Appendix B

Economic assessment of options for the ensuring compliance with heavy vehicle roadworthiness standards

REPORT PREPARED FOR THE NATIONAL TRANSPORT COMMISSION

February 2016

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Tables

Executive summary

The Heavy Vehicle National Law (HVNL) commenced in all jurisdictions (except Northern Territory and Western Australia) in February 2014.

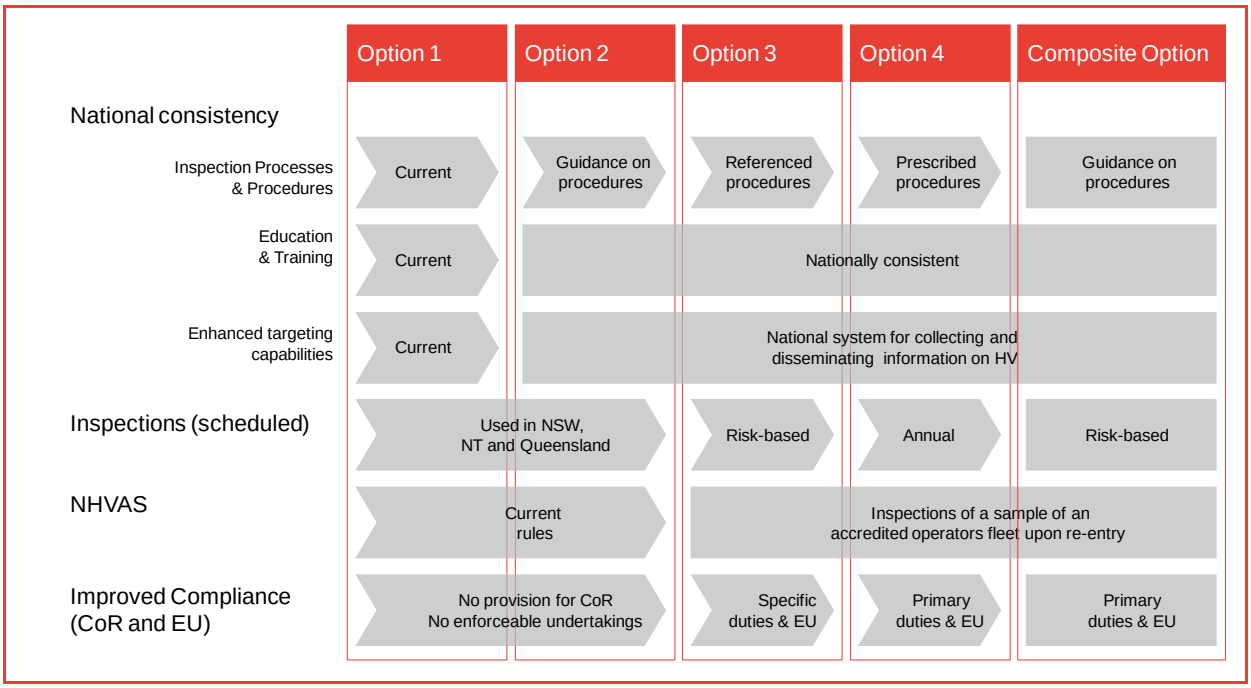
A key objective of the HVNL is to ensure that heavy vehicles operating on Australian roads are roadworthy. Under the HVNL jurisdictions have been able to apply different approaches to the compliance and enforcement of vehicle roadworthiness standards. Hence, the issue of how best to regulate heavy vehicle roadworthiness remains unresolved.

This report presents a cost-benefit analysis of a range of options that have been proposed for regulating compliance with heavy vehicle roadworthiness standards under the HVNL.

The options under consideration are as follows:

- Option 1 — No change to these baseline arrangements, namely the existing state-based variations in roadworthiness compliance and enforcement approaches. This represents the counterfactual against which other options are assessed.
- Option 2 — Voluntary remedies which are largely informational and do not require legislative change (to either the HVNL or state-based legislation).
- Option 3 — Regulatory revisions that enable a risk management approach to compliance and enforcement.
- Option 4 — Prescriptive regulatory revisions to compliance and enforcement.
- Composite Option — As a result of feedback to the Consultation RIS and further consideration, the NTC arrived at an option combining a suite of measures from Options 2, 3 and 4. The cost-benefit analysis assesses the merits of the NTC's preferred option relative to the other four options. The Composite Option consists of:
  - The revision of the National Heavy Vehicle Inspection Manual (NHVIM) and provision of associated guidelines for guidance only (from Option 2), rather than being referenced or prescribed in the HVNL.
  - Development of a risk-based approach to scheduled inspections (from Option 3).
  - Strengthened compliance measures of a primary duty (from Option 4) and enforceable undertakings (from Options 3 and 4).
  - Changes to the National Heavy Vehicle Accreditation Scheme (NHVAS) Business Rules to allow for inspection of heavy vehicles before renewal of accreditation.

Summary of key measures included in each option



Approach

The main categories of regulatory impact which determine the outcome of the cost-benefit analysis are:

- The impacts of the different policy options on risks associated with defect-related crashes and incidents.
- Operators' administrative compliance costs including the opportunity costs of revenue foregone while vehicles are off the road during inspections or audits.
- Operators' costs of maintaining compliant vehicles and correcting defects.
- Regulators' administrative costs.
- Cost savings and efficiencies associated with national consistency.

The paucity of data has limited the quantification of the net present value of all the costs and benefits associated with the options. The analysis therefore draws on available information and data to establish a relative ranking of the options.

In particular, it is difficult to establish whether differences between the options will lead to differences in risks associated with defect-related crashes and incidents, *relative to the baseline*, for several reasons:

- First, it is difficult to establish a causal link between defects and heavy vehicle crashes, in isolation from other safety and non-safety factors. By extension, establishing a causal connection between changes in practices (that result

from changes in the methods used to assess compliance) to changes in risk is even more difficult.

- Second, there is limited evidence on the extent to which differences in the form of enforcement (specifically, between accreditation and inspection approaches), have an impact on defect-related risks.

For these reasons, the analysis primarily focuses on the costs associated with the implementation of the options. The resulting cost difference was then used to determine the reduction in crashes that would need to have been achieved in order to make each option of net benefit. We then considered whether the resulting differences in benefits between the options were likely on the basis of prima facie arguments.

Findings

Each year heavy vehicles are involved in nearly 200 crashes resulting in fatalities 1500 resulting in hospitalisation, 11000 resulting in less serious injuries, and 32000 causing property damage. It was estimated that 4–17% of these road crashes can be attributed to heavy vehicle unroadworthiness. This range is based on whether the defect was the primary cause of the crash (lower bound) or a contributing cause (upper bound).

Based on this, it was estimated that the total cost of heavy vehicle crashes has a NPV in the order of $14.2 billion over the 10 year duration of the economic analysis. Of this total cost, $0.57–2.4 billion can be attributed to road crashes due to heavy vehicle unroadworthiness. In addition, heavy vehicle breakdowns have been estimated to impose costs with a NPV in the order of $1.7 billion on other road users as a result of congestion. This means the annual cost of heavy vehicle road crashes and breakdowns attributed to unroadworthiness is likely to lie between $2.3–4.2 billion.

In respect to policy changes, what is important is the extent to which the roadworthiness-related crash risk changes as a consequence of changes in the approach to roadworthiness enforcement and compliance.

The analysis found that Option 2 is a relatively low-cost option and is likely to generate sufficient benefits to outweigh these costs. This suggests that net benefits would result from moving from the baseline to adopt Option 2.

Option 4 was found to lead to the greatest improvement in roadworthiness and hence greatest reduction in road crashes attributed to heavy vehicle unroadworthiness. However, the high cost of implementing this option (an NPV in the order of $5.5 billion) suggests that it is not cost-effective.

The analysis of Option 3 found that the expected net benefits are highly dependent on how the option is implemented — specifically the risk-based application of inspections:

- Implementation could be such that there is a decrease in the overall number of inspections across Australia relative to the current arrangements. For example, if only dangerous goods vehicles or those over 20 years of age were inspected, there would be a significant decrease in the number of inspections conducted in NSW, Queensland and the NT (where scheduled inspections occur annually) and only a slight increase in the other jurisdictions (where annual scheduled inspections are not required for all heavy vehicles). Under this approach this option would deliver significant cost savings.
- Alternatively Option 3 could be implemented with a nationally uniform risk-based criterion which meant the total number of inspections across Australia was broadly unchanged, but, inspection resources retargeted across jurisdictions. For example, if only vehicle over 15 years of age were inspected, there would be a decrease in the number of inspections conducted in NSW, Queensland and the NT and a broadly offsetting increase in inspections in the other jurisdictions. Under this approach, Option 3 would be expected to deliver a higher level of compliance when compared to Option 2, with potentially limited additional costs.
- If there is only a moderate increase in the overall number of inspections (for example, scheduled inspection are introduced for dangerous goods vehicles and those over 20 years of age in jurisdiction that do not already employ annual inspections for all vehicles), the moderate additional implementation costs may be outweighed by the benefits of reduced crashes and breakdowns and therefore be preferable to the baseline (Option 1).
- If Option 3 is implemented with extensive increases to the number of scheduled inspections, then the cost-benefit analysis becomes closer to the analysis of Option 4 where the significant implementation costs could not be justified by sufficiently large benefits.
- Broadly speaking, the expected net benefits increase for increased targeting (of a given number of inspections) and expected net benefits decrease for increased inspections (at a given degree of targeting).

Similarly, the expected net benefit of the Composite Option is highly dependent on how the option is implemented — specifically the risk-based application of inspections. The judgement of the NTC, based on stakeholder feedback, is that the benefits of the Composite Option are greater than the benefits of an equivalently implemented Option 3. This is because the guidance approach to national consistency and the primary chain of responsibility duty in the Composite Option are expected to better integrate with industry and service providers to manage roadworthiness.

The Composite Option is identified as the option that could lead to the greatest net benefit, depending on the precise approach to its implementation (i.e. it is preferable to Options 1, 2, 3 and 4). It should be noted that an implementation

of the Composite Option that involves significant additional cost (such as through significantly increased inspection effort) would be less preferable than either Option 1 or Option 2.

1 Introduction

1.1 Background and context

The Heavy Vehicle National Law (HVNL) commenced in all jurisdictions (except Northern Territory and Western Australia) in February 2014. The National Heavy Vehicle Regulator (NHVR) administers the HVNL.

The object of the HVNL is to establish a national scheme for facilitating and regulating the use of heavy vehicles on roads in a way that, amongst other things, promotes public safety and encourages safe business practices. [1]

One important aspect of promoting public safety is ensuring that heavy vehicles operating on Australian roads are roadworthy. Under the HVNL jurisdictions have been able to apply different approaches to the compliance and enforcement of vehicle roadworthiness standards (i.e. annual scheduled inspections are used in some States but not others). Hence, the issue of how best to regulate heavy vehicle roadworthiness remains unresolved.

1.2 Objectives of this report

This report presents an economic assessment, in the form of a cost-benefit analysis, of a number of options that have been proposed for regulating compliance with heavy vehicle roadworthiness standards under the HVNL.

The baseline scenario (Option 1) largely assumes the continuation of the status quo —namely the existing state-based variations in roadworthiness compliance and enforcement approaches.

The options under consideration are as follows:

- Option 1 — No change to these baseline arrangements. This is the counterfactual, against which other options are assessed.
- Option 2 — Voluntary remedies which are largely informational and do not require legislative change (to either the HVNL or state-based legislation).
- Option 3 — Regulatory revisions that enable a risk management approach to compliance and enforcement
- Option 4 — Prescriptive regulatory revisions to compliance and enforcement.
- Composite Option — As a result of feedback to the Consultation RIS and further consideration, the NTC arrived at its Composite Option which

[1] See HVNL section 3.

consists of:

- The revision of the National Heavy Vehicle Inspection Manual (NHVIM) and provision of associated guidelines for guidance only (from Option 2), rather than being referenced or prescribed in the HVNL.
- Development of a risk-based approach to scheduled inspections (from Option 3).
- Strengthened compliance measures of a primary duty (from Option 4) and enforceable undertakings (from Options 3 and 4).
- Changes to the NHVAS Business Rules to allow for inspection of heavy vehicles before renewal of accreditation.

The counterfactual baseline and the other options are explained in greater detail in section 3 of this report.

1.3 Approach

The approach taken in this report is consistent with the requirements set out in the Australian Government Guide to Regulation, and more specifically the OBPR's guidance note for cost-benefit analysis.[2]

Under these requirements, a necessary starting point for the cost-benefit analysis is to identify the underlying problem that the proposed options seek to address, and the constraints that affect their implementation.

In this case even in the absence of *any* regulation, operators would, to some extent, seek to manage vehicle defect-related safety risks, as they will bear some of the costs of defect-related crashes. Further, other general arrangements such as liability laws and insurance obligations may cause operators to take into account the wider social costs of defect-related crash risks.

A key issue is the extent to which operators mitigate these risks in a way which reflects the full costs to society of defect-related crashes. To the extent that operators do not efficiently manage these risks, defect-related crashes will impose excessive costs on society. These additional costs represent a market failure, which may provide scope for regulatory intervention, provided the costs of regulation do not outweigh the benefits.

Risk mitigation is never costless: operators will incur costs implementing maintenance-management measures, and costs will also be incurred by regulatory and enforcement authorities. This is why the costs of any proposed regulatory

[2] Office of Best Practice Regulation (2014) *Cost-benefit analysis Guidance Note* , July 2014 & https://www.cuttingredtape.gov.au/sites/default/files/documents/australian_government_guide_regulation.pdf

option need to be weighed against the potential benefits. We consider in greater detail the issue of market failure and the extent to which specific regulation relating to roadworthiness compliance can play a mitigating role in section 2.1 of this report.

In the context of this analysis, it is important to emphasise that what we seek to measure is not the impact of the options versus no regulation at all but rather the incremental costs and benefits of the options relative to a baseline counterfactual. In this case, the counterfactual is Option 1, in which regulation exists which requires operators to maintain roadworthy vehicles or face penalties (in addition to other arrangements, such as liability laws and insurance arrangements).

A challenge for this assessment is that it is difficult to establish whether differences between the options will lead to differences in risks associated with defect-related crashes and incidents, *relative to the baseline*, for several reasons.

First, it is difficult to establish a causal link between defects and heavy vehicle crashes, in isolation from other safety and non-safety factors. By extension, establishing a causal connection between changes in practices (that result from changes in the methods used to assess compliance) and changes in risk is even more difficult.

Second, there is limited evidence on the extent to which differences in the form of enforcement (specifically, between accreditation and inspection approaches) impact on defect-related risks.

For these reasons, the analysis primarily focuses on the costs associated with the implementation of the options. The resulting cost difference was then used to determine the reduction in crashes that would need to have been achieved to make each option of net benefit. We then considered whether the resulting differences in benefits between the options were likely on the basis of prima facie arguments.

While some data relevant to the cost-benefit analysis was sourced from stakeholders (operators, NHVR and jurisdictions), data relating to the wider economic benefits that reflect the possible reduction of certain externalities (for example, crash risk and reduced costs of road pollution) were drawn from external sources.

1.4 Structure of this report

This report is structured as follows:

- Section 2 provides an overview of the issues to be considered and the economic concepts underlying the assessment.
- Section 3 describes the options assessed and the baseline against which the impacts have been derived.

- Section 4 explains the main types of cost and benefits that have been considered.
- Section 5 provides an explanation of how the costs and benefits highlighted in section 4 relate to each of the options under consideration. It identifies the preferred option relative to the baseline.

2 Regulation and the management of defect related risks

In this section we provide an overview of the issues and economic concepts underlying the regulation and management of defect-related safety risks and their relevance to this assessment.

2.1 Costs associated with a lack of roadworthiness

A lack of roadworthiness has been identified as a contributing factor in heavy vehicle crashes and incidents, though it is difficult to quantify the extent of this causation.

International studies have estimated that between 1-5% of fatal crashes involve a defective heavy vehicle[3]. Human factors more generally tend to be the primary cause of crashes. However, it is likely that defects are a contributing factor in a certain proportion of these by preventing the vehicles' defensive mechanisms from mitigating the likelihood or consequence of a crash.[4]

On average over the last five years 17% of all fatal road crashes have involved heavy vehicles[5], despite only 2.8% of all vehicles being heavy vehicles.[6] Each year heavy vehicles are involved in nearly 200 crashes resulting in fatalities, 1500 resulting in hospitalisation, 11 000 resulting in less serious injuries, and 32 000 causing property damage. The costs involved in individual crashes can be large. Data suggests that the NPV cost of crashes involving heavy vehicles in Australia may be close to $14.2 billion over the next 10 years (in 2014 dollars). Of this total cost, $0.57–2.4 billion can be attributed to road crashes due to heavy vehicle unroadworthiness. The calculation methodology is set out in detail in section 4.5.1. It is also noteworthy that the majority of the fatalities and the hospitalisations involve people other than the occupants of the heavy vehicle. This highlights the fact that crash-related costs extend well beyond those that accrue to the operator. [7]

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3 See discussion in section 0.0.0.

4 There is statistical evidence to support this with data from the US suggesting brake defects increase the odds of a truck being the striking vehicle by 1.8 times for rear end and crosspath crashes. D. Blower & P. Green (2009) *Truck Mechanical Condition and Crashes in the Large Truck Crash Causation Study*, The University of Michigan Transportation Research Institute March 31, 2009

5 Australian Road Death database, www.bitre.gov.au/statistics/safety/fatal_road_crash_database.aspx (accessed 25/09/2014).

6 ABS 2012 Survey of Motor Vehicle Use.

7 For example, BITRE (2014) identifies 55% of hospitalisation in 2008-09 from heavy vehicle accidents were people other than the occupants of the heavy vehicle, 80–84% of fatalities in the years 2010–2012 from heavy vehicle crashes were people other than the occupants of the heavy

The costs that result from crashes are, broadly:

- Costs to drivers and other road users involved in a crash and their families associated with death or rehabilitation and care.
- Cost to operators associated with any losses of capital stock; lost man hours or lost productivity.
- Indirect costs on operators associated with lost customer confidence in the reliability of their service and hence reduced volume and revenues.
- Cost on other road users associated with traffic consequences of a heavy vehicle crash and any resulting delays.
- Cost for society more broadly from environmental or road infrastructure damage and repair and the use of emergency and health care services.
- Cost for society more broadly from the lost productive capacity of deceased or injured members of the public.

An unroadworthy vehicle is also more likely to breakdown. On road breakdowns impose costs on other road users associated any resulting delays.

Some of the costs described above are borne directly by the operator, and some are borne by other parties. Operators certainly face private exposure costs that stem from crashes and incidents. However, in managing the crash risks, they may not take into account (that is, "internalise") the broader costs that are borne by society as a whole that arise from these risks. By extension, operators may not take into account the benefits to society that arise through a reduction in risks (i.e. the avoided social costs of avoided crashes and incidents). Where there are discrepancies between private and social costs (and consequently, between the private returns to roadworthiness management and social risks), the market will fail to deliver an optimal result on its own.

2.2 Market failures in heavy vehicle maintenance management

For operators to invest in the socially-optimal level of maintenance effort they must:

- bear all the costs associated with a lack of roadworthiness (including from crashes and incidents caused by a defect) and
- accrue all the benefits (in terms of avoided costs of crashes and incidents that would otherwise have occurred due to defects).

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vehicle. Queensland TMR (2011) data identifies 89.4% of fatalities in 2010 from heavy vehicle crashes were people other than the occupants of the heavy vehicle.

However, heavy vehicle operators may under invest (as compared to the socially-optimal level of maintenance effort) due to a number of factors that can be broadly categorised as relating to:

- Externalities or third-party impacts — operators do not fully take into account the impact their actions or inactions have on other road users and society as a whole.
- Capability — technical/informational constraints (understanding what is required to meet roadworthiness standards, how best to achieve these outcomes i.e. the level of maintenance effort required, and obtain assurance that they have been achieved) In addition, in the presence of financial and managerial constraints operators may be tempted to under-estimate the true probabilities of defects occurring.

Externalities

Economic theory suggests operators will not engage in the optimal level of roadworthiness-risk management:

- if some of the costs of heavy vehicle crashes and the risks posed by unroadworthy vehicles are borne by other road users and the broader community
- existing mechanisms for addressing this externality are ineffective.

The existing (non-regulatory) mechanisms for addressing these externalities are legal liability arrangements (for example, the imposition of damages for crashes with impacts on public safety, infrastructure or the environment) and the costs associated with insuring against these risks.

Legal liability may be only partially effective in accounting for externalities because of the following factors:

- Difficulties associated with attributing blame — it is difficult to pinpoint a vehicle defect as the primary cause of any crash. Instead it is more likely to be one of a myriad of factors that contribute to an accident. This makes it less likely that an operator would be deemed responsible for any incident, which in turn may reduce the likelihood of successful litigation. In addition, it can be difficult to prove that the causes of a vehicle defect were in the operator's control or reflective of maintenance effort or lack thereof.
- Information asymmetries between operators and insurers — Certainly, operators are aware that they may bear some of the broader social costs associated with any incidents. This is evidenced by the fact that they take out liability insurance to limit the extent of their outlay for an 'at fault' crash. However, monitoring operators' crash mitigation efforts is costly, and this may lead to imperfect monitoring by insurers. In such circumstances, operators will face weaker incentives to undertake preventive efforts that are

of net benefit (in terms of avoided future crash costs). This is because the negative consequences would be borne by the insurer, who would have been unable to monitor preventive efforts and reduce accident pay-outs in the event of "insufficient effort". This is more likely to be the case with less experienced operators and/or operators that are financially viable at the margin.

- Damages may be dispersed— For example many road users may experience productivity losses from a crash, such as from being caught in resultant road congestion. This makes it difficult to co-ordinate civil action against a negligent operator.

Capabilities

Technical/informational constraints and cognitive biases are also likely to limit the extent to which operators undertake a socially-optimal level of maintenance effort.

Firstly, operators may lack an understanding of what is required to meet roadworthiness standards, how these technical outcomes can be achieved, and the level of maintenance effort required. This may partially relates to issues with existing regulatory arrangements (see section 2.3). But it may also be because there is a lack of certainty about the links between appropriate management of roadworthiness, the actual roadworthiness of a vehicle (i.e. the number of defects) and the likelihood of crashes/incidents. There are a range of variables that affect the actual roadworthiness of a vehicle at a given point in time. Apart from the level of maintenance effort applied, factors such as the way a driver handles the vehicle, the quality of the road infrastructure, and the weather influence the roadworthiness of a vehicle and hence its crash risk. This creates a number of complications:

- It hides the extent to which factors in an operator's control (such as an adequate maintenance system) helps improve roadworthiness.
- It makes it difficult for an operator to quantify the crash risk from a lack of roadworthiness and hence determine the form and extent of maintenance measures that should be put in place[8].

Secondly, cognitive biases, particularly in the presence of financial and managerial constraints may also mean operators do not correctly assess the crash risk arising from a defective vehicle. These biases have been documented in the case of events — in the transport sector but also in many others — that are low in frequency but high in consequence. Many operators have commented that there is pressure to lower standards due to financial, commercial or service-delivery

[8] It is possible that these risks and mitigation measures may be more visible at the aggregate industry level.

pressures. Where safety benefits (or the links between maintenance efforts, roadworthiness and crash risk) are difficult to quantify these more immediate constraints are likely to take precedence.

2.3 Compliance and enforcement inefficiencies

Aside from the market failures described above, there is also some inefficiency with existing regulatory approaches to compliance and enforcement that may affect whether the level of roadworthiness in the heavy vehicle industry is socially optimal.

Firstly, there appears to be a lack of knowledge about the law and about what the law requires operators to do in order to comply.[9]

Secondly, there are a number of state-based variations in how the law is applied in relation to the compliance and enforcement of roadworthiness standards. The lack of a nationally consistent approach may appropriately reflect jurisdictional differences, but it may also increase compliance costs for interstate operators.

In particular, there is national inconsistency in relation to the interpretation of the roadworthiness provisions of the HVNL. The HVNL, national regulations and associated guidelines and instruments do not define criteria that describe the differences between major and minor defects in detail[10] or define processes and procedures for conducting inspections. As a result the ways each jurisdiction employs second party inspections has evolved relatively independently over time. Consultation with key stakeholders by the NTC reveals that the quality of inspections varies across jurisdictions depending on the tools available and the inspectors' capacity and capability. Variations in approach also exist across jurisdictions in relation to the following:

- Inspection procedures — namely, what should be checked and how it should be checked depending on the circumstances (i.e. off road versus on road inspections).
- The tools and technology used for roadside inspections.
- Defect categorisations (major and minor defects) or priorities based on their impact on safety. This may account for the wide variation in average defect rates reported across jurisdictions. For example, RMS Data indicates that on average, at any one time, 42.7% of NSW registered freight hauling units have

9 NTC (2013) *Heavy Vehicle Compliance Review Consultation Draft* September 2013, p 32

10 Beyond the definitions of major / minor defect and the criteria for issuing a defect notice in the HVNL.

a defect. The corresponding figure has been reported as around 16% in Western Australia, 9.8% in Tasmania and 1% in the Northern Territory[11].

- The required remedial action for any defects identified and the criteria for elevating an inspection category (directing a heavy vehicle to a dedicated off-road inspection facility).
- Procedures for clearing any defects identified — in relation to whether and where an operator must subsequently present their vehicle for inspection (i.e. to government or licensed inspection facilities or by 'self-clearing'.).

There are also other factors that affect the efficiency of the compliance and enforcement efforts. In particular, in many jurisdictions there is limited targeting of operators based on known roadworthiness risk factors, largely because of limitations in the way such information is collected, stored and disseminated.

- There is no agreed national approach to recording key information about inspection outcomes, crashes and incidents.[12] This limits the ability of officers to target operators based on their past levels of compliance (a known roadworthiness risk factor).
- There are also no nationally consistent and accessible arrangements for storing and disseminating this information. With the exception of NSW's 'TruckScan', state transport and enforcement officers do not necessarily have ready access to information about past compliance at the roadside, making it difficult to conducted targeted inspections on this basis.

2.4 Factors affecting the costs of compliance and enforcement

As observed in section 1.3, risk mitigation is not costless, and neither is the regulation of risk mitigation. Two factors relating to the economics of regulation and its costs are of importance to this analysis.

The first of these is that the regulator will have less information about the operator's actions and behaviour than the operator. For example knowing that an operator's vehicle has a defect does not necessarily mean an operator is not adequately maintaining its vehicles.

The regulator may attempt to overcome this by undertaking more inspections, extracting more information from the operator (through accreditation) or building up data on an operator's known past behaviour. These arrangements can

11 Sourced from NTC (2013) *Heavy Vehicle Compliance Review: Consultation Draft*, September 2013.

12 Austroads Research Report (AP-R441-13), Heavy Vehicle Safety Data, June 2013 (source: NTC (2013) *Heavy Vehicle Compliance Review: Consultation Draft*, September 2013.)

improve the effectiveness of the compliance and enforcement efforts but they can also increase the compliance costs for operators and administrative costs for regulators.

The second factor that will affect the cost of regulation is the fragmented nature of the institutional arrangements that underpin regulation. Fragmented arrangements, in which requirements and approaches vary across jurisdictions, can increase compliance and administrative costs for interstate operators. Concerns surrounding such fragmentation have been a main driver for establishing a National Law.

2.5 Summing up

The discussion serves to highlight that the existence of market failures and existing regulatory inefficiencies could warrant a regulatory response. While the observations set out in section 2.2 suggest the need for regulation, they do not, in and of themselves, provide a basis for assessing the appropriate compliance and enforcement response. Determining this requires an assessment of the extent to which the regulatory options:

- deliver incremental benefits — primarily in terms of crash risk reduction (which drives expected avoided crash costs), relative to the counterfactual
- impose incremental costs — primarily on operators and governments when compared to the counterfactual (i.e. the current regulatory arrangements).

3 Reform options and the counterfactual

In this section, we discuss in greater detail the regulatory options under consideration, and the counterfactual baseline (Option 1) against which they are assessed.

The reform options are all aimed at improving compliance with the heavy vehicle roadworthiness standards.

3.1 Defining the baseline (Option 1)

To perform a cost-benefit analysis, it is necessary to compare the expected future outcomes in which each of the options is implemented, against the baseline in which they are not (the counterfactual).

The baseline must consider policy developments that have taken place to date and that will be influential in the future. The baseline used for this assessment, or Option 1 as it is described in the Regulatory Impact Statement, involves no regulatory or non-regulatory changes to roadworthiness arrangements beyond any implemented or currently being implemented by the NHVR, jurisdictional service providers, other regulators and state based registration authorities.

For the purposes of this economic assessment, the incremental costs and benefits associated with the alternative options being considered are measured against the baseline where the following arrangements are in place.

Policies and procedures under the HVNL

Under the baseline the HVNL has been implemented in South Australia, Victoria, NSW, Queensland, ACT and Tasmania, but has not been adopted in the Northern Territory and Western Australia.

The HVNL facilitates national regulations that prescribe vehicle standards (section 59). It also provides that a person must not use, or permit to be used, a heavy vehicle that is unsafe and defines a vehicle that is defective. Heavy vehicles can be issued with defect notices where an authorised officer reasonably believes that the vehicle is defective and that a safety issue exists. Section 527-531 of the HVNL details requirements for the issuing and clearing of these defect notices. The interpretation of these provisions differs across jurisdictions as there are no defined processes and procedures for conducting inspections and the criteria that describe the differences between major and minor defects are subjective.

Under the HVNL the maximum penalty for contravening a heavy vehicle standard is $3000.[13] and for using, or permitting to be used, a vehicle that is

[13] Or $6000 for a contravention of a heavy vehicle standard relating to a speed limiter.

unsafe it is $6000. The HVNL does not include chain of responsibility duties requiring responsible parties to maintain vehicles in a roadworthy condition.

The NHVR has been in operation for two years. Amongst other things the NHVR is responsible for administering the National Heavy Vehicle Accreditation Scheme (NHVAS); Performance-Based Standards Scheme vehicle design and access approvals; heavy vehicle standards modifications and exemption permits.

It has also developed the National Heavy Vehicle Inspection Manual (NHVIM) which provides a baseline for assessing roadworthiness at a technical level. However, it does not mandate:

- inspection procedures — namely, what should be checked and how it should be checked depending on the circumstances (i.e. off road versus on road inspections)
- criteria for elevating an inspection category (directing a heavy vehicle to a dedicated off road inspection facility)
- defect categorisations or priorities based on their impact on safety
- the required remedial action for any defects identified.

The NHVR plays a limited role in providing education and training on the interpretation of the roadworthiness provisions of the HVNL.

Jurisdictions are responsible for developing their own roadworthiness policies and for conducting inspections. The HVNL and associated guidelines and instruments do not define processes and procedures for conducting inspections and the criteria that describe the differences between major and minor defects is subjective. As a result, the following variations in approach exist across jurisdictions:

- Differences in who may undertake the inspection (government inspectors or licensed private inspectors with differing requisite qualifications)
- Differences in the standard of inspection. In particular jurisdictional differences exist in the technology used for roadside inspections. For example, Victoria uses limited testing equipment when conducting roadside inspections while NSW uses dedicated inspection equipment including brake performance testers and shaker rigs and Queensland uses approved decelerometers or roller brake testing machines for random intercepts and a full range of inspection equipment, undercover facilities and inspection pits at government-operated dedicated checking stations.
- Differences in approach to targeting heavy vehicles for unscheduled inspections. Only NSW's transport and enforcement officers have access to up-to-date, in-vehicle information relating to past vehicle/operator compliance through 'TruckScan'.

- Procedures for clearing any defects identified through heavy vehicle inspections differ across jurisdictions mostly in relation to whether and where an operator must subsequently present their vehicle for inspection (i.e. to government or licensed inspection facilities or by 'self clearing'.).

Scheduled inspection

Existing state-based variations, in relation to heavy vehicle roadworthiness assurance approaches, are assumed to continue under the baseline. This means in relation to second party inspections:

- New South Wales, the Northern Territory, and Queensland require annual, second party roadworthiness inspections for trucks and trailers.
- South Australia requires annual, second party roadworthiness inspections for restricted access heavy vehicles (B-doubles and road trains) only.
- The Australian Capital Territory requires biennial inspections of trucks and trailers once they have reached 3 years of age.
- Victoria and Tasmania do not require any periodic inspections for trucks and trailers.
- Buses are subject to periodic (typically biannual) inspections in all states and territories.
- Roadworthiness inspections are required upon registering heavy vehicles in all jurisdictions.
- Roadworthiness inspections are required on a change of ownership of a heavy vehicle in all jurisdictions, (except for buses in South Australia).
- All jurisdictions continue to conduct unscheduled (random and targeted) inspections to varying degrees. These inspections are carried out at the roadside.
- In all jurisdictions inspections can be conducted either by government transport officers, police (for some minor visible defects) or by approved/accredited non-government heavy vehicle inspection providers (for scheduled inspection and clearing defects).

Because of these differences the total amount of second party inspection conducted by jurisdictions are assumed to continue to differ in line with their current practices described in Table 1 below.

Table 1 Second party inspection activities in jurisdictions

	TAS	NSW	QLD	VIC	SA	WA	ACT
Inspections	10600	310500	151800	68800	7700	22,079	305
Number of times a vehicle is inspected per annum	1.2	4.1	1.4	0.6	0.2	0.27	0.12
Inspections per million km travelled	32	79	38	15	6	10	4
Major defect notices	185	6829	10547	2773	486	1296	1.4
Major defect notices per 1000 registered vehicles	15	56	97	23	12	NA	0.5

Source: NTC data

Participation in accreditation

As is currently the case, the National Heavy Vehicle Accreditation Scheme (NHVAS) maintenance management module arrangements are assumed to be in place under the baseline. Operators who demonstrate compliance with the accreditation requirements are exempted from other periodic vehicle inspections (in jurisdictions where they occur). Operators that are part of the NHVAS must be independently audited upon accreditation and re-audited at regular intervals by certified auditors. The current uptake of the NHVAS (maintenance management) has been assumed to continue under the baseline. This is shown in Table 2 below. Thus the baseline assumes:

- the Western Australian Heavy Vehicle Accreditation scheme (WAHVA) and the ATA's TruckSafe accreditation programs will continue to operate.[14]

[14] The Western Australian Heavy Vehicle Accreditation scheme (WAHVA) will continue to operate under the baseline. All restricted access vehicles and those operating on permits or concessions in Western Australia must participate in the WAHVA scheme. This scheme incorporates the NHVAS maintenance management module. The TruckSafe accreditation program established by the ATA is

- there will be voluntary accreditation for heavy vehicle operators in all other jurisdictions and
- there is mandatory accreditation under State-based accreditation regimes for buses in all jurisdictions (except the ACT).

Table 2 NHVAS participation

	QLD	VIC	NSW	SA	TAS	ACT	Total *
Accredited operators	1310	1868	1518	1159	168		6956
Nominated vehicles (accredited under maintenance module)	35399	15386	24911	15046	218		
Registered vehicles	87878	99432	103553	31560	10212	2196	398916
Proportion of vehicles accredited for maintenance	40%	15%	24%	48%	2%		

*Note: * Total includes WA and NT.*
Source: Data supplied by the NHVR, September 2014; ABS (2012).

Other considerations

In practice, operators' approaches to managing roadworthiness and levels of compliance are likely to reflect their own degree of risk aversion.

While not required by legislation, most operators, as a minimum, can be expected under the baseline to schedule maintenance in accordance with heavy vehicle manufacturers' specifications. Of note here is that technological developments such as improvements in the ability of onboard computers to detect defects are likely to continue regardless of which regulatory option is adopted.

also assumed to continue to operate. It also incorporates the NHVAS maintenance management module, however, it is not able to offer the regulatory concessions available to those under the NHVAS.

3.2 Option 2 – Non-regulatory remedies

The consultative process undertaken by the NTC for this review revealed concerns about some operators' capacity to effectively maintain their vehicles. It also suggested that the quality of inspections varies across jurisdiction depending on the tools available and individual inspectors' capacity and capability.

Option 2 involves administration approaches targeted at these problems that do not require legislative change (to either the HVNL or state-based legislation). These remedies can help enhance maintenance management capacity in the industry and assist operators to comply with roadworthiness standards. They can also improve enforcement and compliance capabilities. As a result this option is intended to help government and industry:

- develop a shared understanding of high priority roadworthiness issues (such as brakes and steering).
- improve inspection procedures and processes for issuing and clearing defects and thereby achieve more efficient compliance and enforcement operations that impose lower compliance costs on industry.

The specific measures included in option 2, with implications for the cost-benefit analysis, are described below.

3.2.1 Processes and procedures

Option 2 includes a number of measures aimed at clarifying inspection and defect clearing processes and procedures including:

- Amending the existing NHVIM to describe:
  - high priority issues (such as brakes and steering)
  - standard inspection procedures (for different circumstances) that prioritise components with the greatest impact on safety
  - standard testing equipment (for different circumstances/types of inspections).
- Developing separate guidelines that detail standardised processes and procedures for clearing defects.

3.2.2 Education and Training

Option 2 proposes that the NHVR develops consistent education and training material for authorised officers, operators and drivers. For the purposes of the cost-benefit analysis this has been assumed to be through the provision of information sheets relating to:

- the daily maintenance checks that should be undertaken by drivers

- operator roles and responsibilities in respect to vehicle maintenance
- priority inspections issues to guide inspectors.

3.2.3 National roadworthiness data strategy

Option 2 includes the National Roadworthiness Data Strategy — which will specify the methods, approaches and systems for gathering intelligence on the operation of the national heavy vehicle fleet. This information will provide the foundation of the ongoing data collection required for the NHVR to continually review and assess, amongst other things, the roadworthiness risk of the heavy vehicle fleet.

3.3 Option 3 – Regulatory and quasi-regulatory measures

Option 3 aims to facilitate a more risk-based approach to heavy vehicle roadworthiness by enabling the NHVR to mandate scheduled inspections and aspects of accreditation based on determinations of risk.

It also gives regulatory recognition to many of the remedies proposed in option 2 (by 'calling up' documents in the HVNL). The specific measures included in option 3, with implications for the cost-benefit analysis, are described below.

3.3.1 Scheduled inspections

Under option 3 the NHVR will be given the power to impose scheduled heavy vehicle inspections in a form and on parties/vehicles that may vary with circumstances. These can either be a default interval inspection, or more or less frequent inspections, depending on risk factors (for example vehicle age or load) or triggering events (for example change of ownership, or entry / re-certification into accreditation).

This option, by facilitating a risk-based approach to scheduled inspections, would result in an increase in the number of inspections (relative to the baseline) for heavy vehicles with a higher likelihood of, or consequence from, having a safety critical defect and fewer inspections for heavy vehicles deemed to be at lower risk. This will result in different impacts across jurisdictions given the varying approaches to scheduled inspections that exist under the baseline.

For the purposes of the cost-benefit analysis, five scenarios have been considered which involve the following assumptions:

- A — Heavy vehicle age: This scenario involves undertaking annual scheduled inspections only for vehicles older than 20 years across Australia.
- B — Heavy vehicle age: This scenario involves undertaking annual scheduled inspections only for vehicles older than 15 years across Australia.

- C — Default annual inspections with exemptions based on risk factors: This scenario assumes that:
  - the jurisdictions that currently undertake annual inspections continue to do so, but that:
    - High risk vehicles (assumed to be dangerous goods vehicles) are subject to 6 monthly inspections
    - New vehicles under 4 years of age are subject to inspections every 2 years given they are likely to be subject to scheduled maintenance by the manufacturer.
  - The jurisdictions that currently do not require annual vehicle inspections introduce these for high risk vehicles including dangerous good vehicles and vehicles over 20 years of age.
- D — Dangerous Good vehicles: This scenario involves undertaking annual scheduled inspections only for vehicles carrying dangerous goods across Australia.
- E — Vehicles with a demonstrated risk: The scenario involves undertaking annual scheduled inspections only for vehicles carrying dangerous goods and on the basis of other known compliance risk factors (i.e. past compliance) across Australia.

A scenario which involved moving to annual inspections of all vehicles over 10 years of age across Australia was also investigated. This resulted in a very similar number of inspections to Option 3C above and therefore a very similar cost. Therefore, this option has not been presented individually.

Inspections would also continue to be carried out on change of ownership, on registration and on entry to accreditation and for buses as per the baseline.

3.3.2 Chain of responsibility provisions

Option 3 would impose chapter-specific duties on responsible parties, under new chain of responsibility (CoR) provisions specific to the vehicle standards chapter in the HVNL. This would require specified responsible parties to take all reasonable steps to ensure business practices do not cause a heavy vehicle to be used on road in a condition that is unsafe, unroadworthy or non-compliant with vehicle standards.

CoR would enable pre-emptive investigations of operator executives where a concern around vehicle maintenance exists.

Enforceable undertakings are also to be implemented under Option 3.

3.3.3 Formalised inspection processes and procedures

Option 3 proposes the following measures that affect the processes and procedures for conducting scheduled inspections:

- Developing statutory criteria for declaring a vehicle unroadworthy and for issuing major and minor defect.
- Developing standardised inspection types, practices and defect clearance processes.

These criteria and procedures will be called up in the HVNL but not prescribed in regulation.

3.3.4 Education and Training

Option 3 also includes the NHVR developing consistent education and training material for authorised officers, operators and drivers as per Option 2.

3.3.5 NHVAS

Option 3 provides for changes to the NHVAS Business Rules to allow for inspection of heavy vehicles before renewal of accreditation. This represents a revision to the Option 3 that was considered in the CBA that supported the Consultation RIS and takes up a specific suggestion during consultation.

3.3.6 National roadworthiness data strategy

Option 3 includes the National Roadworthiness Data Strategy. This information will provide the foundation of the ongoing data collection required for the NHVR to continually review and assess, amongst other things, the roadworthiness risk of the heavy vehicle fleet. It would also provide data to support the risk criteria used to implement risk-based scheduled inspection.

3.4 Option 4 – More prescriptive regulatory measures

Option 4 mostly builds on Option 3, but takes a more prescriptive approach. The key measures incorporated into this option are described below.

3.4.1 Scheduled inspection

Option 4 makes provision for scheduled inspections to be introduced for all operators at prescribed intervals (such as annual inspections). For the purposes of the cost-benefit analysis this is assumed to result in the following:

- Annual inspection being introduced for all operators except those who are part of the accreditation system.

- Inspections would continue to be carried out on change of ownership, on registration and on entry to accreditation as per the baseline.

3.4.2 Chain of responsibility provisions

Option 4 would impose a primary duty on responsible parties, under new CoR provisions in the HVNL. This would require responsible parties for a heavy vehicle to ensure that the vehicle is maintained in a compliant and roadworthy condition.

As per Option 3, the CoR would enable pre-emptive investigations of operator executives where a concern around vehicle maintenance exists.

Enforceable undertakings are also to be implemented under Option 4.

3.4.3 Prescribed inspection processes and procedures

Option 4 proposes the following measures which affect the processes and procedures for conducting scheduled inspections:

- Introducing statutory criteria in regulation for declaring a vehicle unroadworthy and for issuing major and minor defect.
- Prescribing standardised inspection types, and procedures, procedures for formal warnings and defect issuing and clearing.

3.4.4 Education and Training

Option 4 also includes the NHVR developing consistent education and training material for authorised officers, operators and drivers as per Option 2.

3.4.5 NHVAS

As with Option 3, Option 4 provides for changes to the NHVAS Business Rules to allow for inspection of heavy vehicles before renewal of accreditation. This represents a revision to the Option 4 that was considered in the CBA that supported the Consultation RIS and this change follows a specific suggestion during consultation.

3.4.6 National roadworthiness data strategy

Option 4 includes the National Roadworthiness Data Strategy. This information will provide the foundation of the ongoing data collection required for the NHVR to continually review and assess, amongst other things, the roadworthiness risk of the heavy vehicle fleet.

3.5 Composite Option – A suite of measures from Options 2, 3 and 4

The Composite Option was developed by the NTC in response to feedback received on the Consultation RIS and further analysis and consideration.

The Composite Option brings together a suite of measures from Option 2, 3 and 4. The key measures incorporated into this option are described below.

3.5.1 Scheduled inspection

The Composite Option includes the development of a risk-based approach to scheduled inspections (from Option 3).

3.5.2 Chain of responsibility provisions

The Composite Option includes strengthened compliance measures of a primary duty (from Option 4) and enforceable undertakings (from Options 3 and 4).

3.5.3 Guidance on inspection processes and procedures

The Composite Option includes the revision of the National Heavy Vehicle Inspection Manual (NHVIM) and provision of material that provides guidance or direction on how to administer, or comply with the law by the NHVR to service providers and operators for guidance only (from Option 2).

3.5.4 Education and Training

The Composite Option includes the NHVR developing consistent education and training material for authorised officers, operators and drivers as per Option 2.

3.5.5 NHVAS

The Composite Option includes changes to the NHVAS Business Rules to allow for inspection of heavy vehicles before renewal of accreditation, as per Options 3 and 4.

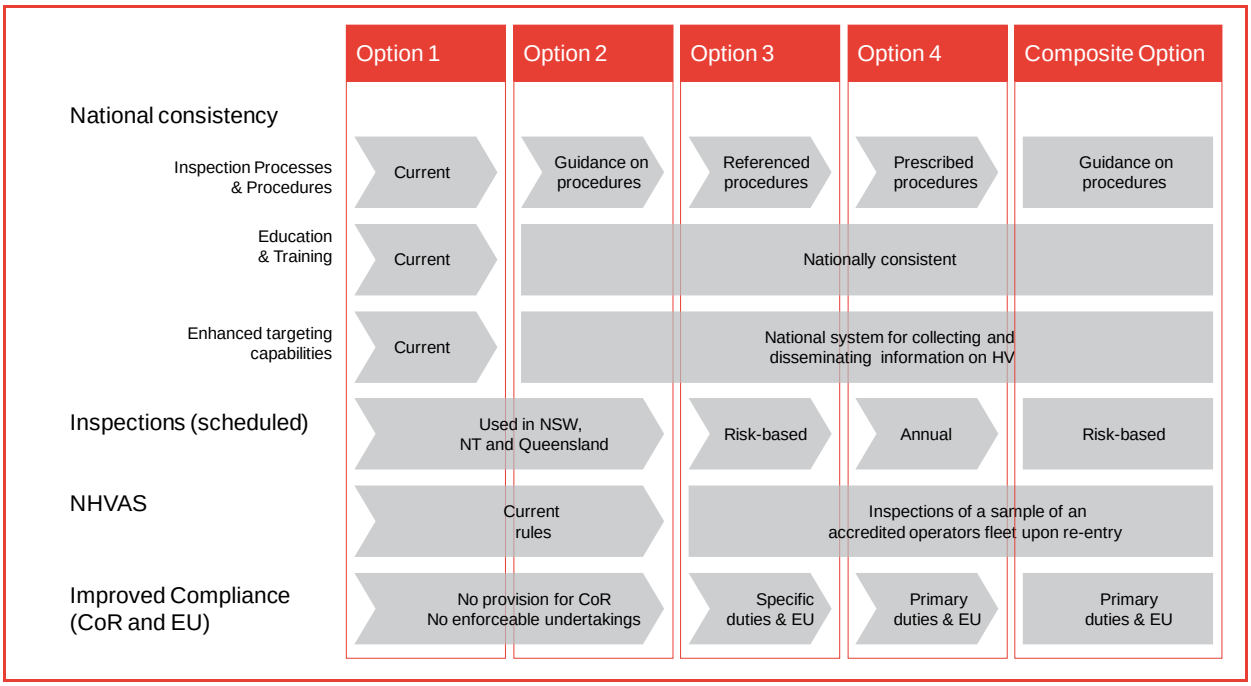
3.5.6 National roadworthiness data strategy

The Composite Option includes the National Roadworthiness Data Strategy. This information will provide the foundation of the ongoing data collection required for the NHVR to continually review and assess, amongst other things, the roadworthiness risk of the heavy vehicle fleet. It would also provide data to support the risk criteria used to implement risk-based scheduled inspection.

3.6 Summary of measure included under the different options

Figure 1 below provides a summary of the key measures included in the options described above.

Figure 1: Summary of key measures included in each option



Source: Frontier Economics analysis.

4 Categories of impacts

In this section, we set out the main categories of impacts that can be expected as a result of implementing the proposed changes to enforcement and compliance of roadworthiness standards. These categories inform the detailed assessment of the *incremental* costs and benefits of each option presented in section 5 of this report.

4.1 Operators' administrative compliance costs

For an operator, the incremental costs of complying with any regulations (or the avoided costs of not complying) will reflect:

- Any investments it needs to make to modify or develop new reporting and information management systems.
- The ongoing costs associated with employing additional staff to manage these systems in order to implement the regulations or demonstrate compliance.
- The costs incurred in dealing or negotiating with the NHVR or compliance and enforcement personnel throughout any:
  - compliance audit (i.e. over and above what is required under the baseline) or
  - inspection processes.

These costs may reflect management and staff time to complete forms, assist with audits and demonstrate compliance to the NHVR, appointed auditor or police; and/or the cost of obtaining advice from external sources.

The following policy measures will have a material impact on operators' administrative compliance costs:

- Wider application of scheduled inspections.
- Inspection of a sample of an accredited operator's fleet upon re-entry (under the NHVAS).
- Provision of information, education, and training on inspection process and procedures.

Operators' administrative compliance costs associated with these policy measures are described in more detail below.

4.1.1 Costs associated with scheduled inspections

Costs of an inspection

The most significant cost for an operator of a scheduled inspection is the opportunity costs of revenue foregone while the vehicle is off the road being inspected[15]. Operators are typically required to book the inspection up to several months in advance. This is likely to reduce scheduling difficulties when compared to targeted and random inspections but it still may result in lost loads and therefore lost revenue. Also, some regional areas do not have inspection facilities so operators must travel to the nearest regional centre to have the vehicle inspected.

From a survey of more than 500 heavy vehicle operators on a range of topics[16] , 90 non-trivial responses were received to questions asked about the costs of scheduled inspections. This included estimated costs from the unavailability of the heavy vehicle, driver time, inspection fees, scheduling disruptions and other costs.

Figure 2 shows the distribution of reported operator costs associated with a scheduled inspection. The median reported cost of an inspection (not including reported costs of repairs) was $2194 per inspection.[17] This number is broadly consistent with the estimate used in the 2011 RIS for the HVNL of $2000 to $3000 per inspection.[18]

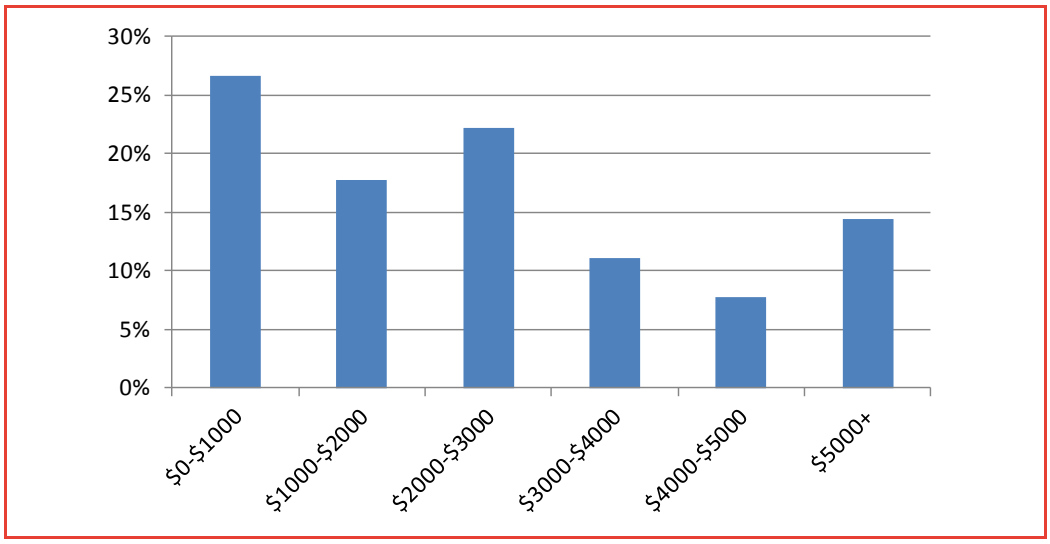
15 Inspections will also impose costs on operators associated with rectifying defects (see section 4.2). This will include the opportunity costs in terms of revenue foregone while the vehicle is off the road for repairs.

16 NTC Survey of operators

17 This number is inclusive of inspection fees. The assumption made is that inspection fees are charged on a cost recovery basis, for the regulator's costs associated with actually conducting the inspection, in which case the inspection fees will effectively be an offsetting transfer from the operator to the regulator. This means that the regulatory inspection resources required for scheduled inspections do not need to be costed.

18 NTC (2011) Heavy Vehicle National Law Regulation Impact Statement, September 2011

Figure 2: Distribution of reported operator costs of a scheduled inspection



Source: Frontier Economics analysis.

Number of inspections and total costs

To understand the incremental changes it is important to identify the current volume of scheduled inspections in different States for different vehicle types, and how these levels are expected to change under each option. As set out in Figure 1, no change from the current volume of scheduled inspections is anticipated under Options 1 and 2, while an increase is expected under Options 3, 4 and the Composite Option.

The assumptions underpinning these estimates, in relation to when scheduled inspections are required, are set out in Table 3 and draw on the information provided in Appendix A of the Phase 1 report (NTC 2014a). The detailed inspection rates (by vehicles type) were multiplied by estimates of vehicle numbers to get an estimate of the total number of inspections conducted under each option. The number of inspections under the baseline was then subtracted from this to get the number of additional inspections. This was then multiplied by the operator cost of a scheduled inspection to estimate the increase in operators' compliance costs.

Table 4 sets out the expected changes to the number of scheduled inspections under each option and the estimated increase in operators' compliance costs.

For the purposes of the cost-benefit analysis we have assume a range of scenarios (A-E under Option 3 and the Composite Option (CO)) for inspections in jurisdictions other than NSW and Queensland (which already have annual inspections). This could include vehicles over a certain age, be based on the type of load carried or on the basis of past operator compliance. Vehicles of operators that are currently maintenance accredited are not assumed to increase scheduled inspections under Options 3, 4 or the Composite Option.

Table 3: Assumptions for triggers of scheduled inspections under alternative options

	Option 1	Option 2	Option 3	Option 4	Composite Option
Change of ownership in fleet	2%	2%	2%	2%	2%
Frequency of truck and trailer inspections (/yr)	0-1 [a]	0-1	0.01-1	1	0.01-1
Frequency of bus inspections (/yr) [b]	1-2	1-2	1-2	1-2	1-2

Notes: [a] assuming 1 in NSW, Queensland and NT for all truck and trailers, , 1 in SA for B doubles and road trains, 0.5 in ACT after vehicle is 3 years of age, 0 in Victoria, WA, Tas. [b] assuming 2 in NSW, Victoria, Queensland, SA, Tasmania, 1 in WA and NT.

Table 4: Expected changes to the number of scheduled inspections under alternative options

Option	1	2	3A / CO-A	3B / CO-B	3C / CO-C	3D / CO-D	3E / CO-E	4
Expected scheduled inspections ('000)	349.4	349.4	284.9	354.3	441.0	107.2	127.3	730.9
Incremental change								
Articulated and rigid fleet ('000)	0	0	-64.5	4.9	91.6	-242.2	-222.1	381.5
Buses	-	0	0		0	0	0	0
Incremental cost to operator ($m pa)*	-	0	$141.6	$10.9	$201.0	$531.4	$487.2	$836.9

*Note: * based on the median reported operator cost of a scheduled inspection of $2194 and the number of relevant vehicles in each jurisdiction.*
Source: Frontier Economics analysis.

4.1.2 Costs associated with changes to the accreditation regime

The options proposed will also result in the following changes to the accreditation regime:

- Increased participation for high risk operators under Options 3A / CO-A and 4.
- Increased voluntary participation as a result of the expansion of scheduled inspection under Options 3C / CO-C and 4.
- Increased inspections of accredited operators' fleets due to inspections of a sample of the fleet upon re-entry.

An operator will incur a number of administrative compliance costs upon entering accreditation.

First, there will be one-off costs associated with developing and implementing compliant vehicle maintenance processes and procedures. For the purpose of this cost-benefit analysis we have assumed that each operator will incur $25,000 to do this, either through employing a consultant or by taking up staff time. In practice, this cost may vary depending on the size of an operator and the complexity of its operations.

Second, semi-regular follow-up vehicle audits will impose an opportunity cost in terms of revenue foregone while the vehicle is off the road being inspected. We have assumed that this will involve approximately one-third of the vehicles in the operator's fleet being audited in the year after entry, then subsequently 2 and then 3 years after that (year 3 and year 6 of accreditation respectively). The cost of single vehicle audit under the NHVAS is assumed to be $1400 per vehicle inspected. This represents the median cost of audits estimated in a recent survey of accredited operators[19]. This number is broadly consistent with the estimate used in relation to scheduled inspections.

Third, there will also be ongoing costs associated with administration of the system and ongoing training of staff. This ongoing cost is assumed to be $7000 per operator. Again this represents the median cost estimated in a recent survey of accredited operators[20].

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19 NTC Survey of accredited operators (2014). It is assumed that the audit costs reported by operators relate to a single vehicle audit. Note we have used the median, as opposed to the average, as the distribution of responses has a long extended tail

20 NTC Survey of accredited operators conducted in (2014). Note this cost is likely to vary significantly depending on operator size. For the purpose of the cost-benefit analysis the median, as opposed to the average, estimate has been used as the distribution of responses had a long extended tail.

Finally, offsetting these costs will be the fact that operators (in jurisdictions that subject heavy vehicles to annual inspections) will no longer have to participate in scheduled inspections. Therefore, there will be a benefit associated with the avoided ongoing scheduled inspection costs:

- Under Option 3 and the Composite Option, this will be associated with the newly accredited operators in NSW and Queensland that are currently subject to annual inspections.
- Under Option 4 this will relate to all newly accredited operators given the assumed expansion of annual scheduled inspections to all jurisdictions.

Table 5 summarises the expected increase in accredited operators and nominated vehicles as a result of the different reform options

Given that accredited operators are not subject to an audit every year and that not all of an operator's vehicles are audited, the costs savings associated with avoided annual inspection costs are significant enough that changes to accreditation (under Options 3, 4 and the Composite Option) result in very low costs or even cost savings for operators (and regulators).

Table 5: Expected changes to the number of NHVAS participating operators and nominated vehicles under alternative options

	Option 1	Option 2	Option 3A / CO-A*	Option 3C / CO-C**	Option 4***
Expected increase in no. of participating operators	-	-	927	705	3051
Expected increase in nominated vehicles	-	-	12045	9160	39666
Avoided annual scheduled inspections	-	-	5300	9160	35,022

Notes:
** The changes under Option 3A / CO-A are based on the assumption that all heavy vehicle operators carrying dangerous goods must be accredited (this affects 16060 vehicles using NTC collated data). Each operator is assumed to have 13 vehicles (this is the current average no. of vehicles per accredited operator). We have also assumed 25% of dangerous goods carrying operators are already accredited under NHVAS. These dangerous goods operators will only be subjected to scheduled inspections if registered in Queensland, NSW and the NT. We have assumed that 44% of newly accredited operators are currently registered in these states (based on analysis of the current breakdown of NHVAS involvement and dangerous good vehicle numbers by state) and that these operators will therefore become exempt from annual inspections. **Option 3C / CO-C results in an increase in the number of scheduled inspection conducted across Australia therefore we have also assumed an increase in voluntary accreditation of 10% for the additional vehicles subjected to a scheduled inspection in each year. Under*

sub options 3 / CO-C, D and E dangerous goods operators will be subjected to scheduled inspections. Also under Option 3 / CO-A, B, D and E the total number of scheduled inspections decreases or stay approximately the same therefore we have assumed no increase in voluntary accreditation.
*** The expected changes under Option 4 assume that the expansion of annual inspections would result in an additional 2125 operators seeking voluntary accreditation. This is based on increasing the accreditation rate in Victoria and Tasmania to the average accreditation rate in NSW and Queensland (where annual inspections currently exist).*
Source: Frontier Economics analysis.

4.1.3 Other policy measures

In principle, uniform regulations across jurisdictions can reduce the costs of service provision by reducing the extent to which parties need to make additional investments in labour and capital to ensure that their operations comply with jurisdiction-specific regulation.

Options 2, 3, 4 and the Composite Option include a number of measures aimed at increasing the consistency of inspection processes and procedures (either in guidelines or regulatory instruments).

On its own, it is doubtful whether a nationally consistent approach to the type, form and procedures for conducting inspections would significantly affect the administrative compliance costs for operators (associated with interacting with the regulator/inspectors).

However, it is possible that an operator's compliance costs will be affected by the subjectivity of the process. By this we mean situations where an operator is uncertain of what information is required to satisfy the regulator or police of its compliance.

It should be noted that the subjectivity of the process is likely to be a function of the regulatory system's clarity and the capacity of operators, regulators and police to understand the system rather than of the form of regulation itself.

Options 2, 3, 4 and the Composite Option all involve the NHVR developing consistent education and training material for authorised officers, government and private sector vehicle inspectors, operators and drivers. While not quantifiable, this policy measure is likely to reduce operators' administrative compliance costs.

4.2 Operator costs of maintaining a compliant vehicle

A change to the enforcement and compliance system will impact on the number of defects identified and/or the degree of proactive heavy vehicle maintenance operators undertake. This will affect operators' costs. These costs will include the costs of:

- rectifying any defects identified through second party inspections —which will typically reflect the value of the time a vehicle and driver are off the road and the costs associated with repair and clearing of the defect; and/or
- undertaking maintenance on their heavy vehicles on an ongoing basis — which will typically reflect the value of the time a vehicle and driver are off road and the costs associated with repair of any defects identified.

The costs of maintaining a compliant vehicle will differ depending on the specific nature of the operator, the degree to which the compliance and enforcement system encourages pro-active maintenance, the defect identified and, in relation to second party inspections, whether the defect is identified through a road-side or scheduled inspection.

It is important to recall that under the baseline, operators are already subject to compliance and enforcement activities. Therefore, what is important is the expected *incremental* impact of any of the policy option on:

- the levels of non-compliance identified through second party inspections
- the levels of pro-active maintenance undertaken
- the costs of rectifying any defect identified.

In relation to the first point, Options 3, 4 and the Composite Option increase the number of scheduled inspections proposed and therefore are likely to increase the number of defects identified and, all other things being equal, the cost of rectifying these defects. There is an argument to suggest that an increase in scheduled inspections may reduce the level of pro-active heavy vehicle maintenance undertaken by operators. This may be true in the absence of significant penalties because operators may choose to rely on second party inspections for vehicle maintenance purposes. However, no conclusive data exist on this proposition.

In relation to the second point, policies that include measures aimed at improving the collection and dissemination of vehicle fleet intelligence to improve the targeting of on-road/random inspections are likely to incentivise operators to increase maintenance management. Options 3, 4 and the Composite Option include measures aimed at doing this.

In relation to the third point, policies that lead to nationally-standardised procedures for clearing any defects identified could reduce the costs of rectifying non-compliance. Under the baseline (Option 1), jurisdictions adopt different practices in respect to clearing the defect. For example, there are differences in where an operator must subsequently present their vehicle for inspection (i.e. to government or licensed inspection facilities or by 'self-clearing'[21].). For some

[21] See NTC (2014), *Heavy Vehicle Roadworthiness Review, Phase 2 - Integrity Review of the National Heavy Vehicle Roadworthiness System*; August 2014 section 7.4.5 for further information.

interstate operators this has resulted in vehicles, post repair, needing to return to an inspector in the state in which the defect was identified in order to clear the defect. Options 2, 3, 4 and the Composite Option propose developing guidelines or regulatory instruments that detail standardised processes and procedures for clearing defects. This would reduce the costs of rectifying any non-compliance for interstate operators and also for other operators where inconsistencies exist within jurisdictions.

With the information available we are not able to quantify the incremental impact the different options are likely to have on operators' costs of maintaining compliant vehicles. However, we note these cost may be:

- reduced (relative to the baseline) under Option 2 given the proposed improvements to defect clearing processes
- higher under Option 3 and the Composite Option on the basis of the proposed increase in scheduled inspections for high risk vehicles and improvements to targeting (although this will be partially offset by improvements to defect clearing processes)
- higher again for Option 4 on the basis of the significant increase in scheduled inspections.

4.3 Regulators' administrative costs

4.3.1 Costs of conducting inspections and audits

Policy options that result in a change in the number of inspections would also result in a change to the NHVR's administrative costs — States perform inspections on behalf of the NHVR under a service level agreement. These costs are primarily associated with the need for more/less staff time spent conducting audits or inspections and administering and recording inspection outcomes.

The current cost of conducting inspections varies significantly across states. The CIE previously identified that inspection costs range from nearly $656 in South Australia (for a full inspection of a B-double) to around $109 in other states.[22]

It is not clear whether the cost of inspections vary on the basis of whether they are carried out by government officers or outsourced to private accredited inspectors[23], or because of differences in processes and procedures.

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22 Figures sourced from CIE (2011) *Benefit cost analysis: National Heavy Vehicle Regulator Model Law*, February 2014 have been inflated to June 2014 prices based on CPI change from December 2010.

23 We also note that while some states charge inspection fees on a cost recovery basis these fee are effectively an offsetting transfer from the operator to the government.

The survey of operators (see section 4.1.1) suggested that the typical inspection fee paid by operators is $204 per inspection. These inspection fees are actually incurred by the operator and so for the purposes of this cost-benefit analysis this has been included in the operators' administrative compliance costs. However, these fees can be assumed to recover some part of the regulatory inspection costs.

For the purposes of our analysis we have assumed that the regulatory cost associated with administering and recording heavy vehicle inspection outcomes or audits is $100 per inspection/audit. This assumes the cost of conducting an inspection is $300 (the approximate mid-point of the CIE's estimates) and that $200 of this is covered by inspection fees.

It seems reasonable to assume that the cost of conducting inspections and audits increase in line with the number inspections conducted as this cost is mostly associated with staff time. It seems reasonable to assume that there will not be any significant economies of scale.

4.3.2 Changes to accreditation

The changes to the accreditation regime described under the different options would also impose costs on the NHVR.

Firstly, there will be one-off costs associated with the need for more staff to develop the proposed operational improvements to the NHVAS — namely to make modifications to the business rules and independent audit framework, and to review the Maintenance Management Accreditation Guidelines. For the purpose of this cost-benefit analysis we have assumed that the NHVR will need to employ two additional staff for a year to do this (1.5 FTE at an average cost of $127,700 pa[24]).

Second, there will also be one-off costs associated with auditing operators' processes and procedures given increased scheme participation as a result of any increase in voluntary accreditation under some options.

Third, there will be ongoing costs associated with the increase in auditor monitoring proposed under the operational improvements to the NHVAS. For the purpose of this analysis we have assumed that the NHVR will need to employ 1 FTE on an ongoing basis to do this. There will also be costs associated with making and implementing modifications to the maintenance management standards to include the need to assess risks arising from uncovered faults and describe the means by which it will verify roadworthiness. The NHVR has estimated these to be in the order of $900,000 per annum.[25] Third, as with

24 Data supplied by NHVR and provided by the NTC in a pers. comm. dated 22/9/14.

25 NTC pers. comm. 4/12/14.

operators, there will be semi-regular costs associated with the need to conduct the follow up vehicle audits on a selection of any newly accredited operators' vehicles.

Finally, there will be cost savings associated with any avoided annual inspections for accredited operators. We have assumed the cost of administering a vehicle audit under the NHVAS is the same as administering a scheduled inspection. Therefore the central estimate for the regulatory cost saving associated with any avoided inspections is $100. Table 5 in section 4.1.2 summarises the expected increase in accredited operators and nominated vehicles as a result of the different reform options.

4.3.3 Other policy measures

Options 2, 3, 4 and the Composite Option include a number of measures aimed at harmonising and clarifying inspection processes and procedures (either in educational material, guidelines or regulatory instruments) to increase consistency between jurisdictions. This includes amending the existing NHVIM such that it provides a uniform framework for performing inspections and standardisation of testing equipment (for different circumstances/types of inspections).

For the NHVR, the resulting changes in processes and procedures could lead to:

- One-off costs associated with developing the educational material, guidelines, and/or regulatory instruments, educating and training existing staff, developing new information systems, and working with inspectors/operators to bring them up to speed on the new requirements.
- Ongoing costs associated with maintaining records if the amount of record keeping required increases under the policy option.

It seems most likely that the changes proposed would impose largely one-off costs on the regulator, particularly in relation to the use of standardised testing equipment.

Options 2, 3, 4 and the Composite Option also include implementing a national system for collecting and disseminating information relating to the risk of non-compliance for different heavy vehicles. This proposal would impose one-off costs on the regulator associated with developing new national intelligence databases to facilitate a move to real-time advice on a vehicle's compliance record. There would also be costs associated with installing the associated in-car systems. NSW currently uses the 'TruckScan' system to target heavy vehicles. It is not known how much this would cost to implement in other jurisdictions. However, the NHVR has estimated the cost of developing and implementing the compliance and surveillance strategy as $1.2m.[26]

[26] NTC pers com 4/12/14.

With the data available we have not been able to quantify these one-off costs. However, we note that the costs will largely be the same across Options 2, 3, 4 and the Composite Option and therefore do not alter the rankings between these options. They are also likely to be less material when compared to the costs associated with changing the frequency with which vehicles are inspected.

4.4 Benefit from chain of responsibility provisions

Options 3, 4 and the Composite Option involve the inclusion of Chain of Responsibility (CoR) provisions for vehicle standards and roadworthiness in the HVNL. This approach could potentially increase roadworthiness compliance by making those parties with the greatest control over maintenance practices personally responsible for properly exercising it. Operators and other responsible parties would become more aware of, and responsive to, their obligations.

CoR provisions would help enable the NHVR to proactively investigate individual office-holders of a given operator where there is a concern about their approach to maintenance. The typical approach taken in respect to defects is to require them to be fixed with minor fines sometimes imposed. However, fines for CoR breaches can be higher. There is evidence that suggests that CoR has had some influence on the heavy vehicle industry's approach to fatigue management, which has had a positive impact on the industry.[27]

Because of the lack of available data we have not been able to quantify this benefit, but believe that it would be positive.

4.5 Impact on the crash and breakdown risk

The primary benefit of increasing heavy vehicle roadworthiness is its expected impact on reducing crashes and breakdowns involving heavy vehicles and the costs associated with these incidents. In order to assess these impacts it is necessary to:

1. Estimate the cost of heavy vehicle crashes and breakdowns attributable to unroadworthiness under the baseline
2. Estimate the extent to which roadworthiness measures would reduce the risks (and thus costs) of heavy vehicle crashes and breakdowns.

27 NTC (2014) *Heavy Vehicle Compliance Review* June 2014, p 60

4.5.1 The cost of crashes involving heavy vehicles

Current estimates

Estimating the cost of crashes involving heavy vehicles requires estimating the value of human consequences of a crash (including any lives lost) as well as the other economic consequences. BITRE[28] has the most current and comprehensive assessment of these costs. For crashes involving all types of vehicles (not just heavy vehicles), BITRE provides an estimate of the economic cost of the following types of crashes in 2006 dollars:

- a fatal crash (life lost and other costs)
- a crash that results in an injury that requires hospitalisation
- a crash that results in an injury that does not require hospitalisation
- a crash that results only in property damage (no fatalities or injuries).

Rather than use the BITRE estimate (based on a hybrid human capital approach to economic valuation of life), the OBPR prefers the willingness to pay approach for measuring the benefits of regulations designed to reduce the risk of physical harm. The OBPR[29] refers to the appropriate value of a statistical life as being $3.5 million (in 2008 dollars). We have used this figure in preference to the BITRE figure for the value of a life lost (or saved), but use the BITRE estimates of the other costs of a fatal accident, and of the costs related to non-fatal accidents.

The cost estimates from BITRE and OBPR are reported in the current dollars of the study year, being 2006 and 2008 respectively. These estimates have been escalated to current dollars for 2014 using the Consumer Price Index (ABS 6401.0).

The estimated cost of a fatal road crash will differ between heavy vehicle types because articulated trucks are more likely to be involved in a crash resulting in multiple fatalities. These estimates are presented in Table 6 below and are based on multiplying the average number of fatalities per crash with the costs per fatality and adding the estimates of the other costs associated with a fatal crash.

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28 Bureau of Infrastructure, Transport and Regional Economics [BITRE], 2009, Road crash costs in Australia 2006, Report 118, Canberra, November.

29 OPBR (2008), Best Practice Regulation Guidance Note: Value of statistical life, https://www.dpmc.gov.au/deregulation/obpr/docs/ValuingStatisticalLife.pdf

Table 6: Cost of a fatal road crash involving a heavy vehicle, by type, 2014

Type of HV involved in fatal crash	Average fatalities per fatal crash	Value of a statistical life (in 2014$'000)	Other costs associated with a fatal crash (in 2014$'000)	Total cost per crash (in 2014$'000)
Articulated truck	1.17	4046.4	330.8	5065.1
Rigid truck	1.12	4046.4	330.8	4862.7
Bus	1.10	4046.4	330.8	4781.8

Source: Frontier Economics analysis; BITRE 2009; BITRE 2014; OBPR 2008; ABS 6401.0.

The aggregate cost of road crashes involving heavy vehicles can be derived by applying the estimated average cost of each type of crash to the estimated numbers of crashes of each type (Table 7).

Table 7: Cost of road crashes involving heavy vehicles, 2014

	Average cost of crash (in 2014$)	Crashes (using various proxies)	Total cost (in 2014$)
	$'000	No.	$ million
Fatal crashes involving articulated trucks	5,065.1	88 [a]	445.7
Fatal crashes involving rigid trucks	4,862.7	69 [a]	335.5
Fatal crashes involving buses	4,781.8	11 [a]	52.6
Injury crashes resulting in hospitalisation [e]	327.6	1536 [b]	503.3
Injury crashes not resulting in hospitalisation [e]	18.2	11264 [c]	204.5
Property damage crashes	12.3	32000 [d]	392.5
Total		**44,968**	**1,934.2**

Note: [a] Using 2013 data from BITRE (2014). [b] Using 2008-09 data from BITRE (2014). [c] Assuming that the 12% of injury crashes involve hospitalisation, as observed in 2006 (BITRE 2009). [d] Using 2006 data from BITRE (2009). [e] Injury crashes do not include fatal crashes.
Source: Frontier Economics analysis; ABS 6401.0.

On this basis it is estimated that, in 2014, the total cost of heavy vehicle fatal and non-fatal crashes is in the order of $2 billion for that year.

Looking forward

Over the last decade, total annual deaths from fatal crashes involving a heavy vehicle have been declining. BITRE[30] estimates the trend as an average reduction of 3.2% per year over the past decade. This is not as large a decline as observed for all road users (3.4%).[31]

This declining trend in fatal crashes is not observed in other types of crashes (such as serious injury hospitalisation crashes)[32].

Further, this decline has been the result of specific actions taken in response to risk factors. Reducing the level of defects is one of the three interventions identified in the National Road Safety Action Plan 2015-2017 as necessary to continue the reduction[33].

The table below describes expected future crashes if it is assumed that fatalities associated with heavy vehicle crashes continue to decline on the 3.2% trend described by the BITRE data, and other types of crashes would continue at present levels. Some 2013 BITRE fatal crash observations are significantly below the long term trend, so the 2013 value from the trend line has been used to ensure representativeness.

Table 8: Possible future road crashes involving heavy vehicles

Type of crash	2014	2015	2016	2017	2018	2019
Fatal crashes involving articulated trucks	100	97	94	91	88	85
Fatal crashes involving rigid trucks	65	63	61	59	57	55
Fatal crashes involving buses	15	14	14	13	13	12
Injury crashes resulting in hospitalisation [e]	1536	1536	1536	1536	1536	1536
Injury crashes not resulting in hospitalisation [e]	11264	11264	11264	11264	11264	11264
Property damage	32000	32000	32000	32000	32000	32000

30 Bureau of Infrastructure Transport and Regional Economics. Statistical Report. Road trauma involving heavy vehicles: crash statistics 2014. (Table 1.1)

31 Bureau of Infrastructure Transport and Regional Economics. Statistical Report. Road Deaths Australia 2013 Statistical Summary. (Table 1)

32 Pers. comm., NTC, 24 December 2014.

33 Transport and Infrastructure Council 2014, National Road Safety Action Plan 2015-2017 (http://www.transportinfrastructurecouncil.gov.au/publications/files/National_Road_Safety_Action_Plan_2015-2017.pdf)

Type of crash	2014	2015	2016	2017	2018	2019
crashes						
Total	**44980**	**44974**	**44969**	**44963**	**44958**	**44953**

Source: Frontier Economics analysis.

These trends can be extended over the 10 year duration of the economic analysis and, using a real discount rate of 7%, converted into a NPV of the cost of road crashes involving heavy vehicles of $14.2 billion.

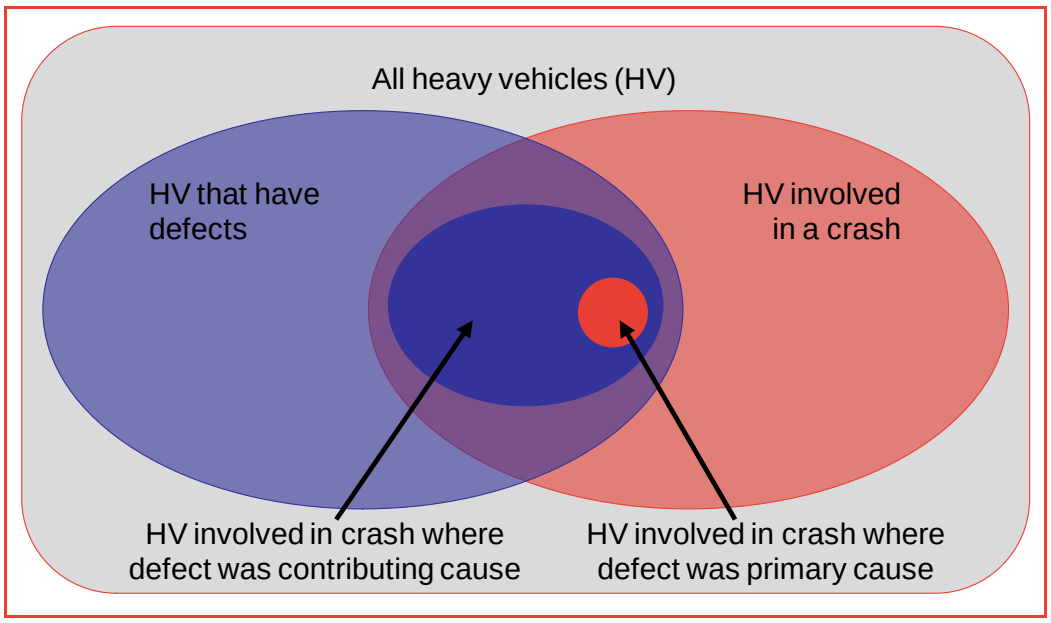
The contribution of roadworthiness to the crash risk

As discussed in section 2.1, it is difficult to quantify the extent to which a lack of roadworthiness is a causal factor in heavy vehicle crashes. This section uses available information to form an estimated upper and lower bound for the contribution of roadworthiness to the crash risk.

Figure 3 is a Venn diagram that shows:

- Many heavy vehicles have defects, but only some are involved in crashes.
- Many heavy vehicles have crashes, but only some of these vehicles have defects.
- Of those heavy vehicles with defects that crash, there are three broad types:
  - crashes where the defect was the primary cause of the crash
  - crashes where the defect was a contributing factor to the crash
  - crashes where the defect played no role in the crash.

Figure 3: Heavy vehicle roadworthiness and crash risk



Source: Frontier Economics.

In 2014, it is estimated that there were 44,968 crashes (Table 7)..[34] This suggests a crash risk of 58.1 per 1000 heavy vehicles.

To form the lower bound, we use information relating to the crashes where the defect was the primary cause of the crash.

- The US Federal Motor Carrier Safety Administration (nd) found that in 1.0% of large truck fatal crashes, the critical event causing the crash was the truck losing control due to vehicle failure..[35]
- The European Commission (nd) estimated that 5.3% of heavy vehicle crashes resulted from issues with the heavy vehicle itself being the main crash cause..[36]
- Mechanical defects represent about 6% of crash-related insurance incidents (which excludes incidents such as vehicle theft and fire damage) (NTARC 2011)..[37]

Using 4% as a central estimate, this suggests that 4% of crashes are caused by a lack of heavy vehicle roadworthiness (lower bound from roadworthiness being the primary cause). Based on the cost estimate above, this suggests that the lower bound cost estimate of road crashes due to unroadworthy heavy vehicles has an NPV in the order of $568 million.

We have also estimated an upper bound cost estimate of road crashes.

We know from research that mechanical defects are consistently reported at low rates in the conventional crash data,[38] indicating there is a likelihood that defects are responsible for a larger number of crashes than can be determined from data about crashes where defects are the primary cause of the crash. Even though seldom reported, the brake system and tyres are most often cited. To explore the upper bound of the possible cost of defect caused crashes, we consider:

- crashes where defects were found in vehicles involved in a crash
- the likelihood that those defects contributed to the crash.

Our calculations are based on the following:

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34 ABS 2012 Survey of Motor Vehicle Use

35 This study only considers crashes associated with a loss of control type manoeuvre and so is likely to be an underestimate.

36 http://ec.europa.eu/transport/roadsafety_library/publications/etac_final_report.pdf, p.40.

37 National Truck Accident Research Centre, 2011 Major Accident Investigation Report, p.18, available at http://www.nti.com.au/files/files/NTARC/2011MajorAccidentInvestigationReport_v10_WS1.pdf

38 D. Blower & P. Green (2009) Truck Mechanical Condition and Crashes in the Large Truck Crash Causation Study, The University of Michigan Transportation Research Institute March 31, 2009.

- Across all heavy vehicle combinations in NSW, 51.1 per cent were found to have a defect in 2012, with 6.8 per cent presenting with a major defect[39]. Assuming this pattern is consistent nationally, we can assume 51.1 per cent of heavy vehicles have a defect present (minor or major) and 6.8 per cent of heavy vehicles have a major defect present.
- Based on a US study of more than 15,000 truck crashes[40], brake defects increase the odds of a truck being the striking vehicle by 1.8 times for rear end and crosspath crashes. In this study, almost 55% of the vehicles had one or more mechanical violations (defects). In this study, and also in Australian data[41], about a third of defects are brake-related. We therefore assume that of those 51.1 percent of heavy vehicles with a defect, one third has a brake related defect, and that those vehicles are 1.8 times more likely to be involved in a crash than defect free vehicles.
- There is no data for the likelihood of vehicles with non-brake defects to have a crash, but we can assume that it is greater than for defect-free vehicles, and less likely than for vehicles with a brake defect. For the purposes of our study, we have assumed the remaining two thirds of non-brake defect vehicles are 1.2 times more likely to have a crash than defect free vehicles.
- To establish how much more likely a vehicles with brake and non-brake defects are to crash than vehicles without a defect, we weight 1.8 by the third of vehicles with a brake defect, and 1.2 by the two thirds of vehicles with a non-brake defect, to get an overall likelihood that a vehicle with a defect of any type is 1.4 times more likely to crash than a defect-free vehicle.

Given we know the rate of accidents is 58.1 per 1000, we can break this down between vehicles with defects and vehicles without defects, based on the number of vehicles with and without defects and their relative likelihood of having a crash.[42]

This suggests a crash risk of 67.5 per 1000 heavy vehicles with a defect present, as compared to 48.2 per 1000 heavy vehicles with no defects present (maintaining an overall average crash risk of 58.1 per 1000 heavy vehicles). This crash risk for heavy vehicles with a defect present can then be disaggregated into two components (Table 9).

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39 NSW HV Compliance Survey 2012, p. 11.

40 D. Blower & P. Green (2009) *Truck Mechanical Condition and Crashes in the Large Truck Crash Causation Study*, The University of Michigan Transportation Research Institute March 31, 2009.

41 NSW HV Compliance Survey 2012, p. 11.

42 Crash risk of a HV with no defects = Average crash risk of HV / (1.4 x proportion of HVs with defects + 1 x proportion of HVs with no defects); Crash risk of a HV with defects = 1.4 x (Crash risk of a HV with no defects).

Table 9: Attributing crash risk

Heavy vehicle characteristics	Crash risk (per 1000 vehicles)		
	Attributable to the presence of the defect(s)	Attributable to factors unrelated to defect	Total
Defect present	19.3	48.2	67.5
No defects present	-	48.2	48.2

Source: Frontier Economics analysis.

Based on the additional crash risk of 19.3 per 1000 for heavy vehicles with defects, this suggests that 17% of all crashes are related to the unroadworthiness of heavy vehicles. This value is in line with a Canadian study of heavy vehicle crashes[43] which found mechanical defects played a role in 30 of the 195 crashes studied (15.4%) — mechanical defects were judged as the exclusive cause in 18 crashes; high contribution in 12; and low contribution in four.

Based on the total cost estimate above, this suggests that the upper bound cost estimate of road crashes due to unroadworthiness in heavy vehicles has an NPV of $2.4 billion.

The costs associated with heavy vehicle breakdowns

A lack of roadworthiness can also result in breakdowns which cause delays and therefore impose congestion costs on other road users. These costs include time lost due to queuing in traffic or from reduced travel speeds, increased fuel costs, and social costs such as increased health costs resulting from additional local air pollution. There will also be some costs associated with clearing the broken down vehicle.

BITRE[44] has estimated the costs of crash-induced congestion and these are included in the estimated costs of heavy vehicle crashes in section 0.0.0 above. This required assumptions regarding the values for the 'time' of the people/traffic involved in the delay, the mix of the vehicles involved, and the flow of traffic for the road networks in the network.

The congestion related costs from heavy vehicle breakdowns can be estimated using the BITRE estimates of crash-induced congestion. Breakdowns most closely match the congestion impacts of a 'property-only crash' (rather than an

43 Gou, M., B. Clement, S. Birikundavyi, O. Bellavigna, and E. Abraham. 1999. Effect of heavy-vehicle mechanical condition of road safety in Quebec. Transportation Research Record (1686): 22-8.

44 BITRE (2009) *Cost of road crashes in Australia 2006*, Report 118

injury or fatal crash) since emergency vehicle do not respond which can cause further delays.

BITRE has estimated the combined delay, health and operating costs (borne by third parties) from heavy vehicle breakdowns (as proxied by property damage-only crashes) as between $9875 per event (in Melbourne and Sydney metropolitan areas) and $7520 per event in other capital city metropolitan areas in 2014 dollars[45]. These estimates are made up of the following:

- Travel delay cots of between $7100 per event in Melbourne and Sydney metropolitan areas, to $5400 per event in other capital city metropolitan areas (in 2006 dollars). BITRE notes that these estimated travel delay costs are likely to be conservative as the bottleneck model used to estimate travel delays does not capture the network congestion that occurs where a disruption affects a major road or intersection during peak periods. Also, delay costs vary significantly by time of day and day of week.
- Additional vehicle operating costs due to this travel delay as between $430 per event in Melbourne and Sydney metropolitan areas, to $330 per event in other capital city metropolitan areas (in 2006 dollars).
- Health costs of additional local air pollution from congestion from additional time queuing in traffic with the engine running as between $480 per event in Melbourne and Sydney metropolitan areas, to $370 per event in other capital city metropolitan areas (in 2006 dollars).

Table 10 presents data on the number of heavy vehicle breakdowns in metropolitan Sydney. By applying the estimated cost of a breakdown in Sydney ($9875) to the number of estimated breakdowns in 2014 this suggests heavy vehicle breakdowns impose costs of $44.4 million per year on other Sydney road users.

Table 10 Heavy vehicle breakdowns in Sydney for the period 2010 to 2014

Year	2010	2011	2012	2013	2014
Number of heavy vehicle breakdowns in Sydney	2977	3334	3926	4597	Approx 4500
Cost/yr ($ million)	29.4	32.9	38.8	45.4	44.4

Source: NSW data
Note: For the incomplete year of 2014, the total estimate is based on breakdowns to October (which are tracking somewhat below 2013 levels) scaled up to account for the two missing months.

45 The BITRE estimates in 2006 dollars were between $8010 per event in Melbourne and Sydney metropolitan areas, to $6100 per event in other capital city metropolitan areas. These estimates have been converted to 2014 dollars

This analysis can be extended Australia-wide (focussing on metropolitan areas) by applying the following assumptions:

- The number and cost of heavy vehicle breakdowns in rural and non-metropolitan areas has been ignored. The costs of breakdown related delays are unlikely to be as significant in these areas as the number of other road users affected is likely to be significantly lower. This assumption will make the presented estimates conservative.
- The number of breakdowns in Melbourne is assumed to be approximately equal to the number in Sydney, since both cities have roughly equal levels of freight activity (as proxied by heavy vehicle tonne kilometre movements). As discussed above, these breakdowns impose a cost of $9875 per event.
- The number of breakdowns in other metropolitan cities (as compared to breakdowns in Sydney and Melbourne) has been estimated by applying the ratio of the number of property damage crashes between these locations. As discussed above, these breakdowns are assumed to impose a cost of $7520 per event.

Given these assumptions, heavy vehicle breakdowns have been estimated to impose $232.3 million in costs on other road users in 2014. Table 11 presents data on the costs of heavy vehicle breakdowns in all Australian metropolitan cities.

We have assumed that this total cost of $232 million per annum can be attributed to heavy vehicle unroadworthiness, as by definition a vehicle that is broken down is unroadworthy.

Assuming this level of breakdowns remains constant over the study period, this represents an NPV of $1.7 billion.

It should be noted that this cost estimate excludes any expenses associated with clearing the broken down heavy vehicle.

Table 11 Heavy vehicle breakdowns in Sydney for the period 2010 to 2014

Year	2010	2011	2012	2013	2014
Total metro HV breakdowns	18569	20796	24488	28674	28068
Cost/yr ($ million)	153.7	172.1	202.6	237.3	232.3

Source: NSW data
Note: For the incomplete year of 2014, the total estimate is based on breakdowns to October (which are tracking somewhat below 2013 levels) scaled up to account for the two missing months.

4.5.2 Impact of different roadworthiness measures on the crash and breakdown risk

This section discusses the extent to which the roadworthiness-related crash risk (and hence cost) may be able to be changed as a consequence of changes in the approach to enforcement and compliance.

It is important to emphasise that what is sought is evidence of a causal connection linking the implementation of a particular compliance and enforcement measure to changes in crash risk (potentially via changes to vehicle maintenance practices) and a comparison of this causal connection with that of the counterfactual scenario — Option 1.

More specifically, setting aside compliance costs, it must be established whether and ideally to what extent:

- an increase in the number of scheduled inspections reduces the risk of defects and hence crashes
- inspections reduce the crash risk to a greater or lesser extent than accreditation
- scheduled inspections reduce the crash risk to a greater extent than or random/targeted inspections.

Establishing a causal connection between changes in enforcement and operator practices (that result from changes in the form of the compliance and enforcement system) is very difficult. However, the sections below consider these issues on both in-principle and empirical grounds.

Increase in the number of scheduled inspection

Setting aside administrative and compliance costs, a compliance and enforcement system that subjects a vehicle to more frequent inspections is likely to deliver more benefits, in terms of reduced defects and therefore reduced crash risk.

It could also be expected that the marginal benefit from increasing vehicle inspections would decline as these inspections become more frequent.

There is evidence to suggest that heavy vehicles subjected to scheduled inspections have fewer defects. NSW's most recent compliance survey shows that:

- There was a much lowest incidence of major defects for coaches (0%) and buses (0.8%) which are mostly subjected to twice yearly inspection when compared to road trains (6.9%), and rigid trucks (6.8%).
- There is a much lower incidence of defects in NSW registered freight hauling units. The overall rate of defects was 42.7% for NSW registered vehicles and 52.7% for interstate registered vehicles. This result was statistically

significant[46]. It also does not appear to be the result of differences in the vehicle composition of the sampled states' fleets — as interstate registered vehicles had higher rates of defects for rigid trucks, articulate trucks and B-doubles. The only exception was road trains where the defect rate was higher for NSW-registered road trains (however this result is based on an extremely small sample).[47]

We note that these differences could still be affected by the age profile of the heavy vehicles in the different state samples and that the sample size is limited. Therefore these results should be interpreted with caution.

It would seem reasonable to suggest that scheduled inspections have some positive effect on improving roadworthiness and therefore reducing the crash risk. The size of this effect is difficult to quantify with the available information.

Inspections vs. accreditation

Accreditation systems are based on the premise that the adoption of good preventative maintenance practices will lead to a reduced likelihood of heavy vehicles becoming defective in the first place and therefore to improved roadworthiness.

By comparison, inspections identify defects and then require operators to undertake corrective action thereby directly reducing the number of unroadworthy vehicles on the road. Importantly, inspections also indirectly reduce the number of unroadworthy vehicles on the road through deterrence and the threat of being caught.

These measures differ according to what is being monitored — in the case of accreditation the vehicle maintenance management system (input to achieving roadworthiness) and in the case of inspections observable defects (output).

There is limited evidence on the relative effectiveness of these different approaches (in terms of improving roadworthiness):

- A 2009 Austroads research study identified an association between accreditation system participation and better safety records.[48] However the report was unable authoritatively to conclude whether accreditation was the cause of these outcomes.
- The Queensland Department of Transport and Main Roads reports that it has collected data showing that vehicles in the NHVAS are generally more compliant on-road than other (non-NHVAS) vehicles inspected by TMR.

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46 χ^2=11.66, df=1, p=.0006 (RMS (2012) Heavy Vehicle Compliance Survey 2012, Final Report, p. 19)

47 RMS (2012) Heavy Vehicle Compliance Survey 2012, Final Report.

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However, this observation is acknowledged to be based on a small sample that has not been extensively tested against other criteria. Also, data from the NSW 2012 compliance survey does not support this finding.

There are mixed economic arguments as to whether inspections or accreditation will be more effective in improving heavy vehicle roadworthiness. For example, it could be argued that an inspection system most closely manages roadworthiness because it directly measures the roadworthiness of inspected vehicles.

However, accreditation regimes could be more effective in improving roadworthiness because of the following factors:

- Accreditation can play a role in teaching operators how to systematically manage aspects of their business in the interests of safety and in the interests of organisational efficiency. If the NHVR, because of their broad oversight of a number of operators, has better access to knowledge about what operators should do to reduce the risk of defects then this suggests there are likely to be benefits to focusing on accreditation.
- Changes to accreditation programs that include fleet sampling will directly measure roadworthiness of the sampled vehicles.
- There are limitations to the effectiveness of inspections:
  - An inspected vehicle will not necessarily be free from safety critical defects as an inspection may not identify all defects (i.e. rigour is dependent on the skill of the inspector and the inspection equipment used).
  - There is no guarantee that a defective vehicle will be inspected in random/targeted roadside inspections, or it may operate with defects between scheduled inspections.
  - Inspections usually result in limited penalties for operators and so are limited in their ability to encourage operator compliance.[49] Time off the road may be more costly than any infringement fine (where issued).

On both in-principle and empirical grounds it is difficult to conclude that either scheduled inspections or accreditation deliver greater benefits through their impact on the roadworthiness-related crash risks.

Effect of the type of inspection

In principle, there appear to be a number of factors that will affect the effectiveness of an inspection system.

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[49] In the context of roadworthiness it is difficult to impose large penalties on operator for a lack of roadworthiness as the cause of some defects are not necessarily in an operator's control or reflective of maintenance effort.

Firstly, approaches that focus inspections (be they scheduled or on-road) on vehicles that have a higher risk of defects will likely deliver more benefits in terms of reduced defects and therefore reduced crash risk. This is due to two effects:

- Successful targeting of inspections on higher defect-risk vehicles will detect more defects which presumably will be subsequently rectified, reducing the crash risk.
- Successful targeting also encourages operators to comply by creating an incentive to avoid being 'targeted' — operators who use heavy vehicles with a higher risk of defects will be more likely to be caught and issued with fines or defect notices. This would be expected to encourage them to undertake more appropriate maintenance to minimise the occurrence of defects.

Second, inspection systems that impose higher penalties for non-compliance (or when defects are identified) will provide a greater incentive to encourage operators to comply and so reduce the occurrence of defects. It could be argued that on-road inspections impose a higher penalty for operators as the opportunity costs, in terms of revenue foregone while the vehicle is off the road being inspected (and possibly repaired), will be higher when this has not been scheduled in advance. Unexpected inspections are more likely to impose scheduling difficulties when compared to scheduled inspections, as they have not been planned for, and so are more likely to result in lost revenue. Also, the costs associated with rectifying any identified defects may be higher as the availability of parts and expertise may be limited.

Finally it is possible that on-road inspections may be less effective than inspections conducted at a dedicated testing station. This may in part be due to occupational health and safety limitations on what can be practically inspected at the roadside. However, some stakeholders have suggested that the standard of an inspection is unrelated to the type of inspection (roadside or station). Rather, the important factor in the effectiveness of roadside inspections is the inspection tools and technology available.

We note there is no compelling evidence relating to these effects. However, on balance, these factors suggests that targeted inspections, irrespective of whether they are conducted at dedicated inspection facilities or at the road side, are more likely to deliver benefits in terms of reduced defects.

Putting this aside it is difficult to conclude whether roadside or scheduled inspections are more effective, on a per inspection basis.

4.6 Summary

This section has examined the key types of impacts that can be expected to result from implementing changes in the enforcement and compliance of roadworthiness standards.

Operator costs and regulators' administrative costs will be affected by:

- Wider application of scheduled inspections.
- Inspection of a sample of an accredited operator's fleet upon re-entry (under the NHVAS).
- Provision of information, education, and training on inspection process and procedures.

Benefits attributable to the change in roadworthiness are realised as avoided crash and congestion costs. It is estimated that, in 2014, the total cost of heavy vehicle crashes is in the order of $2 billion. Taking into account the observed declining trend in fatal heavy vehicle crashes, over the next 10 years heavy vehicle crashes is estimated to have an expected NPV cost of $14.2 billion.

Of this total cost, between $0.57 billion and $2.4 billion (NPV) can be attributed to road crashes due to heavy vehicle unroadworthiness.

In addition heavy vehicle breakdowns is estimated to imposed expected costs of $1.7 billion (NPV) on other users over the next 10 years — all of which can be attributed to heavy vehicle unroadworthiness.

Combining these to figures it is estimated that the NPV total cost of heavy vehicle crashes and breakdowns, attributable to heavy vehicle unroadworthiness is between $2.3 and $4.2 billion over the next 10 years.

It is possible that, even under the baseline, the crash and breakdown risk associated with unroadworthiness may decline over time. This is because we would expect improvements in road infrastructure and vehicle technology — which monitor various aspects of the vehicle and identify defects — to reduce roadworthiness-related risks over time. These changes can be expected to occur under the baseline and irrespective of which option might be implemented. The assumptions used include a 3.2% decline in fatal crashes, while other types of crashes and breakdown remain constant.

We find the following with respect to the impact of the approach to compliance and enforcement on roadworthiness-related safety risks:

- It is not possible to differentiate between the benefits delivered by an accreditation versus inspection regime in terms of the attributable impact they have on safety risks relative to the baseline.

- There is an argument to suggest that targeting inspections (whether conducted on the roadside or scheduled) on vehicles with a higher risk of defects will yield greater benefits than non-targeted inspections.

5 Summary of the assessment

In this section we provide an overview of the costs and benefits of the different options. We have focused on individual elements of the cost-benefit analysis that correspond to the categories of impacts set out in section 4 of this paper, and on data (whether quantitative or qualitative) that have allowed us to provide some indication or commentary on the magnitude and direction (positive or negative) of impacts.

The impacts for each option are summarised in tables. Blank cells indicate an absence of data.

5.1 Framework for assessment

The approach taken in this report is consistent with the requirements set out in the Australian Government Guide to Regulation, and more specifically the OBPR's guidance note for cost-benefit analysis.[50]

A challenge for this assessment is that it is difficult to establish whether differences between the options will lead to differences in risks associated with defect-related crashes and incidents, *relative to the baseline*, for several reasons.

First, it is difficult to establish a causal link between defects and heavy vehicle crashes, in isolation from other safety and non-safety factors. By extension, establishing a causal connection between changes in practices (that result from changes in the methods used to assess compliance) and changes in risk is even more difficult.

Second, there is limited evidence on the extent to which differences in the form of enforcement (specifically, between accreditation and inspection approaches) impact on defect-related risks.

For these reasons, the analysis primarily focuses on the costs associated with the implementation of the options. The resulting cost difference was then used to determine the reduction in crashes that would need to have been achieved to make each option of net benefit. We then considered whether the resulting differences in benefits between the options were likely on the basis of prima facie arguments.

Based on guidelines contained in the cost-benefit analysis guidance note[51], the following parameters have been adopted:

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50 Office of Best Practice Regulation (2014) *Cost-benefit analysis Guidance Note* , July 2014 & https://www.cuttingredtape.gov.au/sites/default/files/documents/australian_government_guide_regulation.pdf

51 OBPR (2014), Cost-benefit analysis guidance note, July 2014.

- An annual real discount rate of seven per cent for the central case in determining the net present value of different costs and benefits. A sensitivity analysis has been conducted which uses real discount rates of three and ten per cent respectively.
- A ten-year evaluation period has been adopted.
- The base year for presenting all prices is 2014.
- Any capital costs (for both the regulator and operators) associated with implementing the new policy are assumed to be incurred in 2014.

5.2 Option 2 – Non-regulatory Package

Table 12 presents an overview of the main impacts under this option.

The main quantifiable impact is an increase in the NHVR's administrative costs of $15.8m over the next 10 years. This would be associated with developing and implementing:

- the operational improvements to the NHVAS
- the education and training material for authorised officers, government and private sector vehicle inspectors, operators and drivers
- guidelines (possibly including the NHVIM) on inspection processes and procedures
- the national roadworthiness survey (baseline assessment).

The effect on operators' overall costs is uncertain. It is likely that the change proposed would increase operators' costs of rectifying any defects identified assuming the operational improvements to NHVAS and NHVIM result in more defects being identified. However there is also likely to be a reduction in operators' administrative costs as a result of the improved education and training material and the development of a consistent defect clearing process.

The main benefit expected from this option is a reduction in the crash risk from the operational improvements to NHVAS and NHVIM. These improvements are expected to increase the detection of safety critical defects and therefore reduce the crash risk.

Assuming the lower bound estimate of crash and breakdown costs due to heavy vehicle unroadworthiness of $2.4 billion (see section 0.0.0), this option only needs to reduce the incidence of heavy vehicle defects (and hence the crash risk associated with heavy vehicle unroadworthiness) by 0.3% in order for the benefits to outweigh the costs. This is not an unreasonable assumption. This suggests that this relatively low cost option is likely to generate net benefits.

Table 12 Summary assessment table for Option 2

Impact	Description	One-off	Ongoing	NPV (central estimate)
Operator costs of maintaining a compliant vehicle	- Impact uncertain assuming operational improvements to NHVAS and NHVIM result in more defects being identified. This may be offset by consistent defect clearing processes.			Unquantified
Operators' administrative compliance costs	- Reduction in operator administrative costs from improved education and training material			Unquantified
Regulators' administrative costs	- Operational improvements to the NHVAS - Increased monitoring of NHVAS auditors - Development of education and training material for authorised officers, operators and drivers - Development of NHVIM standardised inspection processes and procedures - Development of national roadworthiness survey (baseline assessment)	$14.1m[1] $1.7m[2]		$15.8m
Reduced crash and breakdown risk	- Reduced crash risk from operational improvements to NHVAS and NHVIM			Unquantified

[1] This estimate includes development and implementation costs of national consistency initiatives — review of NHVIM, more-standardised inspection types/procedures, competency standards for heavy vehicle inspectors, classifying defects and associated procedures for rectifying them, development of national criteria for roadworthiness and the National Authorised Vehicle Examiner scheme (estimate provided by NHVR).

[2] Cost to implement the national roadworthiness survey (baseline assessment).

5.3 Option 3 – Regulatory enablement of risk management

Table 14 provides an overview of the main impacts under Option 3.

The biggest impact is on operators' administrative compliance costs which either increase or decrease dramatically depending on how the risk-based approach to scheduled inspections is applied:

- For example option 3D removes scheduled inspections for all heavy vehicle operators except dangerous goods operators. This results in a saving of $3459m over a 10 year period.
- Option 3C assumes the regulatory changes result in an increase in the number of scheduled inspections conducted in states other than NSW and Queensland as a result of expanding inspections to include vehicles over 20 years of age and dangerous goods operators, while only reducing annual inspection in NSW, Queensland and the NT for vehicle still subject to scheduled maintenance by the manufacturer. This results in cost of $1423m over a 10 year period.

The specific details of the risk-based approach to scheduled inspections also affect the administrative costs for the NHVR.

Table 13 presents the net present value of the costs or savings associated with the different sub-options (i.e. approaches to implementing Option 3). The net present value of the total quantified costs/benefits associated with this Option is between $3459m in savings to $1423m in cost over the next 10 years. This highlights how sensitive Option 3 is to the assumptions around the expected increase/decrease in the number of inspections.

Table 13 Net present value of the total costs or cost reductions associated with the different approaches to implementing Option 3

Sub Option	NPV ($m) over 10years
3A – Scheduled inspections of heavy vehicles over 20 year of age only	Savings of $804m
3B - Scheduled inspections of heavy vehicles over 15 year of age only	Costs of $229m
3C–Annual inspections with some exemptions in NSW, QLD and NT and inspections of dangerous goods vehicles over 20 year of age in other states	Costs of $1423m
3D – Scheduled inspections of dangerous good vehicles only	Savings of $3459m
3E – Scheduled inspections of dangerous good vehicles and those with poor compliance records	Savings of $2881m

The link between scheduled inspections and their effect on roadworthiness is uncertain, but is assumed to be positive (i.e. more regular inspections can be expected to lead to increased levels of roadworthiness).

Option 3C is the only sub-option that significantly increases the number of scheduled inspections and has expected costs (of $1.3b NPV). This is because it largely envisages an expansion of scheduled inspections outside those jurisdictions that already impose annual inspections. Interestingly, a further option was considered that proposed moving to annual inspections of all vehicles over 10 years of age across Australia. This resulted in a very similar number of inspections to Option 3C and therefore a very similar cost. Under both these scenarios the costs are still less than the lower bound of the potential benefits in terms of reduced crash and breakdown risk — $2.3 billion (see section 0.0.0). This means it is feasible that Option 3C will deliver net benefits.

The critical question is "to what extent could annual inspections of high risk vehicles prevent unroadworthiness and hence reduce the costs of crashes associated with defects?"

This will depend on how well targeted the inspections are, and therefore how many defects can be rectified. For example, if we make the assumptions that the additional annual inspections are imposed on older vehicles; older vehicles in the fleet contain 60% of the defects in the fleet and biennial inspections of these vehicles reduces the presence of defects by 60%, then inspecting these vehicles would reduce the roadworthiness related crash risk by 36%. This would equate to a NPV benefit, in terms of reduced crash and breakdown costs, of between $0.8–1.5 billion.

Under these assumptions even the most expensive sub-option, Option 3C would potentially deliver net benefits. Figure 4 further illustrates how these assumptions affect the benefits derived from Option 3. The pink highlighted areas represent the set of assumptions which would result in the annualised cost of Option 3C being within the range of anticipated benefits.

Figure 4 Reduced crash risk benefit associated with different assumptions around defect reductions across the fleet

% of defects in fleet/ % addressed through inspection	20%	40%	60%	80%	100%
20%	$0.1-0.2b	$0.2-0.3b	$0.3-0.5b	$0.4-0.7b	$0.5-0.8b
40%	$0.2-0.3b	$0.4-0.7b	$0.6-1b	$0.7-1.3b	$0.9-1.7b
60%	$0.3-0.5b	$0.6-1b	$0.8-1.5b	$1.1-2b	$1.4-2.5b

% of defects in fleet/ % addressed through inspection	20%	40%	60%	80%	100%
80%	$0.4-0.7b	$0.7-1.3b	$1.1-2b	$1.5-2.7b	$1.9-3.3b
100%	$0.5-0.8b	$0.9-1.7b	$1.4-2.5b	$1.9-3.3b	$2.3-4.2b

It is worth highlighting that the regulatory changes proposed in Option 3 (in particular the move to a risk-based approach to applying scheduled inspections) do not necessarily need to result in more scheduled inspections. Indeed sub-option 3A, D and E all assume the number of inspections reduces. This may have safety implications but the magnitude of the safety consequences would depend on the extent to which inspections of low risk vehicles delivers improved compliance. If there is minimal benefit (in terms of improved roadworthiness) from inspecting these vehicles there will be minimal impact on the crash and breakdown risk.

A better way of assessing this may be to suggest that Option 3 allows existing inspection resources to be redeployed and retargeted. For example, the number of inspections relative to the baseline would be increased for heavy vehicles with a higher likelihood of, or consequence from, having a safety critical defect and fewer inspections would be conducted on heavy vehicles at lower risk. Option 3B demonstrates one way this could be achieved. By inspecting all vehicles over 15 years of age roughly the same number of inspections would be conducted across Australia, albeit with significant changes at a state level. The cost of this option is estimated to be only $229m (NPV).

In this way Option 3 could deliver a higher level of compliance when compared to the baseline (Option 1), but with no change in the number of inspections conducted overall and therefore minimal incremental costs.

Table 14 Summary assessment of significant impacts for Option 3

Impact	Description	One-off	Ongoing (pa)	NPV	NPV
Operator costs of maintaining a compliant vehicle	- Likely increase assuming increased use of scheduled inspections, improvements to NHVAS and NHVIM that result in more defects being identified. This will be partially offset by consistent defect clearing processes.			unquantified	unquantified
Operators' administrative compliance costs	- Risk-based approach to imposing scheduled inspections		Varies between $531m pa in benefits to $201m pa in costs[1]	$3462m in benefits to 1309m in cost	**$3324m in benefits to $1346m in costs** (under Option 3D and Option 3C)
	- Inspections of a sample of an accredited operators fleet on re-entry[2] and increase in voluntary accreditation[3]	$7.9m[4]	Varies between $1.8m pa to $21m pa[5]	$37 -138m	
	- Reduction in operator administrative costs from improved education and training material.			Unquantified	

Impact	Description	One-off	Ongoing (pa)	NPV	NPV
Regulators' administrative costs	- Risk-based approach to imposing scheduled inspections		$24m pa in benefits to $9.2m pa in costs[6]	$158m in savings to $60m in costs	**$135m in savings to $77m in costs** (under Option 3D and Option 3C)
	- Sample inspections upon re-entry - increase in voluntary accreditation (under 3C) - Development of education and training material, guidelines on inspection processes (as per option 2) and additional data collection and analysis.	$0.3m $0.2m[7] $17.0m[8]	Varies between $0.02m pa in savings to $1m pa in costs[9]	$8m to $14m in costs	
Reduced crash and breakdown risk	- Reduction in crash risk expected from additional targeted scheduled inspections for high risk operators - Small reduction in crash risk from improvements to NHVAS and NHVIM - Additional reduction expected from CoR provisions				unquantified

Option 3D generates a savings as it assumes that only vehicles carrying dangerous goods are now subject to annual inspections. This reduces the number of vehicles in Australia subject to inspections by approximately 70%. This equates to 242,220 fewer inspections per annum. Option 3C results in additional cost as it assumes annual inspections are imposed on dangerous goods vehicles and vehicles over 20 years old in states that do not currently have annual inspections. This results in an additional 91,598 inspections per annum. The cost of an inspection under the medium case is assumed to be $2194 per vehicle under both sub options.

2 Undertaking inspections on a sample of an accredited operator's fleet at re-entry is assumed to result in an increase of 9663 vehicles being inspected under all sub-options (based on analysis provided by the NTC).

3 An expansion of annual inspections (under Option 3C) is expected to increase the number of operators seeking voluntary accreditation. This is assumed to result in an increase of 315 operators being accredited. This is based on the assumptions that a) 12% of the vehicles now subject to scheduled inspection seek accreditation. This is based on the difference in accreditation rates between VIC, TAS and SA and NSW, NT and Queensland b) this increases the number of vehicles that are part of the accreditation system by 10,992 c) Each operator is assumed to have 35 vehicles (based on the average number. of vehicles per operator for those currently in the NHVAS.

4 Associated with the costs of developing and implementing compliant processes and procedures for newly accredited operators under Option 3C. This is assumed to require $25k per operator and be incurred in 2015-16.

5 The range relates to the cost of undertaking inspections on a sample of the accredited fleet under Option 3A, D and E and the increase in voluntary accreditation under option 3C. In both cases the ongoing costs of an inspection is $2194. Approximately 10% of the accredited fleet is assumed to be audited in any one year. Under option 3C all volunteering operators are assumed to be subject to annual inspection and so by virtue of participating there are cost savings associated with the reduction in scheduled inspections.

6 Option 3D generates a savings as it assumes that only vehicles carrying dangerous goods are now subject to annual inspections. This reduces the number of vehicles in Australia subject to inspections by approximately 70%. This equates to 242,220 fewer inspections per annum. Option 3C results in additional cost as it assumes annual inspections are imposed on dangerous goods vehicles and vehicles over 20 years old in states that do not currently have annual inspections. This results in an additional 91,598 inspections per annum. The administrative cost associated with an inspection is assumed to be $100 per vehicle under both sub options.

7 Additional costs for Option 3C associated with auditing operators' processes and procedures as a result of increase in voluntary participation in accreditation under this option. This is assumed to take 1 FTE 1.5 days to complete this task for the 315 additional participating operators. Salary estimates provided by the NHVR.

8 Based on the costs in Option 2 plus additional $1.2m for data collection and analysis to enable risk criteria (estimate provided by NHVR).

9 Frontier estimate of the ongoing costs of inspecting a sample of accredited vehicles upon re-entry and given increase in voluntary accreditation. The range relates to the cost of sample inspections under Option 3A, 3D and 3E and the increase in voluntary accreditation under option 3C. In both cases the ongoing costs are based on an assumed vehicle inspection administrative cost of $100. Approximately 10% of the accredited fleet is assumed to be audited in any one year. Under option 3C all volunteering operators are assumed to be subject to annual inspection and so by virtue of participating there are cost savings associated with the reduction in scheduled inspections.

5.4 Option 4 – More prescriptive regulatory measures

Table 15 provides an overview of the main impacts under Option 4.

As with Option 3 the biggest impact is on operators' administrative compliance costs which increase as a result of the assumption that the regulatory changes result in all heavy vehicles being subjected to scheduled inspections.

This change also imposes additional administrative costs on the NHVR.

The net present value of the total quantified costs associated with this option is $5,511m over the next 10 years.

The link between extensive scheduled inspecting and the impact on roadworthiness is uncertain (see section 4.5.2), but likely to be positive (more regular inspections can be expected to lead to increased levels of roadworthiness).

Option 4 has expected costs that exceed the upper bound of the potential benefits in terms of the reduced crash and breakdown risk ($2.4 –4.2 billion NPV). This analysis suggests that it is not feasible that Option 4 would deliver net benefits.

This option proposes including in legislative instruments standardised inspection practices and procedures. While this is more likely to lead to a consistent national approach (when compared to including standard approaches in unenforceable guidelines) it is only likely to reduce costs when consistency is efficient (i.e. if the standard applied does not, in and of itself, create unnecessary costs). There seems to be a number of ways this could happen:

- First, over-prescription could prevent inspectors from considering all the relevant circumstance, such as the weather when determining the criticality of a defect.
- Second, over-prescription could make it difficult to vary standard procedures and process in the face of change. For example improvements in vehicle technology — which monitor various aspects of the vehicle and identify defects — could reduce the need for inspections to assess certain aspects of vehicle roadworthiness over time.

Table 15 Summary assessment table for Option 4

Impact	Description	One-off	Ongoing	NPV (central estimate)	NPV (central estimate)
Operator costs of maintaining a compliant vehicle	- Likely increase assuming increased use of scheduled inspections, improvements to NHVAS and NHVIM result in more defects being identified. This will be partially offset by consistent defect clearing processes.				unquantified
Operators' administrative compliance costs	- Increase in use of scheduled inspections		$837m pa[1]	$5453m	**$5258**
	- Increase in voluntary accreditation[2] and sample inspections for accredited operators.	$26m[3]	$43m benefit pa[4]	($195m) benefit	
	- Reduction in operator administrative costs from improved education and training material.			unquantified	

Impact	Description	One-off	Ongoing	NPV (central estimate)	NPV (central estimate)
Regulators' administrative costs	- Increased number of scheduled inspections		$38m pa[5]	$249m	**$253m**
	- Increase in voluntary accreditation, - Sample inspections upon re-entry - Development of education and training material, guidelines on inspection processes (as per option 2)	$0.5m[6] $0.3m +$15.8m[8]	$2.3m benefits pa[9]	($3.9m) benefit	
Reduced crash risk	- Reduction in crash risk expected from additional scheduled inspections - Small reduction in crash risk from improvements to NHVAS and NHVIM - Additional reduction expected from CoR provisions				unquantified

Assumes that all vehicles, in States that do not currently have annual inspections, are now subjected to annual inspections. This equates to an additional 381,469 vehicles per annum. The cost of an inspection under the medium case is assumed to be $2194 per vehicle.

2 The expansion of annual inspections is expected to increase the number of operators seeking voluntary accreditation. This is assumed to result in an increase of 1036 operators being accredited. This is based on the assumptions that a) the accreditation rate in VIC and TAS increases by 12% to a level consistent with the NSW and QLD average (22%) b) this increases the number of vehicles that are part of the accreditation system by 36152 c) Each operator is assumed to have 35 vehicles (based on the average number. of vehicles per operator for those currently in the NHVAS.

3 Associated with the costs of developing and implementing compliant process and procedure. This is assumed to cost $25,000 per newly accredited operator and be incurred in 2015-16.

4 This cost is associated with undertaking inspections on a sample of the accredited fleet and the increase in voluntary accreditation. In both cases the ongoing costs of complying with fleet sampling requirements are based on an assumed vehicle inspection cost of $2194. Approximately 10% of the accredited fleet is assumed to be inspected in any one year. Under option 4 all volunteering operators are assumed to be subject to annual inspections and so by virtue of participating there are cost savings associated with the reduction in scheduled inspections. The analysis assumes the cost saving from an avoided inspection is $2194. In addition there are other ongoing costs associated with staff training are assumed to be $7000 per operator.

5 Assumes that all vehicles, in states that do not currently have annual inspections, are now subjected to annual inspections. This equates to an additional 169,542 per annum. The administrative cost of an inspection under the medium case is assumed to be $100 per vehicle.

6 Additional costs associated with auditing operators' processes and procedures as a result of the increase in voluntary accreditation. Have assumed this takes 1 FTE 1.5 days to complete this task for the 1036 additional operators in the scheme. Salary estimates provided by the NHVR.

7 Based on the costs in Option 2 associated with development and implementation of the compliance and surveillance strategy etc. This estimate has been provided b the NHVR (W Sladen, pers. comm., 23 Dec 2014) and RMS.

8 Frontier estimate of the ongoing costs of inspecting accredited vehicles upon re-entry and given the increase in voluntary accreditation. In both cases the ongoing costs are based on an assumed vehicle inspection administrative cost of $100. Approximately 10% of the accredited fleet is assumed to be audited in any one year. Under option 4 all volunteering operators are assumed to be subject to annual inspection and so by virtue of participating there are cost savings associated with the reduction in scheduled inspections.

5.5 Composite Option – A suite of measures from Options 2, 3 and 4

Table 18 provides an overview of the main impacts under the Composite Option.

As with Option 3 the biggest impact of the Composite Option is on operators' administrative compliance costs which either increase or decrease dramatically depending on how the risk-based approach to scheduled inspections is applied. The specific detail of the risk-based approach to scheduled inspections also affects the administrative costs for the NHV:

- Analogous with Option 3, option CO-D removes schedule inspections for all heavy vehicle operators except dangerous goods operators and this results in a saving of $3459m over a 10 year period.
- Option CO-C assumes the regulatory changes result in an increase in the number of scheduled inspections conducted in states other than NSW and Queensland as a result of expanding inspections to include vehicles over 20 years of age and dangerous goods operators, while only reducing annual inspection in NSW, Queensland and the NT for vehicle still subject to scheduled maintenance by the manufacturer. This results in cost of $1423m over a 10 year period.

Table 16 presents the net present value of the costs or savings associated with the different sub-options. The net present value of the total quantified costs/benefits associated with the Composite Option is between $3459m in savings to $1423m in cost over the next 10 years. This highlights how sensitive this option is to the assumptions around the expected increase/decrease in the number of inspections.

Table 16 Net present value of the total costs or cost reductions associated with the different scenarios of the Composite Option

Sub Option	NPV ($m) over 10years
CO-A — Scheduled inspections of heavy vehicles over 20 year of age only	Savings of $804m
CO-B — Scheduled inspections of heavy vehicles over 15 year of age only	Costs of $229m
CO-C — Annual inspections with some exemptions in NSW, QLD and NT and inspections of dangerous goods vehicles over 20 year of age in other states	Costs of $1423m
CO-D — Scheduled inspections of dangerous good vehicles only	Savings of $3459m
CO-E — Scheduled inspections of dangerous good vehicles and those with poor compliance records	Savings of $2881m

As discussed in section 5.3, the best way to assess this option (given the possible variation in scenario outcomes) may be to suggest that the Composite Option allows existing inspection resources to be redeployed and retargeted. For example, the number of inspections relative to the baseline would be increased for heavy vehicles with a higher likelihood of, or consequence from, having a safety critical defect and fewer inspections would be conducted on heavy vehicles at lower risk. Option CO-B demonstrates one way this could be achieved. By inspecting all vehicles over 15 years of age roughly the same number of inspections would be conducted across Australia albeit with significant changes at a state level. The cost of this option is estimated to be $229m (NPV).

As compared with Option 3B (which had a similar expected cost of inspected vehicles meeting the criteria) the potential benefits from the Composite Option are greater because the NTC consider that the other aspects of the Composite Option will contribute to greater compliance because of a better integration with industry and service providers to manage roadworthiness (Table 17).

Table 17 Comparing elements of the Composite Option to Option 3

	Composite Option	Option 3
NHVIM and associated material	Implemented as guidance only	Referenced in the HVNL
Inspections	Risk-based approach	Risk-based approach
CoR	Primary duty	Specific duty

Table 18 Summary assessment table for the Composite Option

Impact	Description	One-off	Ongoing	NPV (central estimate)	NPV (central estimate)
Operator costs of maintaining a compliant vehicle	- Likely increase assuming increased use of scheduled inspections, improvements to NHVAS and NHVIM result in more defects being identified. This will be partially offset by consistent defect clearing processes.				unquantified
Operators' administrative compliance costs	- Risk-based approach to imposing scheduled inspections		Varies between $531m pa in benefits to $201m pa in costs[1]	$3462m in benefits to 1309m in cost	**$3324m in benefits to $1346m in costs** (under Option CO-D and Option CO-C)
	- Inspections of a sample of an accredited operators fleet on re-entry[2] and increase in voluntary accreditation[3]	$7.9m[4]	Varies between $1.8m pa to $21m pa[5]	$37 -138m	

Impact	Description	One-off	Ongoing	NPV (central estimate)	NPV (central estimate)
	- Reduction in operator administrative costs from improved education and training material.			unquantified	
Regulators' administrative costs	- Risk-based approach to imposing scheduled inspections		$24m pa in benefits to $9.2m pa in costs[6]	$158m in savings to $60m in costs	**$135m in savings to $77m in costs** (under Option CO-D and Option CO-C)
	- Sample inspections upon re-entry - increase in voluntary accreditation (under CO-C) - Development of education and training material, guidelines on inspection processes (as per option 2) and additional data collection and analysis.	$0.3m $0.2m[7] $17.0m[8]	Varies between $0.02m pa in savings to $1m pa in costs[9]	$8m to $14m in costs	

Impact	Description	One-off	Ongoing	NPV (central estimate)	NPV (central estimate)
Reduced crash risk	- Reduction in crash risk expected from additional targeted scheduled inspections for high risk operators - Small reduction in crash risk expected from improvements to NHVAS and NHVIM - Additional reduction expected from CoR provisions				unquantified

Option CO-D generates a savings as it assumes that only vehicles carrying dangerous goods are now subject to annual inspections. This reduces the number of vehicles in Australia subject to inspections by approximately 70%. This equates to 242,220 fewer inspections per annum. Option CO-C results in additional cost as it assumes annual inspections are imposed on dangerous goods vehicles and vehicles over 20 years old in states that do not currently have annual inspections. This results in an additional 91,598 inspections per annum. The cost of an inspection under the medium case is assumed to be $2194 per vehicle under both sub-options.

2 Undertaking inspections on a sample of an accredited operator's fleet at re-entry is assumed to result in an increase of 9663 vehicles being inspected under all sub-options (based on analysis provided by the NTC).

3 An expansion of annual inspections (under Option CO-C) is expected to increase the number of operators seeking voluntary accreditation. This is assumed to result in an increase of 315 operators being accredited. This is based on the assumptions that a) 12% of the vehicles now subject to scheduled inspection seek accreditation. This is based on the difference in accreditation rates between VIC, TAS and SA and NSW, NT and Queensland b) this increases the number of vehicles that are part of the accreditation system by 10,992 c) Each operator is assumed to have 35 vehicles (based on the average number. of vehicles per operator for those currently in the NHVAS.

4 Associated with the costs of developing and implementing compliant processes and procedures for newly accredited operators under Option CO-C. This is assumed to require $25k per operator and be incurred in 2015-16.

5 The range relates to the cost of undertaking inspections on a sample of the accredited fleet under Option CO-A, CO-D and CO-E and the increase in voluntary accreditation under option CO-C. In both cases the ongoing costs of an inspection is $2194. Approximately 10% of the accredited fleet is assumed to be audited in any one year. Under option CO-C all volunteering operators are assumed to be subject to annual inspection and so by virtue of participating there are cost savings associated with the reduction in scheduled inspections.

6 Option CO-D generates a savings as it assumes that only vehicles carrying dangerous goods are now subject to annual inspections. This reduces the number of vehicles in Australia subject to inspections by approximately 70%. This equates to 242,220 fewer inspections per annum. Option CO-C results in additional cost as it assumes annual inspections are imposed on dangerous goods vehicles and vehicles over 20 years old in states that do not currently have annual inspections. This results in an additional 91,598 inspections per annum. The administrative cost associated with an inspection is assumed to be $100 per vehicle under both sub-options.

7 Additional costs for Option CO-C associated with auditing operators' processes and procedures as a result of increase in voluntary participation in accreditation under this option. This is assumed to take 1 FTE 1.5 days to complete this task for the 315 additional participating operators. Salary estimates provided by the NHVR.

8 Based on the costs in Option 2 plus additional $1.2m for data collection and analysis to enable risk criteria (estimate provided by NHVR).

9 Frontier estimate of the ongoing costs of inspecting a sample of accredited vehicles upon re-entry and given increase in voluntary accreditation. The range relates to the cost of sample inspections under Option CO-A, CO-D and CO-E and the increase in voluntary accreditation under option CO-C. In both cases the ongoing costs are based on an assumed vehicle inspection administrative cost of $100. Approximately 10% of the accredited fleet is assumed to be audited in any one year. Under option CO-C all volunteering operators are assumed to be subject to annual inspection and so by virtue of participating there are cost savings associated with the reduction in scheduled inspections.

5.6 Comparative assessment of options against the baseline

We draw on the analysis presented in the preceding sections to establish a ranking across the different options. The paucity of data precludes us from establishing a ranking based entirely on the net present value of the net benefits associated with each option. Instead we draw on available information and data to establish, for each category of impact, relative option rankings.

The results are reported in Table 19. We have assigned positive ranking (+) to options with a favourable impact relative to the baseline, (0) to impacts equal to or indistinguishable from the baseline, and negative ranking (–) to options with an unfavourable impact.

Table 19: Comparative ranking of options

Cost type	Option 1	Option 2	Option 3	Option 4	Composite Option
Operator costs of rectifying non-compliance	0	0	–	– –	–
Operators' administrative costs	0	+	+ + / – ($3324m in benefits to 1346m in costs)	– – – ($5,258m)	+ + / – ($3324m in benefits to 1346m in costs)
Regulators' administrative costs	0	0 ($15.8m)	0 ($135m in savings to $77m in costs)	– – ($253m)	0 ($135m in savings to $77m in costs)
Crash and breakdown risk reduction benefits	0	+	+ +	+ + + +	+ + +
Likely to deliver net benefits	0	YES	YES (depending on implementation)	NO	YES (depending on implementation)

Because of data constraints, the overall rankings are unweighted — each impact category is treated as equal. In practice, this may not be the case; indeed, it is plausible to suggest that the reduced crash risk should be assigned the greatest weight. In any case this would not affect the overall rankings that align with the rankings for this cost category.

The net benefits associated with the Composite Option are expected to be greater than for Option 3 because:

- The costs of the Composite Option are expected to be the same as the costs for Option 3. This is because the major cost drivers are the same — primarily the development and implementation of national consistency initiatives and the risk-based approach to scheduled inspections.
- The benefits of the Composite Option are expected to be potentially greater than for Option 3. This is because the elements of difference — namely the guidance approach to national consistency and the primary CoR duty in the Composite Option — are expected to better integrate with industry and service providers to manage roadworthiness.

The rankings suggest that either Option 2 or the Composite Option is the preferred option. Given these options are likely to be of net benefit they are also preferable to doing nothing (Option 1).

It is worth reiterating here that the regulatory changes proposed in Option 3 and the Composite Option allow for greater flexibility in employing scheduled inspections. This enables existing resources to be redeployed and retargeted. For example, there could be an increase in the number of inspections relative to the baseline for heavy vehicles with a higher likelihood of, or consequence from, having a safety critical defect, and fewer inspections for heavy vehicles at lower risk. In this way the Composite Option would deliver a higher level of compliance when compared to the baseline (Option 1) and Option 2, but with no change in the number of inspections conducted overall and, therefore, very limited cost impacts. Under this scenario, the Composite Option would be preferred to Option 2.

It should be noted that if the Composite Option (or Option 3) is implemented in a way that involves significant additional cost (as a result of significantly increased inspection effort) it would be less preferable than either Option 1 or Option 2.

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