to the consultation undertaken in 2016, the initial target sample included two national HGV operators with significantly differing business models, as well as two local HGV operators. Six local authorities were selected. The choice of local authorities to approach was devised to achieve a balance between different types of organisation (Metropolitan, County Councils and Unitary Authorities), as well as ensuring a geographic spread across the country. A number of the originally targeted organisations either did not respond to a request to take part in the evaluation, or indicated that they would not be able to provide a meaningful contribution.

In total six individuals or organisations took part in the 2019 stakeholder interviews, covering national HGV operators, trade associations and local authorities. All interviews were relatively short, spanning from 30 minutes up to an hour depending on the knowledge of the participant, and based around pre-defined discussion guides (an example of which is provided below). The discussion guides were tailored to each organisation type, but generally followed a similar format considering the key topic areas:

- Awareness of the policy;
- Response to the policy;
- Perceived costs and benefits of the policy to the organisation and 3rd parties;
- External factors influencing traffic and driver behaviour; and
- The response of other drivers (non-HGV) to the policy.

Example Discussion Guide

<u>Freight Association</u>

Introduction

Introduction to the study:

In April 2015 new national speed limits came into force for heavy goods vehicles (HGVs) over 7.5 tonnes on single carriageway (50mph, from 40mph) and dual carriageway roads (60mph from 50mph) in England and Wales. In October 2015 the Department for Transport commissioned AECOM and Atkins to undertake a three year evaluation of the speed limit change with primary *aims of generating the evidence needed to support future policy decisions and validate the initial impact assessment for the increase.*

As part of this evaluation over the previous three years we have been assessing the key impacts of the speed limit change in terms of traffic speeds and flows, road safety, environmental and economic impacts. We will also seek to evaluate how individuals and organisations have responded to the changes as part of a Process Evaluation, which is the focus of this interview.

What is the role of your Association?

- Nature of relationship with HGV operators and drivers
- Nature of relationship with the public sector (DfT, LA's and Highways England)

What is your role within the Association?

- Level of involvement with individual operators

Awareness of Limit Change

Are you aware of the change in speed limit for HGVs over 7.5 tonnes on single carriageways and dual carriageways? How were you first made aware of this change?

Did your organisation participate in the DfT consultation on the policy change (if so seek to obtain copy of consultation response)?

Response to Limit Change

To what extent have haulage companies instructed HGV drivers to alter their driving behaviour as a result of the speed limit changes on single carriageway roads, and if so how?

To what extent have haulage companies instructed HGV drivers to alter their driving behaviour as a result of the speed limit changes on dual carriageway roads, and if so how?

Have haulage firms made any changes to the policies, procedures and processes in place as a response of the speed increase, and if so how?

- E.g policies on rest periods

How have HGV firms/operators changed their routing patterns as a result of the speed increase?

- How has routing been altered?
- Is this on specific routes or by road type?
- What impact is this likely to have had (e.g. less use of motorways or reduced distance travelled)?

Has the Freight Association issued any information/advice relating to the speed limit changes, and if so what did they include?

Benefits/Costs of Limit Change

Are there any benefits/positive impacts of the speed limit changes to the Haulage industry, and if so what (ensure that responses are evidence based not opinion)?

- Reduced delivery times
- Reduced fuel consumption/costs
- Reduced stress levels of drivers

- Etc

Are there any costs/negative impacts of the speed limit changes to the Haulage industry, and if so what (ensure that responses are evidence based not opinion)?

- Increased stress levels of drivers
- Reduced rest periods?
- Increased fuel consumption/costs
- Perceived increase in accidents?
- etc

What external/independent factors do you think have influenced traffic speeds and flow since implementation of the speed limit changes (April 2015)?

- Increased traffic volumes
- More local speed limits
- Improved vehicle technologies – facilitating perceived safer speeding

Other Road Users

Do you feel as though general traffic (e.g. car drivers) is aware of the speed change?

Do you feel as though general traffic has altered their driving style on single carriageway roads as a result? If so, how?

- less likely to risk overtaking HGVs
- making more dangerous overtaking due to additional speed)

Appendix B: Speed Impact Evaluation Methodology

Introduction

The methodology for analysis the speed impact of the policy change was collaborative and involved analysts at AECOM and DfT. A broad outline of the methodology is as follows:

- DfT supplied average hourly data for 50 and 60 mph single carriageways roads, 70 mph dual carriageway roads and 70 mph motorways (motorways acted as a control group);
- AECOM then reviewed the data on a site by site basis to identify if the site was suitably for use in the study and to identify periods of road works or other disruptions which should be excluded;
- DfT used the filtered list of sites and time periods to run a database query and output individual vehicle records in order to identify changes in speed and speed variance. These were then summarised to meet the criteria for the evaluation;
- AECOM then compiled the results to produce the analysis required for the evaluation report.

Data Sources

The key source of data for the impact: speeds work is the DfT Traffic Surveys 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 three years ex-post (2015/16, 2016/17, 2017/18) 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 B1 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 B1: Categorisation of count sites to be used in the study

	Single Carriageways	Dual Carriageways		Motorways			All Road Classes
		2-lane	3-lane	2-lane	3-lane	4-lane	
DfT Count Sites	50 (25)	14 (8)	2 (2)	9 (9)	29 (29)	6 (6)	110 (79)
		All dual carriageway sites: 16 (10)		All motorway sites: 44 (44)			

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.

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.

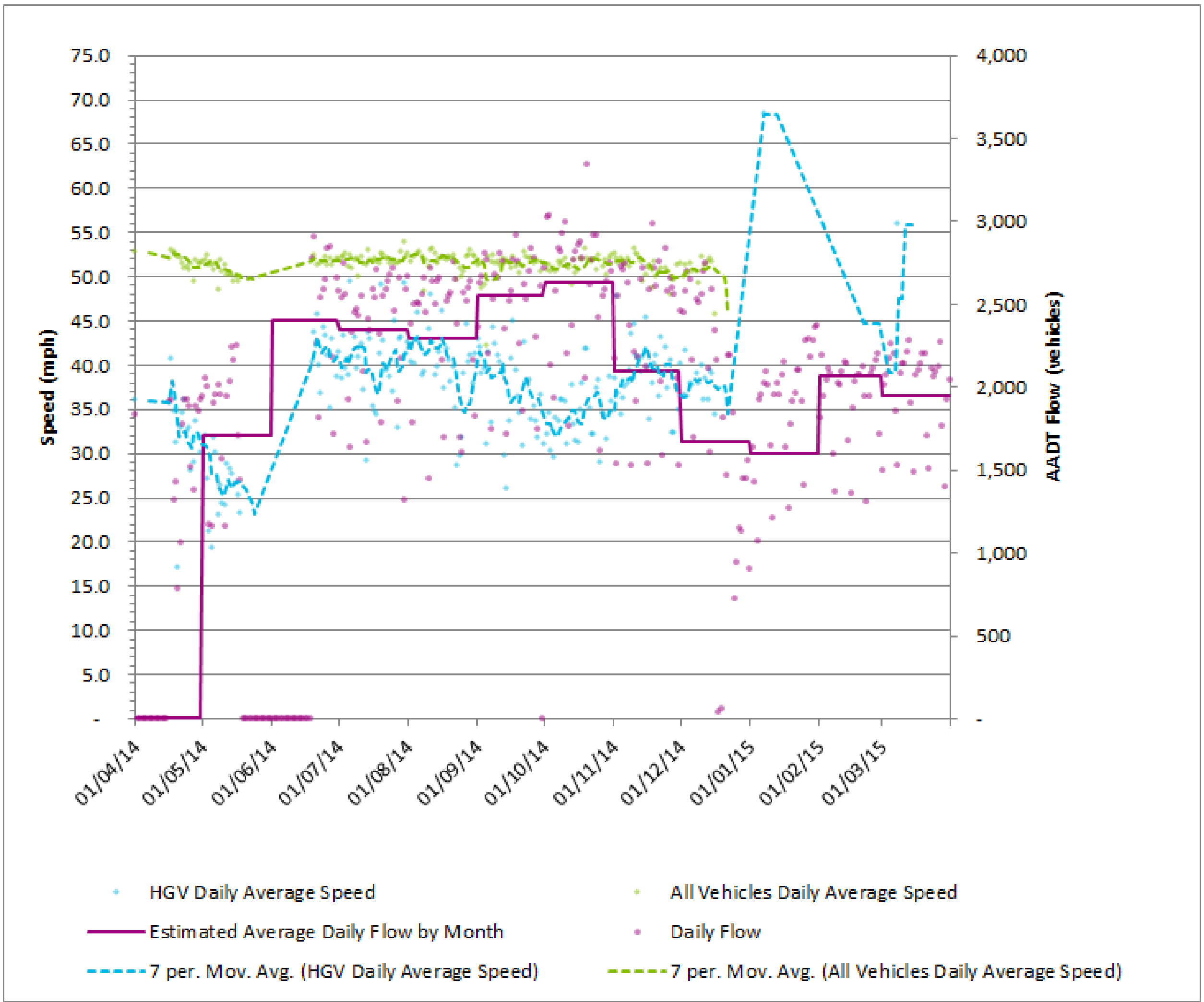
The overall approach was conservative based on the premise that data should only be excluded when there is a good reason for doing so and that rules should be applied as consistently as possible across all sites. The following list of points illustrates the decision making approach used, and a detailed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

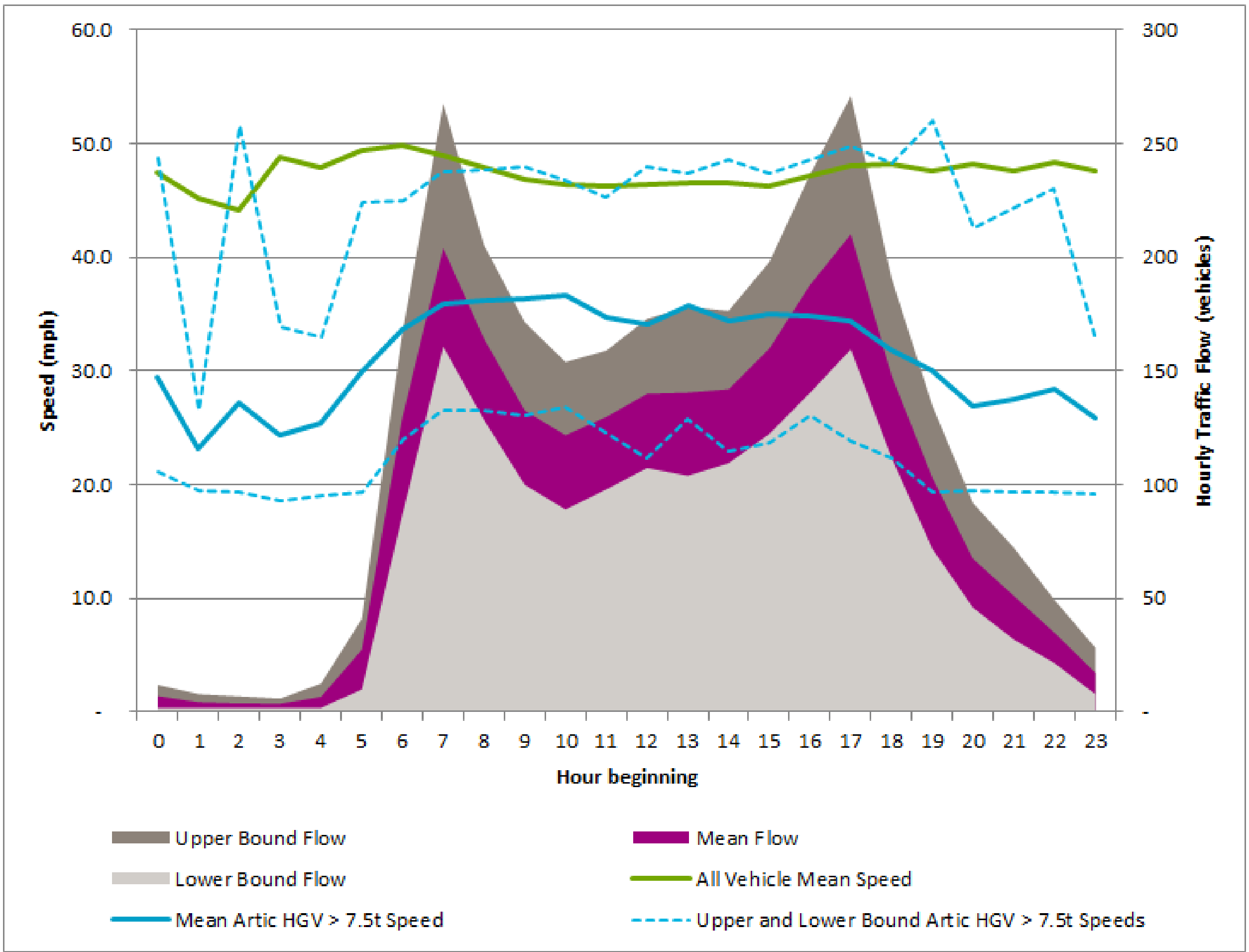
Figure B3: Example of speeds and flows at a site from April 2014 to March 2015



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 10th and 90th percentile bounds have been applied).

Figure B4: Example of weekday speeds and flows at a site



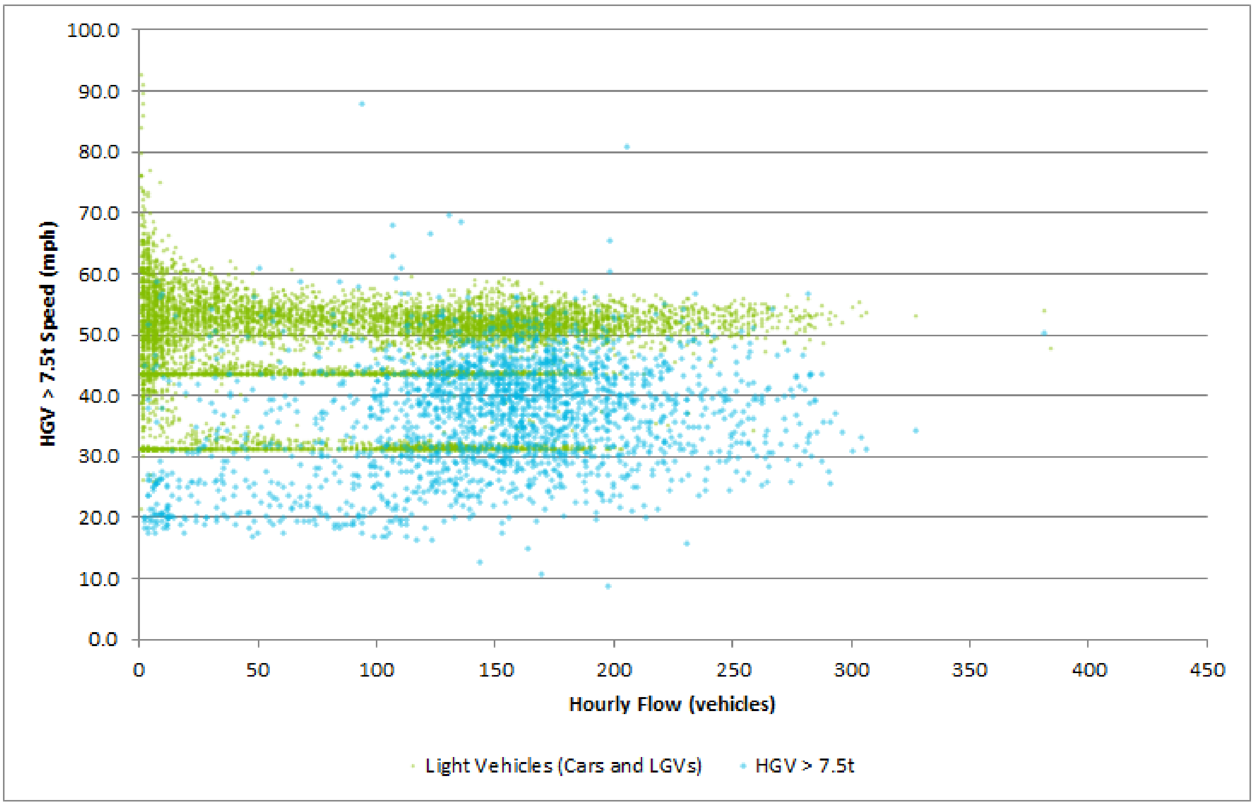
Profile of Speeds and Flows

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.

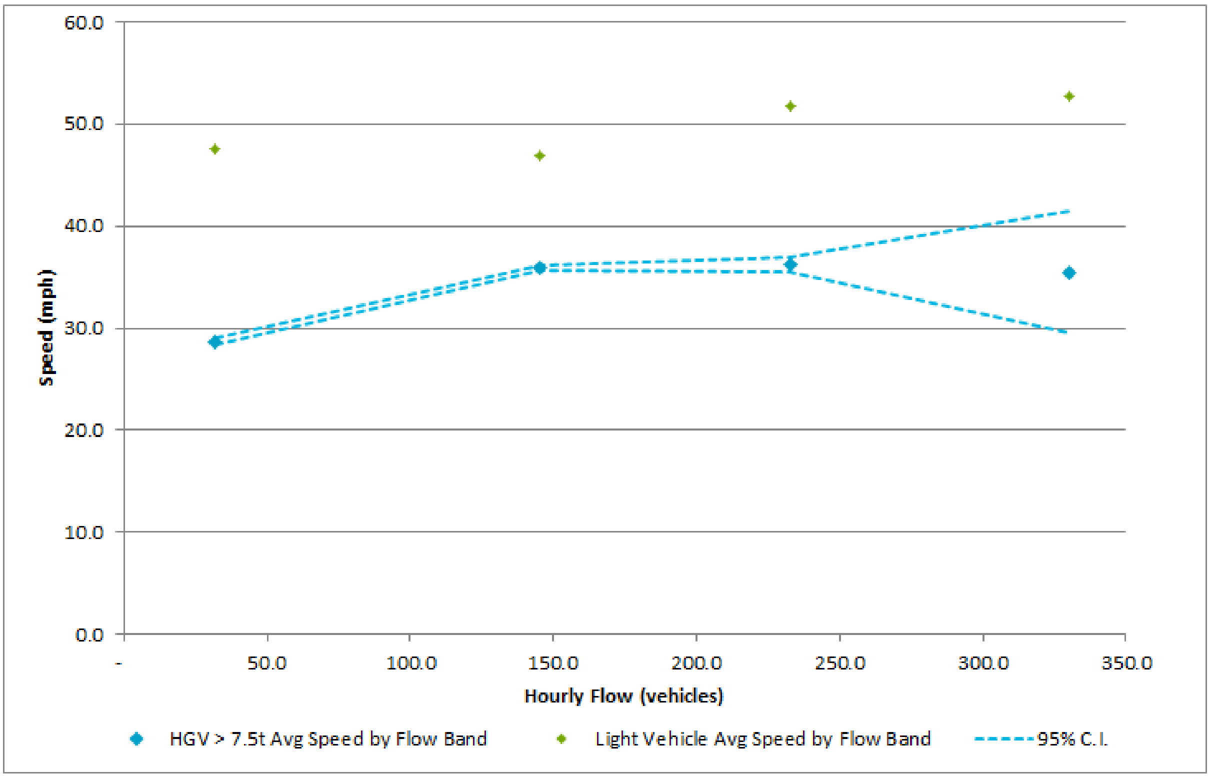
Figure B5: Example scatter plot of speeds and flows for light vehicles and HGVs > 7.5t



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 B6: 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 across all vehicle types from the individual vehicle data received from the DfT. The calculation of speed variance was undertaken by grouping individual vehicle records into 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.

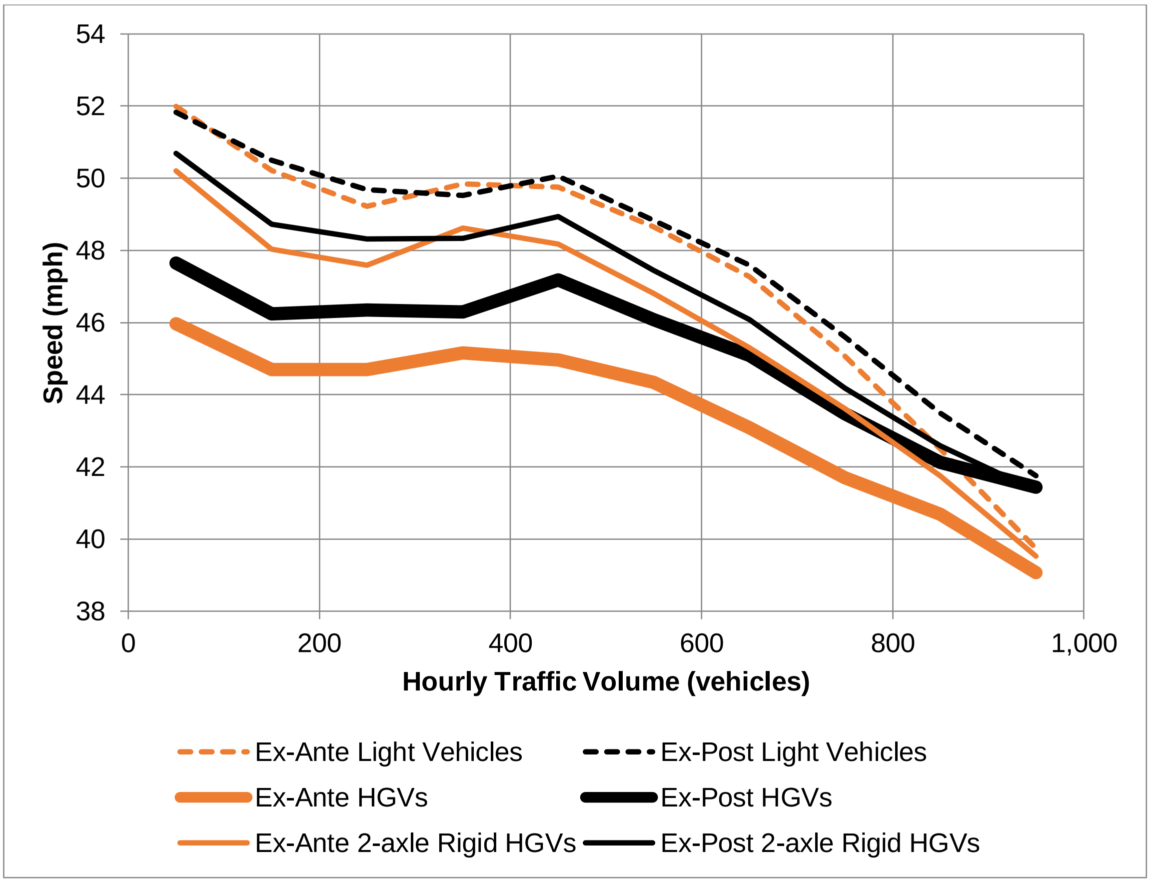
Appendix C: Speed Impact Evaluation Results Including 2-Axle Rigid HGV Class

Single Carriageways

Table C1: 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	51.8	-0.16 [-0.18 to -0.15]
Rigid 2-Axle HGVs	50.2	50.7	+0.48 [+0.43 to +0.54]
HGVs	46.0	47.6	+1.68 [+1.65 to +1.71]
All Flows (0 – 1,000 vehicles per hour)			
Light vehicles	47.9	48.2	+0.24 [+0.23 to +0.25]
Rigid 2-Axle HGVs	46.3	46.8	+0.49 [+0.44 to +0.53]
HGVs	44.1	45.7	+1.59 [+1.56 to +1.63]

Figure C1: Average Speed Analysis Results for 60 mph Single Carriageways

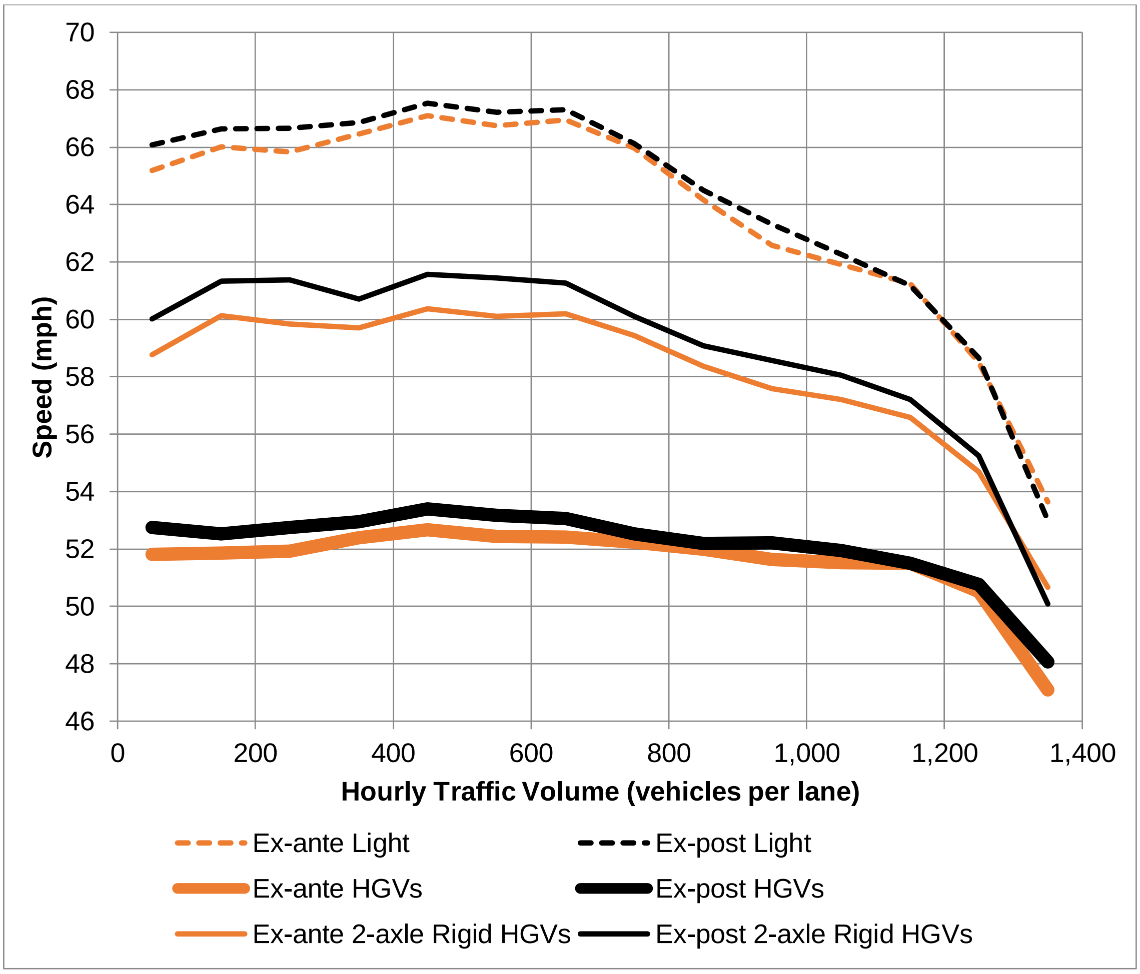


Dual Carriageways

Table C2: 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	66.7	+0.60 [+0.59 to +0.61]
Rigid 2-Axle HGVs	59.6	60.8	+1.17 [+1.12 to +1.22]
HGVs	52.0	52.8	+0.73 [+0.71 to +0.75]
All Flows (0 – 1,400 vehicles per hour per lane)			
Light vehicles	65.0	65.1	+0.15 [+0.14 to +0.16]
Rigid 2-Axle HGVs	58.9	59.7	+0.79 [+0.75 to +0.84]
HGVs	52.0	52.5	+0.48 [+0.46 to +0.51]

Figure C2: Average Speed Analysis Results for 2-Lane 70mph Dual Carriageways



Appendix D: Additional Air Quality Analysis

Summary of Impact Assessment of HGV Speed Limit Increase, 2014

Single Carriageway Impact Assessment

The DfT undertook an impact assessment of the policy decision to raise the speed limit for HGVs over 7.5t on single carriageways from 40mph to 50mph, where other local speed limits are not already in place. The pre-change average free flow speed travelled by HGVs on single carriageways is 45mph, 5mph above the existing speed limit. The speed statistics include Rigid HGVs over 7.5t which make up approximately 40% of the rigid HGV group and whose speed limit is already set at 50mph for single carriageways, (RER3, Barber, DfT, 2014). On this basis, the impact of the policy decision is likely to be limited.

The impact assessment for single carriageways used the National Transport Model (NTM) v2 to provide modelled evidence of the effects of increasing the HGV speed limit on vehicles speeds and associated costs and benefits. The NTMv2 was used to establish the change in speed and consequently the change in fuel consumption and emissions. The change in speed limit for HGVs over 7.5t was estimated to result in an increase from the current average speed for all HGVs on single carriageways of 45mph to between 46 and 49mph. At the higher end of the speed increase (49mph) there was a subsequent reduction in NOx emissions resulting from HGVs travelling at slightly more efficient engine speeds, when compared with emission rates at 45mph. For PM_{10} emissions, although some vehicle types are operating more efficiently at increased speeds, other types are above their most efficient speed. This resulted in an overall increase in PM_{10} emissions. The model also indicated that faster HGV journeys result in small increases in HGV traffic which will have knock-on effects for other vehicles trying to occupy the same road capacity. There may be links where gradient or traffic conditions allow most heavy vehicles to travel at or above the raised 50mph HGV speed limit. The increase in speeds resulted in a modelled increase in fuel consumption and a subsequent increase in CO_2 emissions.

Dual Carriageway Impact Assessment

An impact assessment of the policy decision to raise the speed limit for HGVs over 7.5t on dual carriageways from 50mph to 60mph was completed for the DfT. The pre-change average speed travelled by HGVs on dual carriageways is 53mph (with 80% of HGV rigid3+ travelling above the speed limit). The assessment concluded that raising the speed limit on dual carriageways would have no effect on the existing average speed of HGVs, (RER3, Barber, DfT, 2014), given current speeds and speed limiter use (56mph or 52mph). If there is no change to the average speed of HGVs, there will be no change to their NOx, PM and CO2 emissions. There may be links where gradient or traffic conditions allow most heavy vehicles to travel above the 53mph average speed. These will be hard to model given the limitations of the current dataset and speed varying emission factors only available for speeds up to 53.4mph for all HGV. On this basis, the impact of the policy decision was considered likely to be limited.

Reducing Impacts from HGVs

In 2011 the DfT issued a consultation on how to reduce the impacts that buses and HGVs have on air quality. Respondents had applied technical improvements to their fleet including replacing vehicles with improved euro standards or electric/hybrids, converting to LPG or ethanol, retrofitting emission controls, use of fuel additives, use of automatic idling cut outs and use of telematics driver warning systems to improve driving styles. In addition, improved driver training was widely used with emphasis on anti-idling policies. The justification for these measures was focussed on improving fuel consumption - climate change and air quality were ranked of lowest concern. A third of respondents identified that traffic management measures would have a significant effect if they smoothed vehicle operation and increased journey times. Respondents suggested additional action should include acceleration limiters, improved telematics, improve dynamic re-routing traffic, amend vehicle type specifications to reduce weight, financial assistance and incentives to replace older vehicles, (RER6, DfT 2011). On that basis, the change in speed limits could assist this strategy by improving smooth vehicle operation, but this may be limited given the current actual average speeds for HGV on relevant roads.

Air Quality – Year 1 Beta Testing

This section provides the results of the beta testing of the air quality evaluation methodology as undertaken during the one year after evaluation. This is provided as background to the analysis in the main report, as this detailed methodology was not able to be repeated during this three year after final evaluation

Traffic Data Processing Methodology

Traffic data for one traffic count point was used as a beta test site of the processing method. The site was a rural single carriageway located in the West Midlands on the A46 between Stratford-upon-Avon and Alcester.

The traffic count point has two monitors with data provided separately for each direction. Hourly data representing flows and speeds over the period 1/04/2014 to 31/12/2015. The data had been screened to remove periods under temporary speed limits, congestion, events, and accidents. Data was provided in spreadsheet format.

The vehicle composition of the traffic data is broken down to show Car, LGV, Rigid 2-axle HGV below 7.5t, Rigid 2-axle HGV above 7.5t, Other Rigid HGV above 7.5t, Artic HGV above 7.5t. The traffic data has been processed to represent the following criteria.

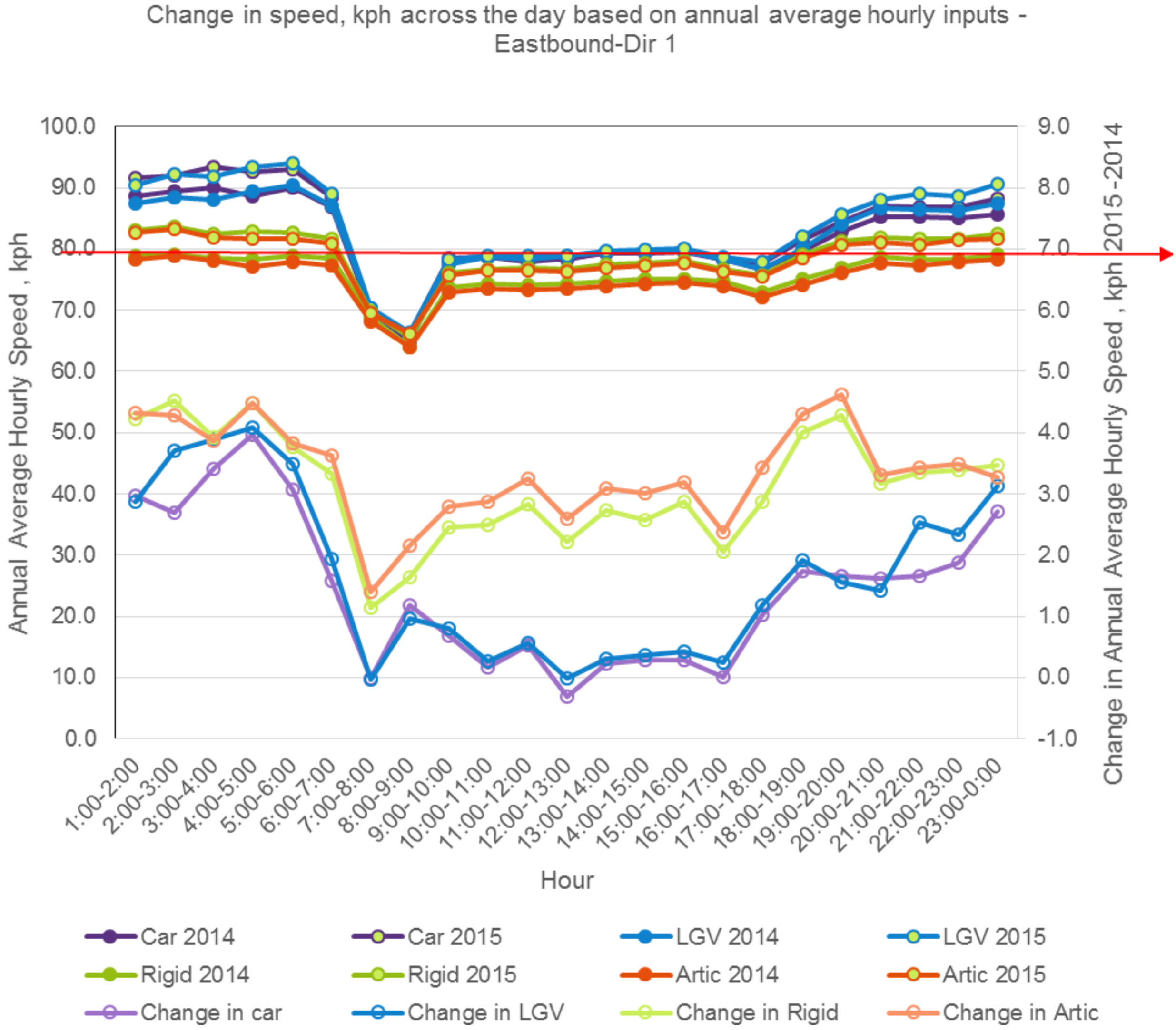
Traffic categories:

- Car = Car
- LGV = LGV + Rigid 2-axle HGV below 7.5t
- Rigid HGV = Rigid 2-axle HGV above 7.5t + Other Rigid HGV above 7.5t
- Artic HGV= Artic HGV above 7.5t

The data was combined and processed to represent the annual average hourly flow for the period 01/04/2014 to 01/04/2015, described as 2014, representing the year before the change to HGV speed limits was applied and the period 01/04/2015 to 31/12/2015, described as 2015, representing the 8-month period after the change to HGV speed limits was applied.

As speed is the key driver for this assessment the speed of each vehicle category was analysed and the annual average hourly speed for 2014 and 2015 and the change in speed in 2015 are presented on the following charts for eastbound and westbound separately.

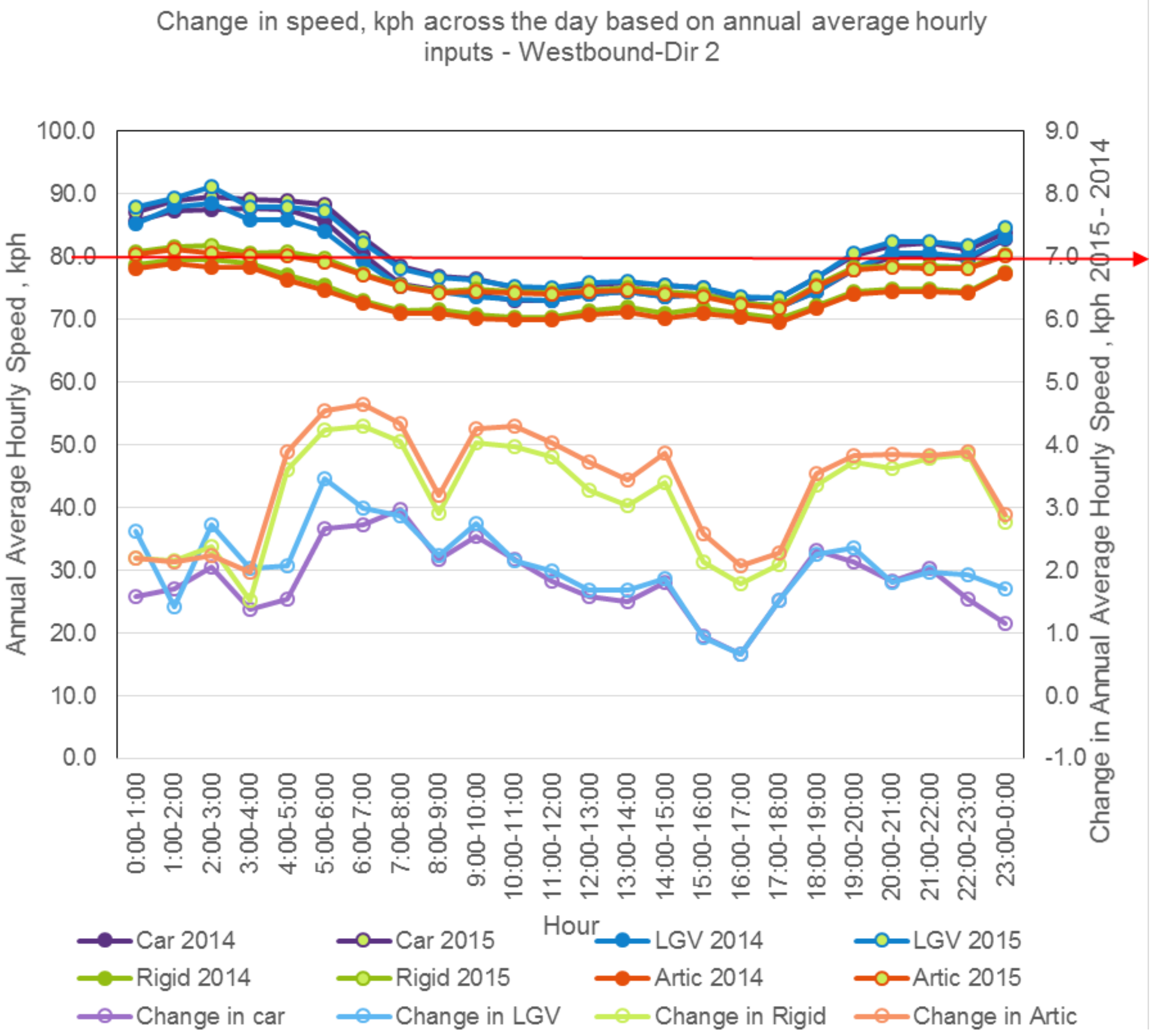
Figure D1: Comparison of 2014 and 2015 annual average hourly speed per vehicle type at Site 862-EB



The new speed limit for HGV vehicles is shown for this rural single carriageway as a red line at 80kph or 50mph. The left-hand axis represents the annual average hourly speed for each vehicle category in 2014 and in 2015. Figure C1 shows that there is a distinct drop in speed for all vehicle types between 07:00 and 09:00, as expected during a congested morning rush hour period. It also shows that in 2014 Rigid and Artic vehicles were travelling above the 2014 speed limit of 40mph or 64kph for the majority of the day. In contrast after the introduction of the higher speed limits in 2015, Rigid and Artic speeds are only above the 2015 HGV speed limit of 50mph between 19:00-07:00 (the off-peak period).

To more clearly express the effect of changes in speed per vehicle category, the change in annual average speed was calculated by subtracting the 2014 hourly speed from the 2015 hourly speed for each vehicle category per hour. This information is also shown on the graph by using the right axis and shows that there are increases in Car and LGV speed in 2015 outside the period 07:00 – 17:00. For Rigid and Artic vehicle types, annual average hourly speed is higher for all hours of the day under the new speed limits, though the difference is greater outside the period 07:00 – 17:00.

Figure D2: Comparison of 2014 and 2015 annual average hourly speed per vehicle type at Site 862-WB



The same analysis is provided for westbound data at the same site in Figure C2. The results are similar, with the only difference being a lack of speed impact during the AM peak (this is likely a route with heavy AM peak traffic flow eastbound). The findings are otherwise similar.

The speed data was combined using flow weighted averages of ‘All vehicle flows’ and ‘All vehicle speeds’ to determine the Annual Average Daily Speed combining both carriageways. In 2014 the annual average daily speed was 75.9kph and in 2015 it was 77.4kph; an increase of 1.5kph or 0.9mph. Note that this is less than the 2mph benchmark set to define a valid change in conditions after the revised speed limits.

The emissions are also affected by total flow. Therefore, a similar analysis was completed on the Annual Average Hourly Flow across the 24-hour period. Figure C3 and Figure C4 show the change in flow for each vehicle category. The total change in AADT flow for the road with both carriageways combined is an increase of 1,400. Assuming no other variable changes, this implies that the higher speed limit has increased capacity on the road section, leading to a change in AADT which would meet the DMRB traffic change criteria for undertaking an air quality assessment.

Figure D3: Comparison of 2014 and 2015, change in annual average hourly flow per vehicle type at Site 862 - Eastbound

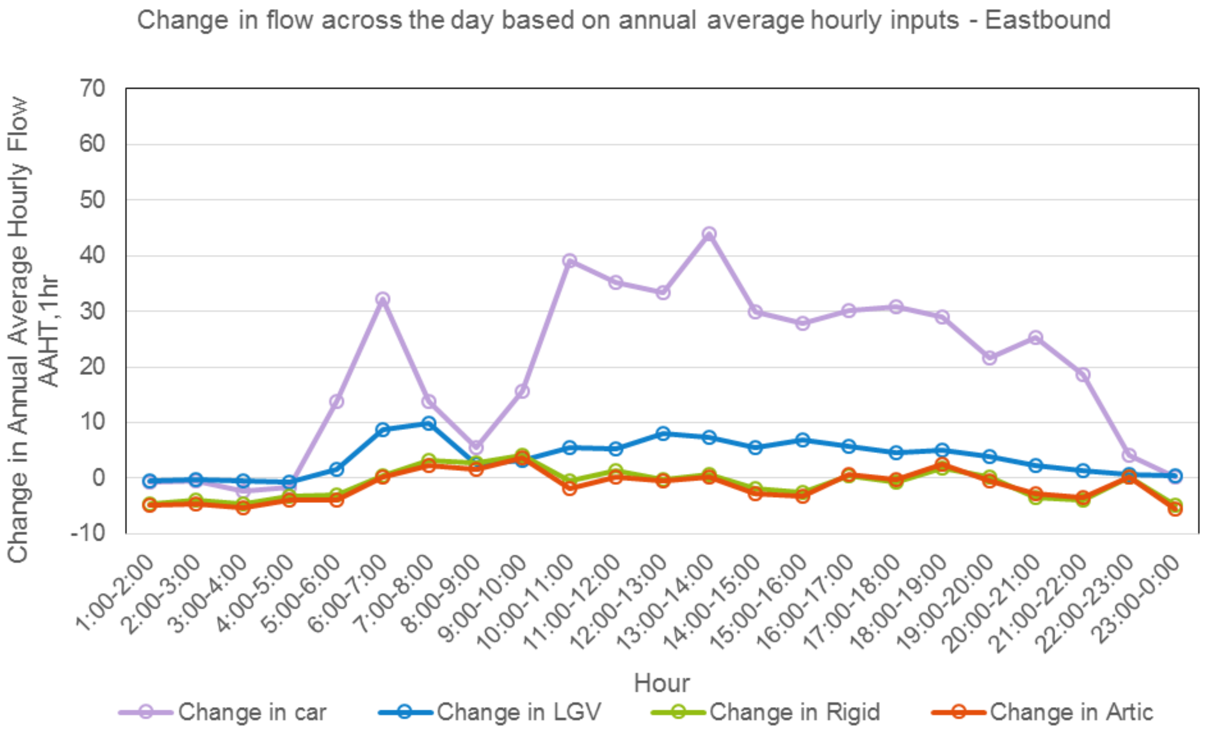
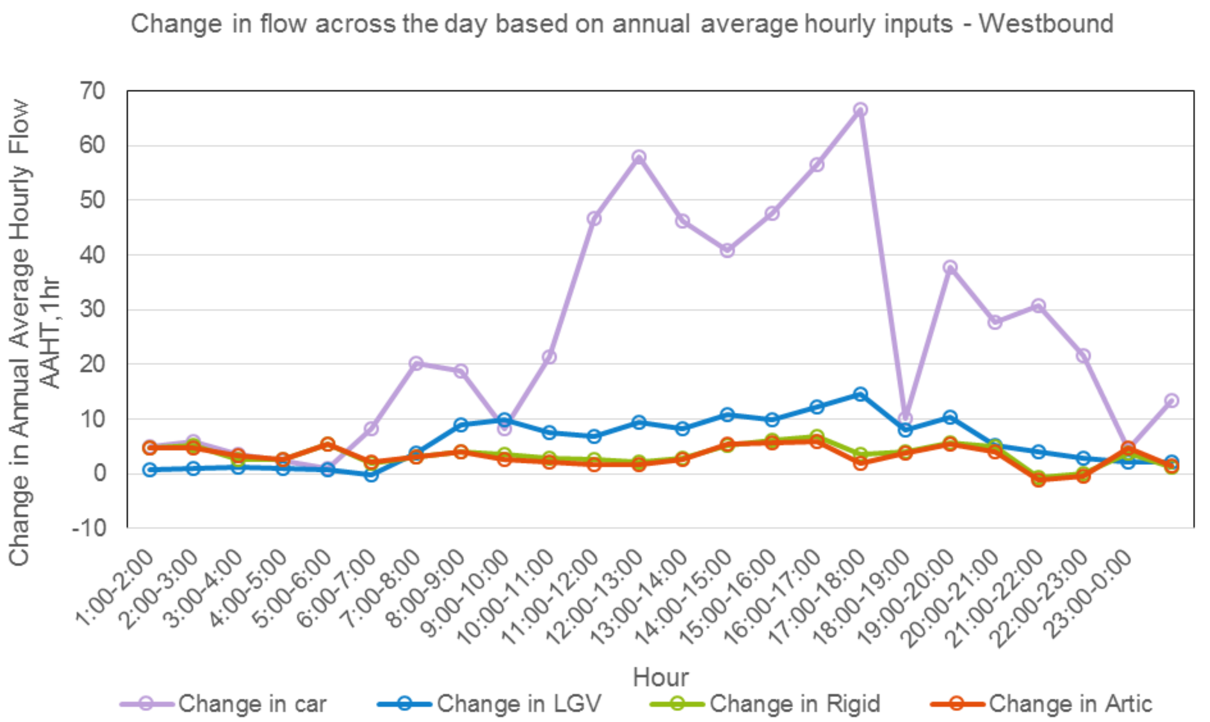


Figure D4: Comparison of 2014 and 2015, change in annual average hourly flow per vehicle type at Site 862 - Westbound



The changes in flow on the Eastbound carriageway were reductions of approximately 30 vehicles each for Rigid and Articulated vehicle types over the day, with an increase of 90 LGV vehicles and an increase of 440 cars. For the Westbound carriageway the changes in flow are increases of 85 and 80 in Rigid and Articulated HGV, an increase of 140 in LGV and 600 in cars. The overall change in flow is an increase of 1,400 vehicles over 24 hours.

Change in Emissions

The annual average hourly vehicle speed and flow for each traffic category were combined to calculate emissions using the Emission Factor Toolkit (EFT2014 v6.0.2). The hourly emissions of NOx, PM_{10} and CO_2 were determined using the national fleet compositions based on COPERT v4.10 emission factors for NOx and PM_{10} and DfT/TRL emission factors for CO_2. The traffic data input format was set for the Detailed Option 2, that allows fleet input by %Car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach and %Motorcycle.

The change in HGV speed limits does not affect Buses as they were already set at 50mph for single carriageways and 60mph for dual carriageways. As the number of Buses and motorcycles on the traffic network is relatively small these vehicle types were not included in this analysis. Taxi inputs only apply in London areas and refer to the volume of London Black Cabs, this vehicle type has not been included in further analysis. The vehicle types included in further analysis are therefore Car, LGV, Rigid HGV and Articulated HGV.

The EFT has been run to generate the hourly emission per vehicle category per direction per year - to take account of the individual changes in flow and speed with different vehicle categories.

Analysis of the annual average hourly emissions are presented in Figure C5 and Figure C6 for NOx, PM_{10} and CO_2. The figures show both before and after the speed limit change data. The charts show the stacked hourly emissions for each vehicle category which contribute to the total hourly emissions of each pollutant from each carriageway of the road, (excluding contributions from buses and motorcycles).

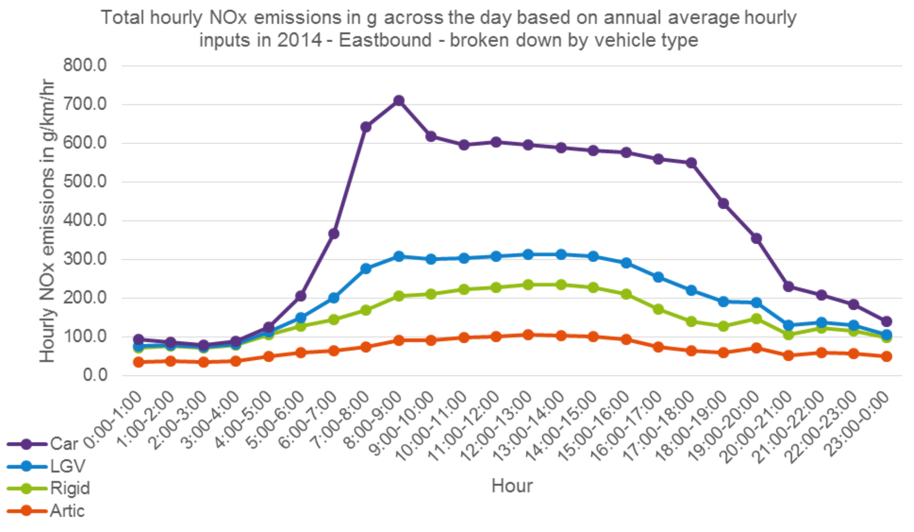
Figure D5: Site 862- Eastbound NOx, PM10 and CO2 emissions charts

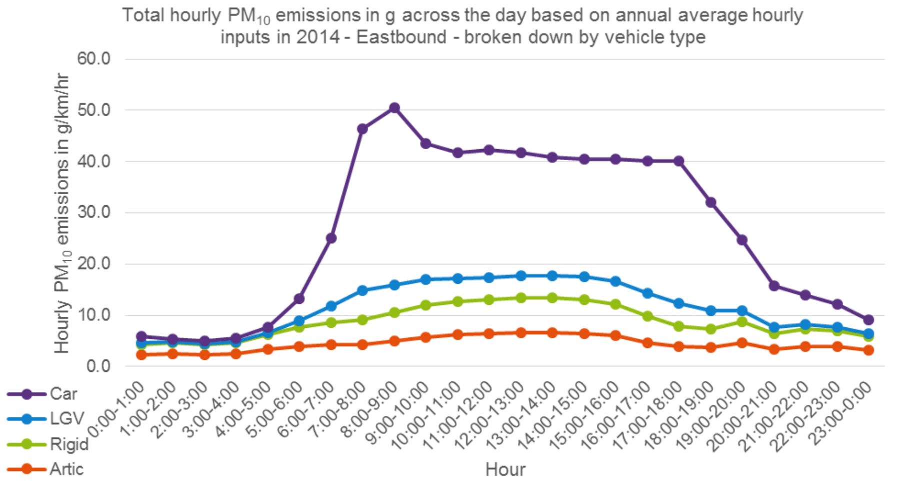
Hourly NOx emissions in 2014 and contribution per vehicle type

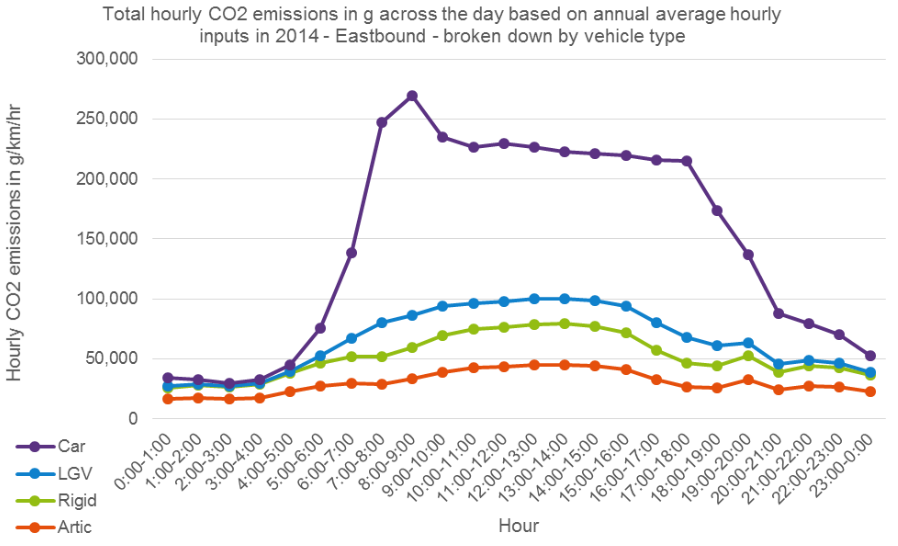
Hourly PM10 emissions in 2014 and contribution per vehicle type

Hourly CO2 emissions in 2014 and contribution per vehicle

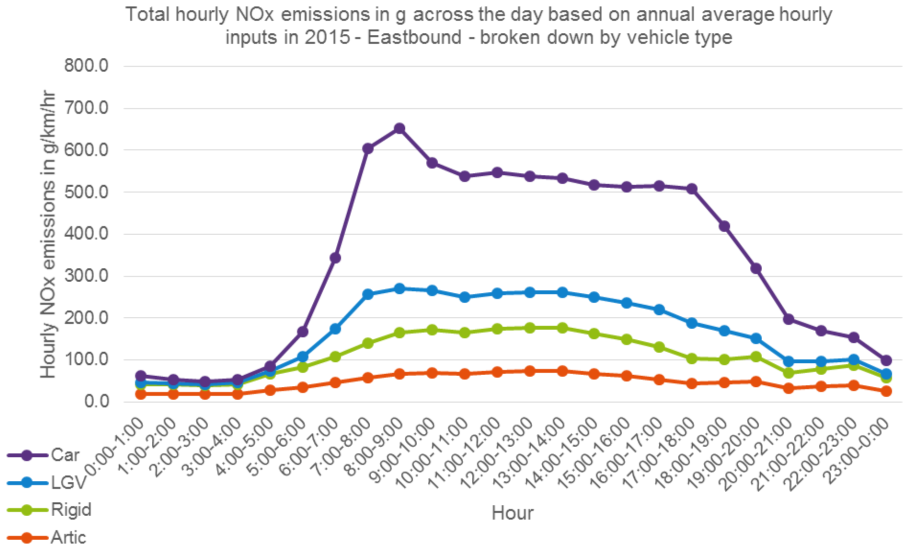
2014

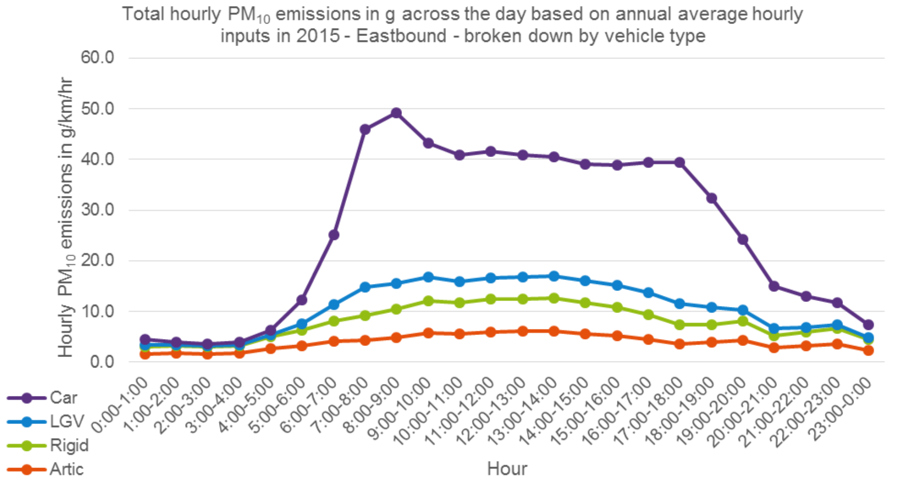






2015





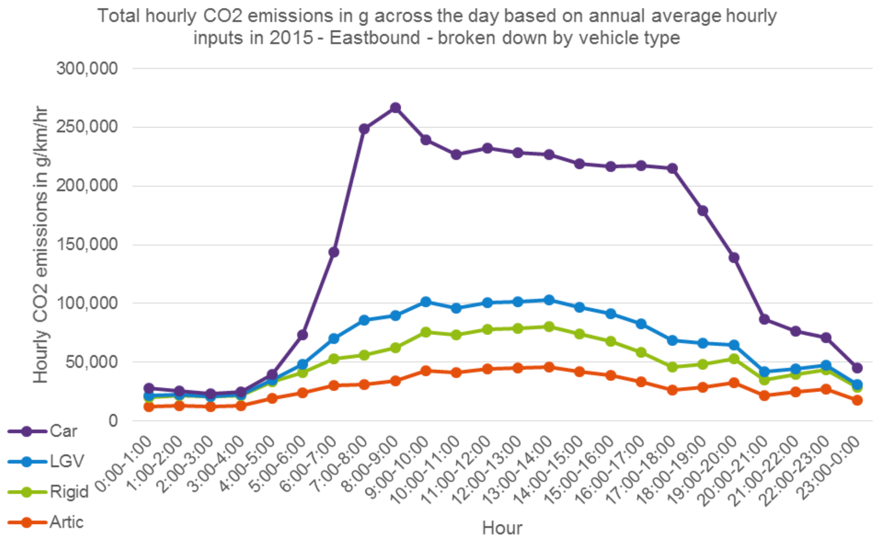
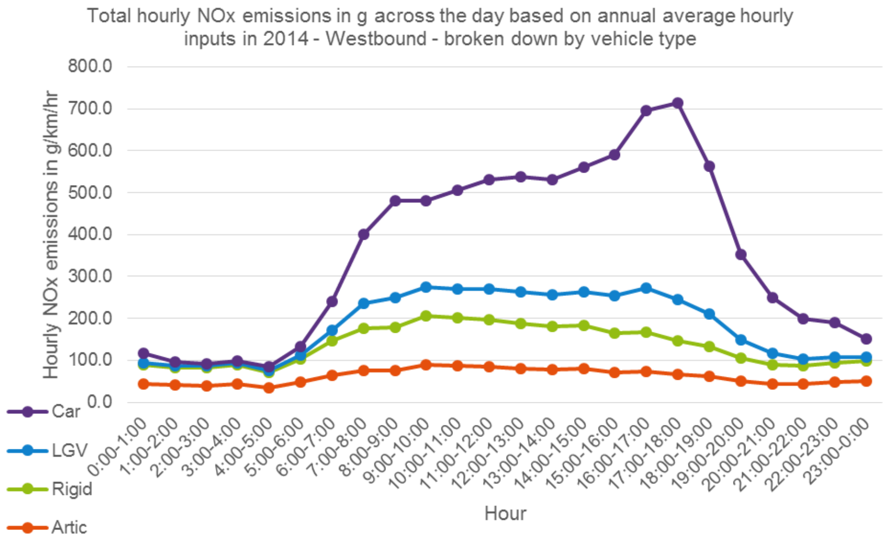
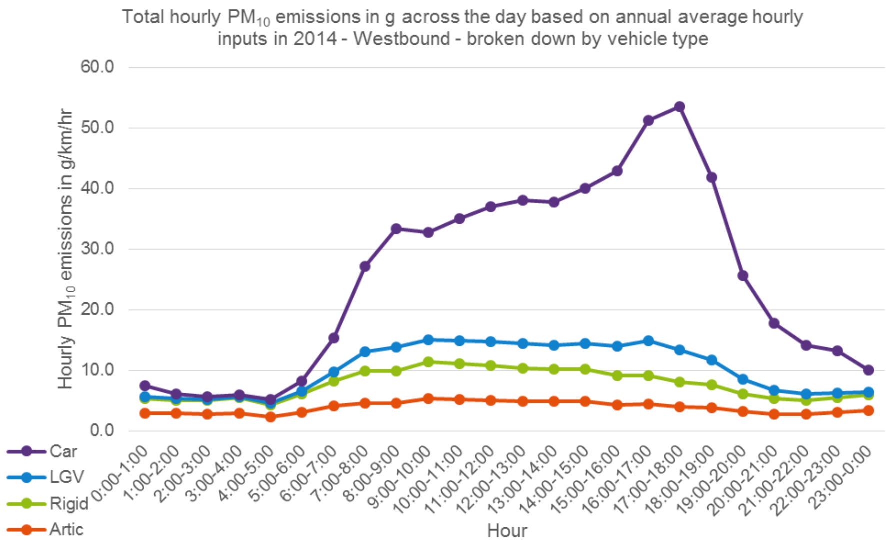


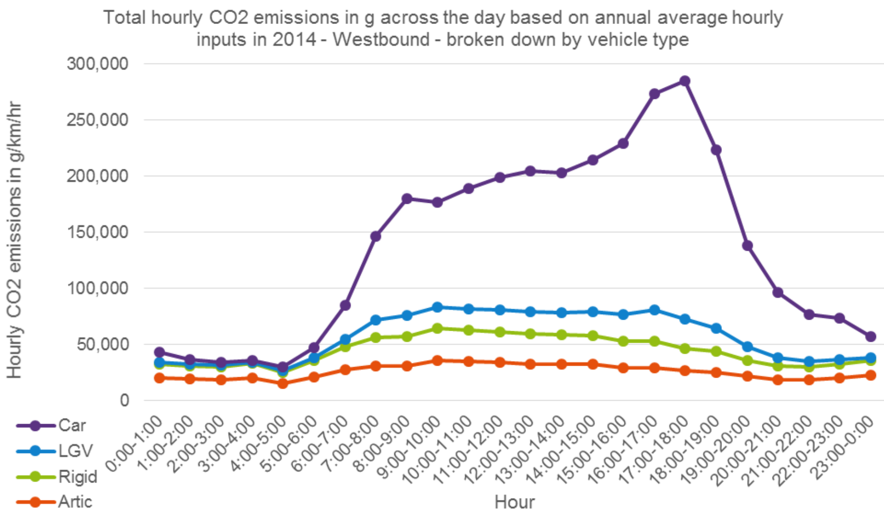
Figure D6: Site 862- Westbound NOx, PM10 and CO2 emissions charts

Hourly NOx emissions in 2014 and contribution per vehicle type | **Hourly PM10 emissions in 2014 and contribution per vehicle type** | **Hourly CO2 emissions in 2014 and contribution per vehicle**

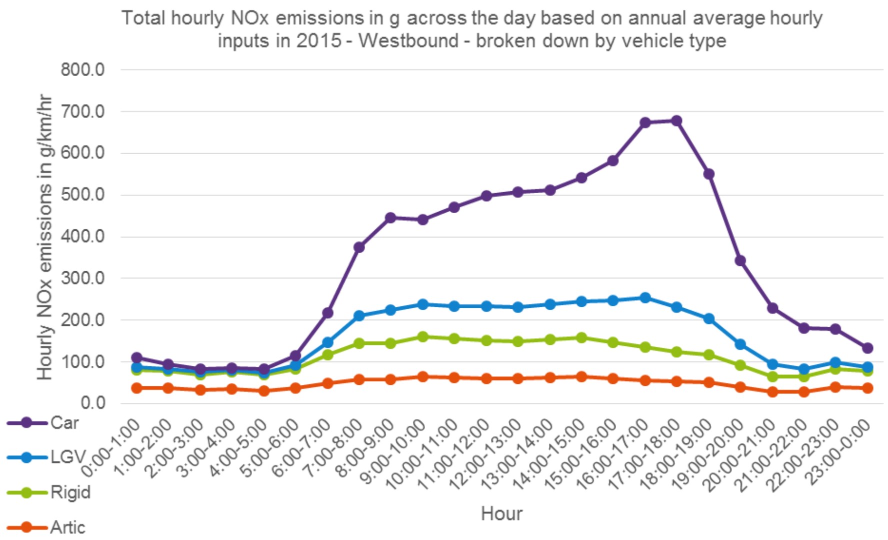
2014

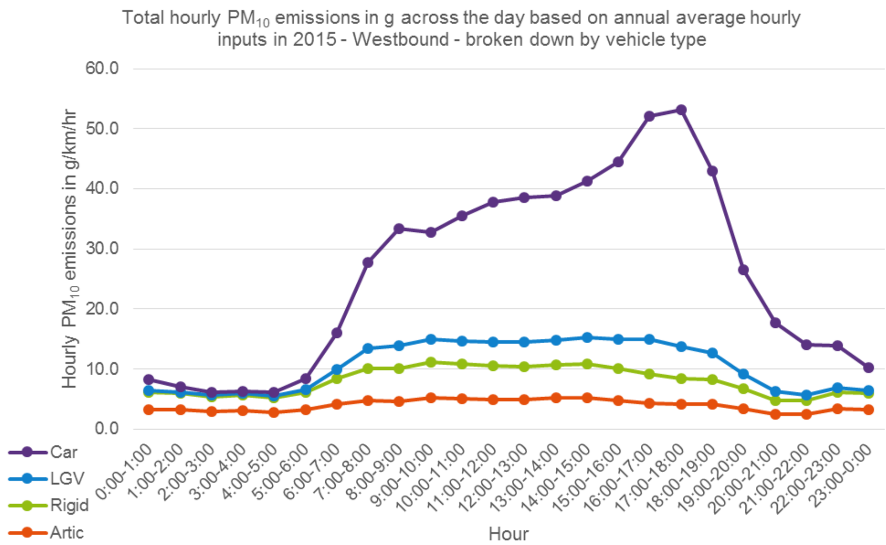


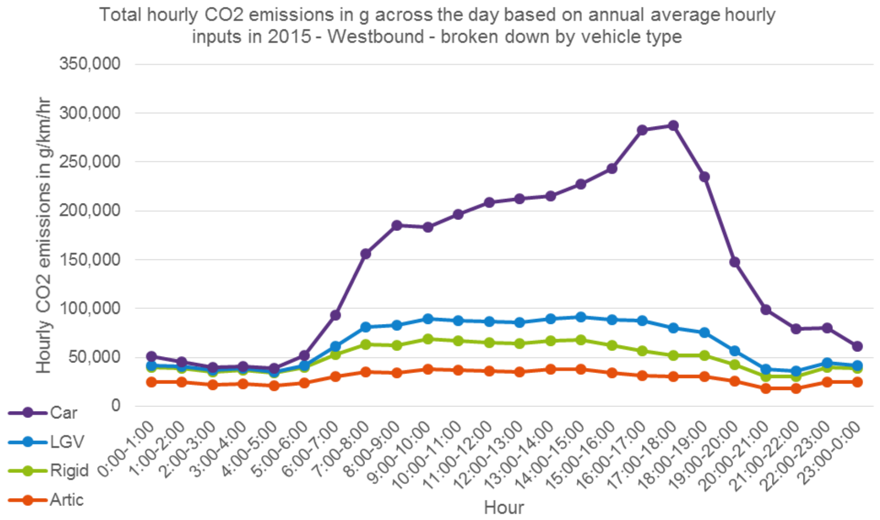




2015







The total emissions of NOx over a day (shown in the figures as the area under the line labelled as Car emissions) was calculated for 2014 and for 2015. The change in total NOx emissions is:

- **Eastbound (2015: 8.2 kg/day, 2014: 9.2 kg/day):** a decrease of 1 kg/day, an **11% reduction in NOx emissions.** There is an 11% reduction in Rigid and Articulated HGV NOx emissions in 2015 when compared with 2014. This is mainly as a result of the overall speed increase for all vehicles and a small reduction in HGV flow in 2015 and despite an increase in Car and LGV flow of 530 in per day.
- **Westbound (2015: 8.1 kg/day, 2014: 8.6 kg/day):** a decrease of 0.5 kg/day, a **5% reduction in emissions.** The reduction in Rigid and Articulated HGVs in 2015 amounted to 7% of the 2014 emissions, despite a 165 increase in flow, this results from the overall speed increase. Car and LGV emissions amounted to a 2% increase in 2015 compared with 2014, as although there was an overall speed increase in 2015, there was also an increase in AADT flow of 745.

The total emissions of PM_{10} over a day (shown in the figures as the area under the line labelled as Car emissions) was calculated for 2014 and for 2015. The change in total PM_{10} emissions is:

- **Eastbound (2015: 620 g/day, 2014: 640 g/day):** a decrease of 20 g/day, a **3% decrease in emissions.** This change results from a 3% reduction in emissions from HGV vehicles as a result of the overall speed increase in 2015 and a small decrease in flow and despite an increase in flow of Cars and LGV (+530 at AADT level).
- **Westbound (2015: 620 g/day, 2014: 605 g/day):** an increase of 15 g/day, a **2% increase in emissions.** This results from a 1% increase in HGV emissions and a 1% increase in Car and LGV emissions as a result of an increase in flow of 900 at an AADT level and an overall speed increase in 2015 (which resulted in reductions in emissions for Eastbound traffic).

The total emissions of CO_2 over a day (shown in the figures as the area under the line labelled as Car emissions) was calculated for 2014 and for 2015. The change in total CO_2 emissions is:

- **Eastbound (2015: 3,493 kg/day, 2014: 3,519 kg/day):** a decrease of 25.5 kg/day, a **1% decrease in emissions.** This is all attributed to a decrease in HGV emissions as a result of the overall speed increase in 2015 and a reduction in HGV flow. There was a corresponding increase in LGV and Car emissions because of an increase in their flow of 530 AADT,24hr when compared to 2014 traffic data.
- **Westbound (2015: 3,461 kg/day, 2014 3,283 kg/day):** an increase of 178 kg/day, a **5% increase in emissions.** 4% of the increase is attributed to an increase in HGV emissions resulting from an increase in flow of 165 vehicles over a day and an increase in speed in 2015. 1% of the increase is attributed to an increase in Car and LGV AADT of 745 and an overall speed increase in 2015, (reductions in emissions were observed for Eastbound traffic).

Summary of Change in Emissions

The rapid evidence review identified the following, as reported in the DfT impact assessment for speed limit changes on single carriageways published in 2014[1] "*The change in speed limit for HGVs >7.5t was estimated to result in an increase from the current average speed for all HGVs on single carriageways of 45mph to between 46 and 49mph. At the higher end of the speed increase (49mph) there was a subsequent reduction in NOx emissions resulting from HGVs travelling at slightly more efficient engine speeds, when compared with emission rates at 45mph. For PM_{10} emissions, although some vehicle types are operating more efficiently at increased speeds, other types are above their most efficient speed. This resulted in an overall increase in PM_{10} emissions. The model also indicated that faster HGV journeys result in small increases in HGV traffic which will have knock-on effects for other vehicles trying to occupy the same road capacity. There may be links where gradient or traffic conditions allow most heavy vehicles to travel at or above the raised 50mph HGV speed limit. The increase in speeds resulted in a modelled increase in fuel consumption and a subsequent increase in CO_2 emissions*."

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 above. The overall change in average annual daily speed with both carriageways combined was 1.5 kph or 0.9 mph. The NOx emissions were 8% lower in the 8-month period following the speed limit change when compared with emissions from 2014, comprising a 9% drop in HGV emissions and a 1% increase from Car and LGV sources, The PM_{10} emissions were 1% lower in 2015 when compared with 2014, comprising a 2% decrease in HGV emissions and a 1% increase in Car and LGV emissions. CO_2 emissions were 2 % higher, with a 1% increase in HGV emissions and a 1% increase in Car and LGV emissions.

The PM_{10} result just shows how minor adjustments in the speed affects different vehicles. Despite an increase of 1,400 vehicles, when compared to 2014 data, the majority of vehicles must be travelling at a more efficient engine rate to result in an overall decrease in emissions.

Change in Air Quality

The change in Air Quality is calculated at the receptor nearest to the road represented at the traffic count point, identified from the mapping. The emissions of NOx and PM_{10} in g/hr.km calculated in the change in emissions section above have been used to determine the contribution from traffic to pollutant concentrations at the nearest receptor. All locations are between 5 and 168m of the road centre line so the simple dispersion equation detailed in HA207/07 of DMRB has been used to give an illustration of the concentration at distance *d* from the road centre.

$$\text{traffic contribution in } \mu gm^3 \text{ per g/km.hr} =$$
$$0.17887 + 0.00024\, d - (0.295776/d) + (0.2596/d\ 2) - 0.0421 \ln(d)$$

The traffic contribution in $\mu g/m^3$ per g/km.hr is combined with emissions of NOx and PM_{10} from the combined carriageway averaged over a day, which results in the traffic contribution at the receptor. For PM_{10} concentrations the contribution from the road is then added to a background value of PM_{10} for the study area from Defra national mapping, to give the estimate of PM_{10} concentrations at the receptor. For NO_2 the road increment of NOx is combined with the background NO_2 concentration for the study area from Defra national mapping using the Defra NOx to NO_2 calculator tool (the latest v4.1 was used) to give the estimate of NO_2 concentrations at the receptor.

For Site 862, there is a receptor 10m from the A46 called Toll Bar House. It is located at a junction with a minor road but as the flow is likely to be very low and we are only

[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

interested in the contribution from the A46 emissions from this minor road are excluded. The table below shows the estimates of PM_{10} and NO_2 concentrations based on 2014 data and the 8-month period of data provided for 2015.

Table D1: Change in concentrations at nearest receptor with emissions calculated for 2015 when compared to 2014.

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

For the beta test site, the initial findings suggest that whilst the change in PM_{10} is negligible, the change in annual mean NO_2 is noticeable at 1.8ug/m^3, or 4.5% of the Air Quality Assessment Level. Note that this is the change attributable to total traffic changes between the before and after years, and not that just from changes in HGV characteristics.

Change in Monetised Impacts

The change in NOx and CO_2 emissions will be calculated for each link selected for analysis. The emissions calculated for 2014 will represent the without scheme scenario and the average for 2015-2017 will represent the with scheme scenario. The standard TAG valuation worksheets for Air Quality and Greenhouse Gases will be used to estimate the change in Net Present Value as a result of the HDV speed limit change. As this process is a DfT standard format calculation, and the emissions determined can be used in this approach without adjustment then this step has not been beta-tested.

Test Statistical Significance

With a maximum of five sites selected from the total sample at initial site selection (noting that this may be reduced at refined site selection stage), a test of statistical significance will not be possible due to the small number of data points.

Beta testing - Traffic Data Processing Issues

There are two different sources of traffic data for the five sites identified. The method of completing the traffic counts is different for traffic collected from DfT count points when compared to the HE count points, and so cross-comparison between all sampled sites will be different. The HE count points measure vehicle length and approximate this to the different categories of vehicles. The breakdown between Rigid and Articulated vehicles is calculated based on local factors. For HE traffic data there is also an underestimate of the proportion of cars when split into Cars and LGVs as longer cars (executive class) are binned into the LGV category. The DfT traffic data combines automatic count points with classified manual counts; the results provide a breakdown of vehicles > 7.5t and represent flows for Rigid and Articulated HGVs separately.

Appendix E Supporting Noise Analysis

Night time results by road type

Table E1: Category A

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	41.6	20.9	86.9	58.4	4.7	63.1
	2017-2018	50.3	20.1	86.4	59.2	4.6	63.8
	Comparison	**8.7**	**-0.7**	**-0.5**	**0.8**	**-0.1**	**0.7**
01:00-02:00	2013-2015	26.5	30.9	85.9	56.4	5.6	62.0
	2017-2018	32.7	29.0	86.0	57.3	5.5	62.8
	Comparison	**6.2**	**-1.8**	**0.0**	**0.9**	**-0.1**	**0.8**
02:00-03:00	2013-2015	24.9	36.8	85.6	56.2	6.1	62.3
	2017-2018	31.6	34.8	85.9	57.2	6.0	63.2
	Comparison	**6.6**	**-2.1**	**0.3**	**1.0**	**-0.1**	**0.9**
03:00-04:00	2013-2015	29.3	38.4	85.5	56.9	6.2	63.1
	2017-2018	38.8	36.7	85.4	58.1	6.1	64.2
	Comparison	**9.6**	**-1.6**	**-0.1**	**1.2**	**-0.1**	**1.1**
04:00-05:00	2013-2015	56.5	32.7	85.9	59.7	5.8	65.5
	2017-2018	75.5	32.1	85.9	61.0	5.7	66.7
	Comparison	**19.1**	**-0.6**	**0.0**	**1.3**	**-0.1**	**1.2**
05:00-06:00	2013-2015	164.0	19.1	85.8	64.3	4.4	68.7
	2017-2018	219.4	19.0	85.6	65.6	4.4	70.0
	Comparison	**55.4**	**0.0**	**-0.2**	**1.3**	**0.0**	**1.3**

Table E2: Category B

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	30.1	21.7	78.7	57.0	4.2	61.2
	2017-2018	31.0	24.9	79.7	57.1	4.6	61.7
	Comparison	**0.9**	**3.2**	**1.0**	**0.1**	**0.4**	**0.5**
01:00-02:00	2013-2015	20.9	34.3	78.2	55.4	5.4	60.8
	2017-2018	21.2	33.1	78.7	55.5	5.3	60.8
	Comparison	**0.3**	**-1.2**	**0.5**	**0.1**	**-0.1**	**0.0**
02:00-03:00	2013-2015	23.0	40.2	76.8	55.8	5.8	61.6
	2017-2018	22.8	39.9	77.2	55.8	5.8	61.6
	Comparison	**-0.2**	**-0.3**	**0.4**	**0.0**	**0.0**	**0.0**
03:00-04:00	2013-2015	22.9	39.9	76.7	55.8	5.8	61.6
	2017-2018	24.0	41.3	79.5	56.0	6.0	62.0
	Comparison	**1.1**	**1.4**	**2.7**	**0.2**	**0.2**	**0.4**
04:00-05:00	2013-2015	35.4	33.3	79.7	57.7	5.4	63.1
	2017-2018	43.3	25.7	80.9	58.6	4.8	63.4
	Comparison	**7.8**	**-7.6**	**1.2**	**0.9**	**-0.6**	**0.3**
05:00-06:00	2013-2015	108.7	14.0	80.8	62.6	3.3	65.9
	2017-2018	134.1	13.7	81.4	63.5	3.3	66.8
	Comparison	**25.5**	**-0.3**	**0.5**	**0.9**	**0.0**	**0.9**

Table E3: Category C

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	31.3	23.9	76.7	57.2	4.3	61.5
	2017-2018	33.5	23.6	76.6	57.4	4.2	61.6
	Comparison	**2.1**	**-0.3**	**-0.1**	**0.2**	**-0.1**	**0.1**
01:00-02:00	2013-2015	19.0	34.2	76.4	55.0	5.3	60.3
	2017-2018	21.3	35.1	76.4	55.5	5.3	60.8
	Comparison	**2.4**	**0.9**	**0.0**	**0.5**	**0.0**	**0.5**
02:00-03:00	2013-2015	15.6	40.3	78.2	54.1	5.9	60.0
	2017-2018	18.8	39.3	79.6	54.9	5.9	60.8
	Comparison	**3.2**	**-1.0**	**1.5**	**0.8**	**0.0**	**0.8**
03:00-04:00	2013-2015	18.6	39.7	77.1	54.9	5.8	60.7
	2017-2018	22.4	39.1	76.9	55.7	5.7	61.4
	Comparison	**3.8**	**-0.6**	**-0.2**	**0.8**	**-0.1**	**0.7**
04:00-05:00	2013-2015	37.3	34.4	75.4	57.9	5.2	63.1
	2017-2018	45.2	32.3	78.1	58.8	5.2	64.0
	Comparison	**7.9**	**-2.1**	**2.7**	**0.9**	**0.0**	**0.9**
05:00-06:00	2013-2015	126.6	25.1	77.6	63.2	4.5	67.7
	2017-2018	156.9	21.7	78.2	64.2	4.1	68.3
	Comparison	**30.3**	**-3.4**	**0.6**	**1.0**	**-0.4**	**0.6**

Table E4: Category D

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	186.7	21.8	104.2	64.9	6.0	70.9
	2017-2018	214.8	23.0	104.9	65.5	6.2	71.7
	Comparison	**28.1**	**1.2**	**0.8**	**0.6**	**0.2**	**0.8**
01:00-02:00	2013-2015	126.1	32.9	101.2	63.2	6.8	70.0
	2017-2018	154.8	33.8	102.4	64.1	7.0	71.1
	Comparison	**28.7**	**1.0**	**1.2**	**0.9**	**0.2**	**1.1**
02:00-03:00	2013-2015	109.7	42.2	99.0	62.6	7.4	70.0
	2017-2018	132.4	42.9	100.0	63.4	7.5	70.9
	Comparison	**22.7**	**0.6**	**1.0**	**0.8**	**0.1**	**0.9**
03:00-04:00	2013-2015	131.8	43.6	98.7	63.4	7.5	70.9
	2017-2018	164.2	43.5	99.8	64.4	7.5	71.9
	Comparison	**32.4**	**-0.1**	**1.0**	**1.0**	**0.0**	**1.0**
04:00-05:00	2013-2015	263.0	40.0	100.6	66.4	7.3	73.7
	2017-2018	346.7	36.2	101.7	67.6	7.1	74.7
	Comparison	**83.7**	**-3.8**	**1.1**	**1.2**	**-0.2**	**1.0**
05:00-06:00	2013-2015	667.6	27.2	105.1	70.4	6.6	77.0
	2017-2018	824.1	26.3	105.6	71.4	6.6	78.0
	Comparison	**156.5**	**-0.9**	**0.5**	**1.0**	**0.0**	**1.0**

Table E5: Category E

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	86.5	14.7	95.0	61.6	4.5	66.1
	2017-2018	86.6	16.8	94.2	61.6	4.7	66.3
	Comparison	**0.1**	**2.1**	**-0.8**	**0.0**	**0.2**	**0.2**
01:00-02:00	2013-2015	42.6	25.4	94.1	58.5	5.7	64.2
	2017-2018	46.9	24.1	93.9	58.9	5.5	64.4
	Comparison	**4.3**	**-1.2**	**-0.1**	**0.4**	**-0.2**	**0.2**
02:00-03:00	2013-2015	37.2	30.0	92.8	57.9	6.0	63.9
	2017-2018	41.0	29.9	93.0	58.3	6.0	64.3
	Comparison	**3.8**	**-0.1**	**0.2**	**0.4**	**0.0**	**0.4**
03:00-04:00	2013-2015	45.5	35.4	92.6	58.8	6.5	65.3
	2017-2018	48.9	28.7	93.6	59.1	6.0	65.1
	Comparison	**3.4**	**-6.7**	**1.1**	**0.3**	**-0.5**	**-0.2**
04:00-05:00	2013-2015	86.9	33.2	91.4	61.6	6.2	67.8
	2017-2018	98.2	28.4	92.5	62.1	5.8	67.9
	Comparison	**11.3**	**-4.8**	**1.1**	**0.5**	**-0.4**	**0.1**
05:00-06:00	2013-2015	251.8	20.5	90.4	66.2	4.9	71.1
	2017-2018	303.9	18.0	90.5	67.0	4.6	71.6
	Comparison	**52.1**	**-2.5**	**0.1**	**0.8**	**-0.3**	**0.5**

Table E6: Category F

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	21.5	13.1	85.8	55.5	3.6	59.1
	2017-2018	23.4	15.0	85.6	55.9	3.8	59.7
	Comparison	**1.9**	**1.9**	**-0.2**	**0.4**	**0.2**	**0.6**
01:00-02:00	2013-2015	12.9	23.1	83.7	53.3	4.7	58.0
	2017-2018	15.1	25.8	84.3	54.0	5.0	59.0
	Comparison	**2.2**	**2.7**	**0.6**	**0.7**	**0.3**	**1.0**
02:00-03:00	2013-2015	10.5	32.6	82.8	52.4	5.6	58.0
	2017-2018	12.3	33.6	83.9	53.1	5.7	58.8
	Comparison	**1.8**	**1.0**	**1.2**	**0.7**	**0.1**	**0.8**
03:00-04:00	2013-2015	13.7	32.8	82.6	53.6	5.6	59.2
	2017-2018	16.8	33.1	83.4	54.5	5.6	60.1
	Comparison	**3.1**	**0.3**	**0.9**	**0.9**	**0.0**	**0.9**
04:00-05:00	2013-2015	27.2	26.2	83.0	56.6	5.0	61.6
	2017-2018	32.6	29.1	83.8	57.3	5.3	62.6
	Comparison	**5.3**	**2.9**	**0.8**	**0.7**	**0.3**	**1.0**
05:00-06:00	2013-2015	80.7	16.3	83.6	61.3	3.9	65.2
	2017-2018	93.5	17.3	84.2	61.9	4.0	65.9
	Comparison	**12.8**	**1.0**	**0.6**	**0.6**	**0.1**	**0.7**

Table E7: Category G

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	179.8	25.0	100.5	64.7	6.1	70.8
	2017-2018	200.8	25.3	100.3	65.2	6.1	71.3
	Comparison	**21.0**	**0.3**	**-0.2**	**0.5**	**0.0**	**0.5**
01:00-02:00	2013-2015	125.3	34.2	98.2	63.2	6.7	69.9
	2017-2018	146.6	33.3	97.9	63.9	6.6	70.5
	Comparison	**21.3**	**-0.9**	**-0.4**	**0.7**	**-0.1**	**0.6**
02:00-03:00	2013-2015	110.8	42.1	96.8	62.6	7.2	69.8
	2017-2018	133.0	39.0	97.7	63.4	7.1	70.5
	Comparison	**22.3**	**-3.1**	**0.9**	**0.8**	**-0.1**	**0.7**
03:00-04:00	2013-2015	137.9	42.7	96.9	63.6	7.3	70.9
	2017-2018	167.8	40.0	98.1	64.4	7.2	71.6
	Comparison	**29.9**	**-2.7**	**1.2**	**0.8**	**-0.1**	**0.7**
04:00-05:00	2013-2015	269.9	37.9	98.9	66.5	7.1	73.6
	2017-2018	322.0	35.6	99.8	67.3	7.0	74.3
	Comparison	**52.2**	**-2.4**	**0.9**	**0.8**	**-0.1**	**0.7**
05:00-06:00	2013-2015	738.4	30.7	100.8	70.9	6.6	77.5
	2017-2018	894.0	28.5	101.3	71.7	6.5	78.2
	Comparison	**155.7**	**-2.2**	**0.5**	**0.8**	**-0.1**	**0.7**

Table E8: Category Z

Time	Date	Average Flow	Average % Heavy vehicles	Average Speed (kph)	Average Flow BNL (dB)	Average Flow Correction (dB)	Average Total Noise Level (dB)
00:00-01:00	2013-2015	182.5	23.2	109.8	64.8	6.6	71.4
	2017-2018	207.3	24.3	108.8	65.4	6.6	72.0
	Comparison	**24.7**	**1.1**	**-1.0**	**0.6**	**0.0**	**0.6**
01:00-02:00	2013-2015	127.8	32.7	106.7	63.3	7.2	70.5
	2017-2018	148.7	31.5	106.5	63.9	7.1	71.0
	Comparison	**20.9**	**-1.2**	**-0.1**	**0.6**	**-0.1**	**0.5**
02:00-03:00	2013-2015	122.9	37.3	104.9	63.1	7.4	70.5
	2017-2018	144.2	36.6	104.7	63.8	7.4	71.2
	Comparison	**21.2**	**-0.7**	**-0.2**	**0.7**	**0.0**	**0.7**
03:00-04:00	2013-2015	142.8	38.5	104.5	63.7	7.5	71.2
	2017-2018	176.4	37.0	104.7	64.7	7.4	72.1
	Comparison	**33.6**	**-1.5**	**0.2**	**1.0**	**-0.1**	**0.9**
04:00-05:00	2013-2015	233.5	37.3	105.2	65.9	7.4	73.3
	2017-2018	293.5	35.1	105.8	66.9	7.3	74.2
	Comparison	**60.1**	**-2.2**	**0.5**	**1.0**	**-0.1**	**0.9**
05:00-06:00	2013-2015	571.9	27.5	108.5	69.8	6.9	76.7
	2017-2018	750.5	25.9	108.9	71.0	6.7	77.7
	Comparison	**178.6**	**-1.6**	**0.4**	**1.2**	**-0.2**	**1.0**

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

This appendix provides the collision data used in our statistical models. It is derived from STATS19, and provided overleaf. The data is complex however, and so the following provides an overview of how these numbers are derived.

The Study Area

The figures are specifically for collisions on study area roads. Study area roads is defined as:

- In England and Wales, and
  - On Single Carriageways that have the speed limit 50mph or 60mph; OR
  - On Dual Carriageways that have the speed limit 60mph or 70mph]

Preventing double counting

Note that as the HGV Speed Limit Policy relates to vehicles over 7.5 tonnes, these are considered our primary focus. The numbers in the table below relate do the number of collisions in which specific vehicle types are involved by calendar quarter. However, it is acknowledged that it is possible for a collision to involve a combination of over 7.5 tonne, 3.5-7.5 tonne and unknown weight goods vehicles. With that, to avoid double counting of accidents and to maintain a focus on the over 7.5 tonne goods vehicles that this policy relates, the following rules are applied when deriving the figures overleaf:

- Over 7.5 Tonnes figures relates to all collisions involving an over 7.5 tonne vehicle, regardless of the other vehicles involved
- 3.5-7.5 Tonnes figures relates to all collisions involving 3.5-7.5 tonne vehicles, except for those that also include an over 7.5 tonne vehicle, as these are captured in the above.
- Unknown Weight figures relate to all collisions involving unknown weight goods vehicles, except for those which also include either an over 7.5 tonne or 3.5-7.5 tonne vehicle, as these are captured in the above.

Question	Year	UC	Average	Percent of all	Quarterly Totals	2005				2006				2007				2008				2009				2010				2011				2012				2013				2014				2015				2016				2017			
	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	1	2	3	4
		MAX HGV COLLISIONS	399	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	319	302	316	356	296	291	326	348	305	323	340	390	347	301	352	411	335	329	383	345	290	272	316	315
		BEST ESTIMATE HGV COLLISIONS				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	319	302	316	356	295	290	324	347	302	321	335	386	344	296	346	399	326	319	370	331	275	263	305	305
All HGV Collisions		All Collisions (3.5-7.5t)	108			126	138	178	158	136	135	146	173	176	136	160	159	147	113	114	112	73	108	97	106	92	67	106	87	76	78	80	91	78	77	93	88	77	73	93	91	96	76	100	90	79	89	78	82	71	54	77	74	70	41	48	55
		All Collisions (>7.5t)	395			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	227	217	248	258
		All Collisions (unknown weight)	4			0	0	0	0	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	0	6	6	9	7	14	11	21	21	17	22	29	62	46	61	65	68	63	55	68	57
		MAX HGV COLLISIONS	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	20	20	26	22	19	21	17	33	26	38	25	27	22	26	31	32	20	16	20	31
		BEST ESTIMATE HGV COLLISIONS				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	20	20	26	22	19	21	17	33	26	38	25	27	22	26	31	31	20	16	20	31
	Fatal	All Collisions (3.5-7.5t)				9	6	9	7	12	3	4	10	9	6	9	6	7	5	12	5	4	3	3	1	3	2	3	3	5	3	4	3	2	3	4	3	5	5	3	2	3	3	2	0	3	3	7	4	4	1	7	5	1	1	2	3
		All Collisions (>7.5t)				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	19	16	19	28
		All Collisions (unknown weight)				0	0	0	0	0	0	0	0	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	1	0	1	0	0	3	0	1	1	3	1	4	1	0	1	3
		MAX HGV COLLISIONS	371	93%		500	490	515	607	471	415	513	562	523	422	438	489	416	407	355	388	301	306	329	374	325	288	324	366	332	304	303	322	300	269	296	330	276	271	300	326	286	302	323	357	321	263	327	384	313	303	352	313	270	256	296	284
		BEST ESTIMATE HGV COLLISIONS				500	490	515	607	471	415	513	562	523	422	438	489	416	407	355	388	301	306	329	374	325	288	324	366	332	304	303	322	300	269	296	330	275	270	298	324	283	300	318	353	318	258	321	372	304	293	339	299	255	247	285	274
	Slight or Serious	All Collisions (3.5-7.5t)				117	132	169	151	124	132	142	163	167	130	151	153	140	108	102	107	69	105	94	105	89	65	103	84	71	75	76	88	76	74	89	85	72	68	90	89	93	73	98	90	76	86	71	78	67	53	70	69	69	40	46	52
		All Collisions (>7.5t)				500	490	515	607	471	415	513	562	523	422	438	489	416	407	355	388	301	306	329	374	325	288	324	366	332	304	303	322	299	268	294	330	271	265	291	319	273	291	303	336	304	244	298	323	268	245	288	249	208	201	229	230
		All Collisions (unknown weight)				0	0	0	0	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	0	5	6	9	7	13	11	20	21	17	19	29	61	45	58	64	64	62	55	67	54
Severity		**MAX HGV COLLISIONS**	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	53	64	75	75	57	68	68	73	56	46	71	90	72	69	70	75	66	65	73	70
		BEST ESTIMATE HGV COLLISIONS				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	53	63	75	75	56	67	67	72	56	46	69	88	71	67	68	73	64	62	71	67
	Serious	All Collisions (3.5-7.5t)				17	29	28	20	20	26	33	24	21	27	21	26	27	13	14	21	15	25	20	13	12	17	22	15	11	14	11	8	13	15	15	15	10	15	12	13	21	17	14	22	18	13	19	14	16	9	15	14	11	11	11	17
		All Collisions (>7.5t)				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	52	49	61	58
		All Collisions (unknown weight)				0	0	0	0	0	0	0	0	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	1	2	4	3	4	1	0	8	14	4	12	9	13	14	16	12	12
		MAX HGV COLLISIONS	296	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	243	217	233	262	223	207	225	251	229	234	255	284	265	217	256	294	241	234	282	238	204	191	223	214
		BEST ESTIMATE HGV COLLISIONS				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	243	217	233	262	222	206	223	250	226	233	251	281	262	212	252	284	233	225	271	226	191	185	214	207
	Slight	All Collisions (3.5-7.5t)				100	103	141	131	104	106	109	139	146	103	130	127	113	95	88	86	54	80	74	92	77	48	81	69	60	61	65	80	63	59	74	70	62	53	78	76	72	56	84	68	58	73	52	64	51	44	55	55	58	29	35	35
		All Collisions (>7.5t)				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	156	152	168	172
		All Collisions (unknown weight)				0	0	0	0	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	0	4	3	9	6	11	7	17	17	16	19	21	47	41	46	55	51	48	39	55	42
		MAX HGV COLLISIONS	31	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	33	21	15	29	34	28	22	26	22	16	18	35	28	20	26	15	19	21	26	18
		BEST ESTIMATE HGV COLLISIONS				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	33	21	15	29	34	28	22	26	22	16	18	34	28	19	25	15	18	21	25	17
	Single Vehicle	All Collisions (3.5-7.5t)				12	12	16	15	7	10	12	17	20	15	16	11	15	15	10	16	5	10	8	12	8	6	5	7	2	4	9	5	4	9	5	5	9	9	11	2	8	4	6	5	8	3	8	6	7	3	4	3	5	1	4	7
		All Collisions (>7.5t)				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	15	17	18	15
Number of Vehicles		All Collisions (unknown weight)				0	0	0	0	0	0	0	0	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	2	1	1	0	1	1	1	4	2	4	4	2	4	4	8	3
		MAX HGV COLLISIONS	369	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	289	275	301	328	263	270	311	319	273	298	319	364	326	285	334	377	309	315	364	335	276	261	296	304
		BEST ESTIMATE HGV COLLISIONS				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	289	275	301	328	262	269	309	317	269	295	314	359	322	279	328	365	299	303	350	318	260	250	285	293
	Multiple Vehicle	All Collisions (3.5-7.5t)				114	126	162	143	129	125	134	156	156	121	144	148	132	98	104	96	68	98	89	94	84	61	101	80	74	74	71	86	74	68	88	83	68	64	82	89	88	72	94	85	71	86	70	76	64	51	73	71	65	40	44	48
		All Collisions (>7.5t)				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	212	200	230	243
		All Collisions (unknown weight)				0	0	0	0	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	0	5	6	9	7	12	10	20	21	16	21	28	58	44	57	61	66	59	51	60	54

Appendix G: 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:

- At the 95% confidence level there is no evidence of a statistically significant change in the number of collisions. This is true across all study roads and when disaggregated to single or dual carriageways.
- Despite there being an issue with an increasing number of unknown weight goods vehicles in recent years, the sensitivity tests show that this does not influence the findings.
- On single carriageway roads the intervention parameter suggests a small increase in the number of collisions, however the p-value is 0.364 which is not significant.
- On dual carriageways, there is some indication of a reduction in HGV collisions ($p = 0.085$). The combined impact with single carriageways results in an intervention parameter estimate of -10.4% across all study roads ($p = 0.153$).

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.

As with the main section of this report, where appropriate given the dataset, additional sensitivity tests will be conducted to determine whether the number of HGVs of unknown weight is influencing the findings. Full details of how the dataset is determined for each of the sensitivity tests can be found in section 6.3.

A summary of all the analysis conducted along with the values for the intervention parameter for those found to be significant is presented in Table G5. This section also contains a precise definition of which collisions are being counted for each level of disaggregation.

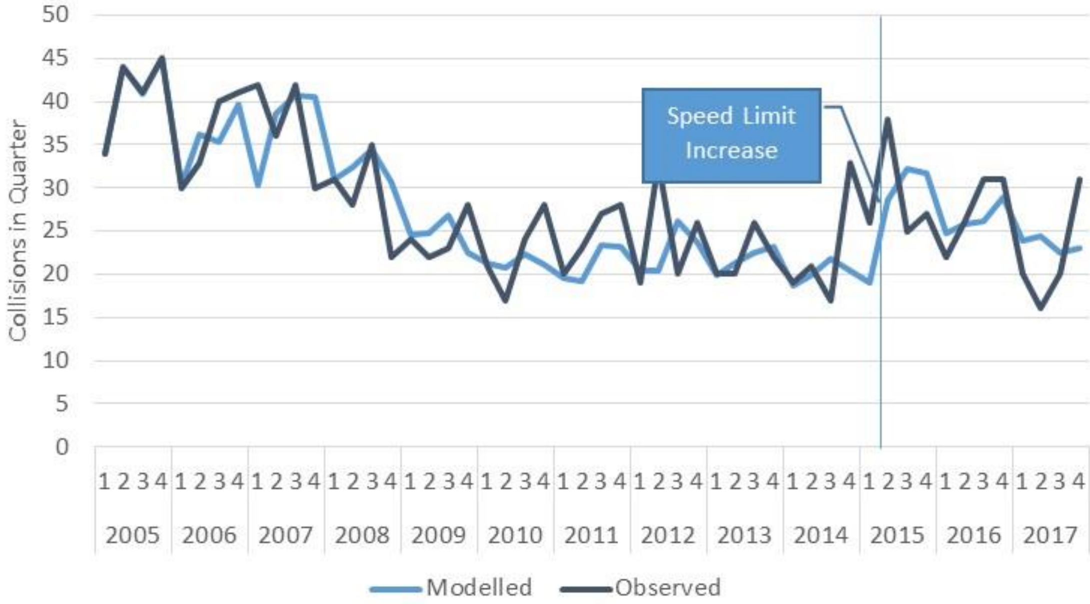
Collision Severity

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 in reporting 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 a possible 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 G1 shows the quarterly fatal collisions involving HGVs on study roads, whilst Figure G2 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 G1: Fatal collisions involving at least one HGV, on study roads, per quarter – Core Scenario



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

Figure G2: Serious/slight collisions involving at least one HGV, on study roads, per quarter – Core Scenario

**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 Table G1.

Table G1: Model Outputs – HGV collisions: by severity

Scenario	Intervention Parameter	Low Confidence Interval	High Confidence Interval	p-value	Statistically Significant?
Fatal					
Min	17.6%	-15.0%	62.7%	0.327	✕
Core	29.4%	-3.5%	73.5%	0.085	✕
Max	29.5%	-3.5%	73.9%	0.085	✕
Serious/Slight					
Min	-10.5%	-23.8%	5.0%	0.173	✕
Core	-15.7%	-27.9%	-1.3%	0.033	✓
Max	-14.5%	-26.9%	-0.0%	0.050	✓

The table shows that for fatal collisions there has been no significant change in the number of accidents since the policy introduction (p = 0.085). The impacts assessment estimated an increase of 2-3 fatal collisions per annum on single carriageways, which given the number of yearly collisions would correspond to an intervention parameter of approximately 3% over both single and dual carriageways, such a small change would be extremely difficult to measure accurately, especially given the sample sizes available.

The p-value indicates that though the result is not significant at the 95% confidence level it is not far from being significant and that would be tending towards an increase in fatal collisions, which supports the conclusions of the impacts assessment. The confidence interval is very wide though, so it is not possible to give an indication for the size of increase with much certainty.

For serious and slights, the finding is significant with the intervention parameter estimated to be a reduction of 15.7% for the core scenario (p = 0.033). It is noted that though the finding is also significant for the Maximum scenario (p = 0.050) it is not significant in the Minimum scenario (p = 0.173). It is therefore concluded that the finding is sensitive to the treatment of HGVs of unknown weight, but the weight of evidence points to a reduction in slight and serious collisions.

The impact assessment predicted an increase of 4-9 serious collisions on single carriageways per annum and made no estimates for the change in slights. Due to the reclassification of severity, the reporting of combined slights and serious collisions means that though a pre-post comparison is possible, it isn’t possible to determine whether the decrease in serious/slight collisions is due to a reduction in one, the other or a combination of the two. Though serious and slights have been considered together, the statistically significant reduction in the combined dataset indicates that there is little reason to be concerned that the policy has negatively impacted either serious or slight collisions. Data presented here is for both single and dual carriageways combined whereas the forecasted increase was for single carriageways only.

Type of Collisions on Study Roads

The STATS19 collision data contains a number of fields which record a number of details relating to 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 heavy goods 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. For completeness, sensitivity tests were undertaken for these factors, however given the low likelihood of a significant finding only the core results are presented here for simplicity.

All the quarterly collision data used in this section is provided in Appendix A for transparency.

Overtaking Collisions

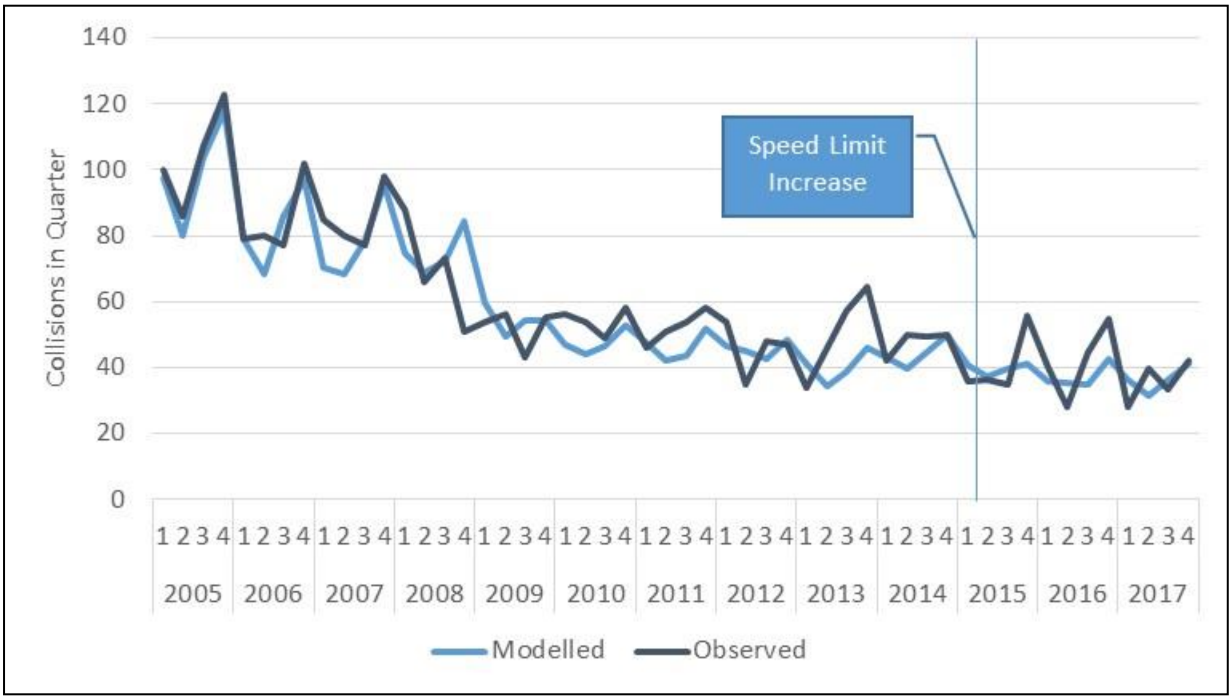
It is realistic to assume that overtaking could be affected by the HGV speed limit increase. The theory of change tells us that this impact could relate to two counteracting effects occurring:

- HGVs are travelling faster, and therefore the need to overtake is reduced and thus collisions relating to overtaking might reduce, which though not specified originally in the logic map, may be true on both single and dual carriageway roads; 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 G3 shows HGV collision data on study roads related to overtaking.

More explicitly, the data shown in the graph is the number of collisions per quarter that involve at least one HGV and at least one of the vehicles involved in the collision was overtaking. Note this definition allows for either the HGV or a non-HGV to be the vehicle doing the overtaking, as long as an HGV is involved in the collision.

Figure G3: 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 21.1% decrease to a 31.9% increase, therefore there is insufficient data to suggest that there has been a change in the number of collisions and we must accept the null hypothesis of no change. The impact assessment considered that there would be two opposing impacts on overtaking collisions. They could get worse due to the higher speed nature of overtaking events or improve due to the reduced necessity to overtake. No conclusion may be drawn about the magnitude of each of these effects, only that the residual is not significant.

Table G2: Model Outputs – HGV collisions: overtaking movement

Intervention Parameter	Low Confidence Interval	High Confidence Interval	p-value	Statistically Significant?
2.0%	-21.1%	31.9%	0.880	×

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 model 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 14.5% with the low confidence level stating a 29.8% reduction and the high a 4.2% increase. This result is not significant.

- Shunt impact collisions may have reduced slightly (intervention parameter estimated as a 1.7% reduction), but the results are not significant, and the confidence interval is wide.

- Given the wide confidence interval observed for both side impacts and shunts, no robust conclusions may be drawn from the data.

Table G3: Model Outputs – HGV collisions: shunt or side impacts

Point of Impact	Intervention Parameter	Low Confidence Interval	High Confidence Interval	p-value	Statistically Significant?
Sides (near or offside)	-14.5%	-29.8%	4.2%	0.121	×
Shunt (front or rear)	-1.7%	-21.5%	23.1%	0.881	×

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 collision (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.

- 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. The decreased speed differential between HGVs and other vehicles was identified in the logic map as a potential cause of a reduction in collisions. It is logical that this reduced differential would impact collisions involving multiple vehicles and may be behind the apparent reduction.

Table G4: Model Outputs – HGV collisions: number of vehicles involved

Number of Vehicles	Intervention Parameter	Low Confidence Interval	High Confidence Interval	p-value	Statistically Significant?
One HGV only	-3.0%	-34.2%	42.9%	0.876	×
Two or more vehicles (Inc. one or more HGV)	-11.3%	-23.1%	2.2%	0.098	×

The impact assessment references previous research that shows that increasing speeds relates to less time to react and therefore worsening safety outcomes. This was considered relevant for single carriageway roads only as the speed of HGVs was expected to change, which it was not on dual carriageways.

HGV collisions involving only a sole vehicle are the type most likely to be impacted if an increase in average speeds is observed. Despite the increase in speed along both single and dual carriageways reported by this study since the policy introduction no significant change in sole HGV collisions has occurred.

Summary of all Safety related analysis

Table below illustrates all of the analysis conducted and, where the results was found to be significant the intervention parameter is presented.

Table G5: Summary of ARIMA Analysis

Total Collisions			
	All	**Single**	**Dual**
Min	×	×	×
Core	×	×	×
Max	×	×	×
Fatal			
Min	×	×	×
Core	×	×	×
Max	×	×	×
Slight or serious			
Min	×	×	×
Core	-15.7%	×	×
Max	-14.5%	×	×
Single vehicle			
Min	×	×	×
Core	×	×	×
Max	×	×	×
Multiple vehicle			
Min	×	×	×
Core	×	×	×
Max	×	×	×
Point of impact - side			
Min	×		
Core	×		
Max	×		
Point of impact – front or rear			
Min	×		
Core	×		
Max	×		
Manoeuvre - overtaking			
Min	×		
Core	×		
Max	×		

Glossary

While conducting the analysis it became clear that given the nature of relational databases it is necessary to be explicit in what is being counted. For transparency a glossary of terms is provided below for each of the factors for which analysis was conducted.

- Fatal collisions: The number of collisions involving one or more HGVs, classified as fatal in the severity field of the accident table.
- Slight or serious collisions: The number of collisions involving one or more HGVs, classified as either serious or slight in the severity field of the accident table. Though each collision may have multiple associated vehicles, only one severity value is attributed to each collision
- Single vehicle collisions: The number of collisions involving one HGV only. That is the total number of vehicles involved in the collision is one.
- Multiple vehicle collisions: The number of collisions involving one or more HGVs and in which the total number of vehicles involved is more than one.
- Point of impact collisions – side: The number of collisions involving one or more HGVs in which at least one of the HGVs involved had its first point of impact as the side.
- Point of impact collisions – front or rear: The number of collisions involving one or more HGVs in which at least one of the HGVs involved had its first point of impact as either front or rear.
- Manoeuvre – overtaking collisions: The number of collisions involving one or more HGVs and in which at least one of the vehicles involved in the collision was overtaking. Note that the vehicle overtaking may or may not have been an HGV.

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