REPORT OUTLINE

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Address: National Transport Commission
Level 15/628 Bourke Street
MELBOURNE VIC 3000

E-mail: ntc@ntc.gov.au
Website: www.ntc.gov.au

Type of report: Feasibility Review

Objectives: This report directly addresses the Council of Australian Governments (COAG) request to undertake a review of the feasibility of incremental pricing schemes (taking into account trials) by December 2008 as part of phase one of the COAG road reform plan (2007).

NTC Programs: Pricing, Productivity

Key Milestones:
Circulation to Transport Agency Chief Executives 20 November 2008

Provided to the Australian Transport Council 23 December 2008

Release for public consultation 16 January 2009

Abstract: The development of an incremental pricing scheme has the potential to provide productivity benefits for the road transport industry and the overall economy. Industry consultation, including a broad survey, has shown reasonably strong interest from transport operators in accessing additional mass. This report outlines the principles and options for the different components of an incremental pricing scheme and discusses the feasibility of different options with reference to the progress of state governments in conducting trials and a similar international scheme.

Key words: Incremental pricing scheme, road pricing, heavy vehicle charges, mass limits, performance based standards.

Purpose: For public consultation.
FOREWORD

The National Transport Commission (NTC) is an independent body established under Commonwealth legislation and an intergovernmental agreement to develop regulatory and operational reform for road, rail and intermodal transport.

Transport is a key component of the Australian economy. Improved transport productivity can have a significant impact on the cost of freight and, ultimately, the cost to consumers for goods and services. With this in mind, the Council of Australian Governments (COAG) on 13 April 2007 clearly set out an agenda for road infrastructure pricing reform to unlock more productivity from the road network and deliver more efficient pricing and investment through a market based approach.

One of the key first steps in this agenda is to investigate the potential for the development of a scheme that would enable heavy vehicles, such as trucks and buses, to pay an “incremental charge” to operate at mass levels higher than the current regulated limits. This concept has become known as “incremental pricing” and has the potential to increase productivity by allowing transport operators to move the same amount of product with fewer trips. This could be beneficial on both major roads and for the “first mile” or “last mile” in the supply chain, where existing mass limits can have large impacts on the efficiency of a supply chain. COAG outlined that the first phase in the development of a potential scheme should involve an investigation of the feasibility of incremental pricing schemes, taking into account incremental pricing trials, which are to be undertaken by state governments.

This report is a first step in the potential development of a national incremental pricing scheme and outlines guiding principles and possible options for developing such a scheme. These options and potential feasibility issues with different options are discussed with reference to the progress of state governments in conducting trials and a similar international scheme. Ultimately, incremental pricing is an early step in the COAG agenda towards a comprehensive scheme under which the base charges (registration and fuel based charges) may be replaced by mass-distance location based charges.

In this context, NTC is seeking public comment on the feasibility report. In particular, comments are invited in relation to the following:

1. The suitability of the guiding principles for an incremental pricing scheme
2. The feasibility of the options outlined in the report for developing the different components of an incremental pricing scheme
3. The preferred option(s) of each scheme component discussed in the report and the reasons why some options may be preferred to others
4. Whether different options are better suited to different supply chains or transport movements

The preferred options will form the basis for the development of an incremental pricing scheme model. This will be subject to a regulatory impact statement, which is planned to be completed by end of 2009.
The NTC acknowledges the work of Meena Naidu, Matthew Clarke, Mark Crosher, Tania Wilson, Emily Porter, Ray Hassall, Sander Jansen and Annabelle Ong in preparing this report.

Greg Martin
Chairman

Submissions to the Incremental Pricing Scheme Feasibility Report will be accepted until 27 February 2009. These can be made online at www.ntc.gov.au or by mail to:

Chief Executive
National Transport Commission
15/628 Bourke St
Melbourne 3000

NTC will also be holding workshops on the report in late February/early March 2009. If you wish to participate in these workshops or would like more information about the report please contact Matthew Clarke, Senior Manager Economics on (03) 9236 5028.
SUMMARY

Background and objectives of an incremental pricing scheme

The Council of Australian Governments (COAG) has outlined a plan for the development of an incremental pricing scheme, should it prove to be feasible, which is part of a broad reform agenda for road infrastructure pricing and investment. This reform plan is well aligned with the objectives and principles in the new National Transport Policy Framework approved by Transport Ministers in 2008, which forms the basis for the next wave of national transport reform.

An incremental pricing scheme will establish a base mass limit which reflects what operators pay for under the current charging scheme. Operators would then be charged an additional amount based on the extra road wear caused by carrying mass above the base mass limit.

This would be an important first step towards the potential development of a comprehensive mass-distance location-based (MDL) charging scheme, which could replace the charges under the current charging scheme (that is, registration and fuel charges) with a charge for road use based on the mass of the truck as it travels, the distance travelled and the location of the road use. Just like an incremental pricing scheme, the development of a comprehensive mass distance location-based scheme will require the benefits to clearly outweigh the costs in moving to such a scheme.

An incremental pricing scheme should deliver improved productivity through higher payloads per trip and allow transport operators to make more optimal economic decisions around the appropriate mass load taking into account road wear and damage. Therefore, in terms of the National Transport Policy Framework, incremental pricing should lead to a more efficient movement of goods across the nation and more optimal use of the road infrastructure. In addition, an incremental pricing scheme would be based on full cost recovery of the additional road wear and costs associated with higher loads which would contribute to effective competitive neutrality between road and rail. This is consistent with improving productivity in both road and rail in a way that is supported by efficient pricing and investment outcomes.

Industry interest in incremental pricing

In mid-2008, NTC commissioned a survey to assess the level of interest in incremental pricing among businesses (both operators and non-operators) in the road freight transport industry. This survey showed reasonably strong interest in carrying mass additional to current limits and broad interest across all vehicle types and regions of Australia. It also showed a large proportion of the current vehicle fleet is operating at or near the current mass limits.

Guiding principles and options of a scheme

There are a number of components of an incremental pricing scheme (Figure ES1). These components relate to: entry considerations; charging; and fee collection and road spending, which would each be established under a legal framework. This document outlines the guiding principles for each component, options for each component as well as outlining a preliminary assessment of the feasibility of different options where appropriate. A summary of the guiding principles is presented in Table ES1.
Figure ES1: Components of an incremental pricing scheme

Table ES1. Summary of guiding principles

<table>
<thead>
<tr>
<th>Component</th>
<th>Summary of Guiding Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Assessment</td>
<td>▪ Nationally consistent process using Performance Based Standards (PBS) for safety</td>
</tr>
<tr>
<td>Infrastructure Assessment</td>
<td>▪ Access up to maximum road infrastructure capacity</td>
</tr>
<tr>
<td>and Route Definition</td>
<td>▪ Nationally consistent outcomes</td>
</tr>
<tr>
<td>Pricing and Monitoring System</td>
<td>▪ Efficient, nationally consistent and simple</td>
</tr>
<tr>
<td></td>
<td>▪ Align with the applicable current charging system (currently PAYGO(^1))</td>
</tr>
<tr>
<td></td>
<td>▪ Monitoring of mass, distance and location</td>
</tr>
<tr>
<td></td>
<td>▪ Privacy (aligned with same controls as current Intelligent Access Program process)</td>
</tr>
<tr>
<td>Fee Calculation and Collection</td>
<td>▪ Accurate and timely</td>
</tr>
<tr>
<td></td>
<td>▪ Transport operator friendly</td>
</tr>
<tr>
<td></td>
<td>▪ Scalable and flexible structure</td>
</tr>
<tr>
<td></td>
<td>▪ Effective debt management</td>
</tr>
<tr>
<td>Funds Distribution</td>
<td>▪ Funds directed back to road infrastructure service provider</td>
</tr>
<tr>
<td>Road Spending</td>
<td>▪ Road spending to ensure service level</td>
</tr>
</tbody>
</table>

\(^1\) PAYGO refers to the current approach to setting heavy vehicle charges (registration and fuel charges) which involves establishing a PAYGO (Pay-As-You-GO) cost base. This cost base is based on estimating the annual cost of road service provision through the collection of historic expenditure data for the whole road network across Australia.
There are a number of options that can be considered for each of these components. The options have been developed in consultation with a wide range of stakeholders, including industry, customers and governments. The options have also been explored with reference to the progress of state governments in conducting trials. The state governments that have been intending to operate trials include Queensland, New South Wales, Victoria and South Australia.

At the time of writing this report, none of these state governments has a trial that is operational. Consequently, the report has been unable to include any post-trial assessment, which has somewhat limited the assessment of the feasibility of different options. Nonetheless, a lot of preparatory work has been undertaken in moving towards an operational trial, which has been taken into account in determining the key options and potential issues with their implementation.

In addition, a substantial amount of further research has been undertaken to augment the preliminary findings from the trials. This includes a broad industry survey, targeted industry consultation and consideration of the Saskatchewan Transportation Partnership Program.

**Key feasibility issues**

Many of the scheme components have options that are feasible in the short-term. In particular, the charges and fee collection and road spending scheme components all have options that are feasible for implementation in the short-term (refer to Table ES2).

The state government trials have given some indication as to which options will be relatively easy to implement. These tend to be options that do not necessarily best meet the guiding principles but are practical and low cost, although all of the short-term feasible options will require some developmental work (e.g. preparing a nationally consistent pricing methodology).

**Table ES2. Feasible Options**

<table>
<thead>
<tr>
<th>Component</th>
<th>Feasible Options</th>
</tr>
</thead>
</table>
| Pricing and Monitoring System                  | - **Price structure.** Two feasible pricing structures have been identified to establish marginal costs, which can be used to develop incremental charges. This refers to a pricing structure that has a variable component based on either short-run or long-run marginal costs with a fixed charge for residual costs to ensure that the total costs associated with additional mass are recovered.  
  - **Pricing method.** There are a number of feasible methods to estimate marginal costs. For example, either based on estimating the marginal cost of each increment using forward looking costs or based on an average cost approach, such as the current case accounting approach. However, it must be emphasised that some of these methods are costly to implement and will require some further research and analysis. In addition, incremental prices may initially be based on a very small number of road classifications due to road cost and usage data limitations. These data limitations could be resolved over time.  
  - **Distance measurement.** There are a number of feasible methods |
## Component | Feasible Options
--- | ---
to measure actual distance including using the Intelligent Access Program (although this would require significant legislative changes to be applied for charging purposes) and other less costly approaches including non-telematic options, such as measuring the number of trips via self-reporting verified by transport documents.  
**Mass measurement.** There are short-term feasibility issues for one of the key scheme options, which relates to the measurement of mass via telematic on-board mass monitoring systems. The resolution of these feasibility issues requires further detailed research, investigation and policy development and assessment of whether the cost may limit the attractiveness of the scheme to transport operators. However, other alternatives have been identified (e.g. charging for a “block” of incremental mass or self-reporting of mass) to provide the basis under which mass can be monitored and/or reported for charging and compliance purposes. These alternatives could be associated with the application of the Intelligent Access Program to monitor route compliance.  
**Aligning with current charging system.** In order to align with the current charging system, a number of adjustments have been identified that should be made to the current charging system and to the incremental price. The intention of these adjustments is to ensure that there is no double counting of costs and revenues. In addition, any revenue received under an incremental pricing scheme will have to be excluded from the PAYGO cost base to ensure that the incremental charge is not recovered twice from transport operators.  
**Fee Collection and Road Spending**  
- There are a number of options for invoicing, payments and debt management, many of which could be incorporated into current heavy vehicle collection systems.

**Funds Distribution**  
- The structure of funds distribution will depend on the body(ies) that are responsible for fee collection and their relationship with the body(ies) that are responsible for maintaining and upgrading road infrastructure. Since this requires structural considerations there are many possible feasible options.

**Road Spending**  
- Roads involved in the incremental pricing scheme will need to be maintained to ensure the specified service level. This should be feasible so long as the structure of funds distribution is such that the body responsible for maintaining and upgrading the road receives sufficient funds at the right intervals.

However, for two entry scheme components (safety assessment and infrastructure assessment and route definition) there are feasibility issues in the short term that may impact either the ability of incremental pricing to become an operational scheme or the attractiveness of the scheme to transport operators (refer to table ES3).
### Table ES3. Key short-term feasibility issues

<table>
<thead>
<tr>
<th>Component</th>
<th>Feasibility Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Assessment</td>
<td><strong>Performance Based Standards assessment process.</strong> The requirement to have Performance Based Standards for safety applied as part of the entry assessment process for incremental pricing raises several issues that will need to be addressed in order for the current Performance Based Standards assessment process (as undertaken by the Performance Based Standards Review Panel) to be feasible for an incremental pricing scheme. This includes the ability of the current process to handle a large number of applications in a cost effective and efficient manner.</td>
</tr>
<tr>
<td>Infrastructure Assessment and Route Definition</td>
<td><strong>Road pavement capabilities.</strong> The knowledge of how pavements perform under axle loads at the very high end is very limited, both in an Australian and international context. As a result, the suggested maximum increases that are being proposed by some of Australia’s leading pavement engineers is in the order of around 10% above current regulated mass limits, although this may vary by road type. This has the potential to constrain productivity gains and the attractiveness of the scheme to participants, especially if there is substantial entry or ongoing costs. Additional research on the impact of higher axle loads for different road types is required to assist asset managers to assess the capabilities of road pavements at very high mass levels.</td>
</tr>
<tr>
<td></td>
<td><strong>Bridge capabilities.</strong> Bridges currently represent a major impediment to increased network productivity. Indeed, the progress in implementing trials has highlighted that bridges are a major potential impediment to the success of an incremental pricing scheme. Many bridges simply cannot take increased mass loads, which reduces the number of routes available for above mass vehicles. In other cases, not enough information is known to make a reasonably quick and low-cost assessment of their capacity for extra mass. This has the potential to constrain an incremental pricing scheme unless an understanding of the capabilities of bridges is improved and/or an incremental pricing scheme is associated with the ability to fund bridge upgrades where significant barriers to increased network productivity exist. This issue is also particularly important since there is currently a certain degree of overloading across the network. Therefore, allowing access to higher loads could result in severe distress for some bridges if transport operators overload above an even higher allowed mass limit. It is this concern that highlights the need for effective mass compliance strategies as part of an incremental pricing scheme.</td>
</tr>
<tr>
<td></td>
<td><strong>Bridge assessments.</strong> Bridge assessments can be time consuming, costly, complex and require appropriate engineering skills. This will be challenging for the efficient operation of an incremental pricing scheme and may require assistance to be provided to some governments (e.g. local governments) to perform bridge assessments.</td>
</tr>
</tbody>
</table>
Conclusion

The development of an incremental pricing scheme has the potential to provide productivity benefits for the road transport industry and the overall economy. Industry consultation, including a broad survey, has shown reasonably strong interest from transport operators in accessing additional mass.

A number of feasible options have been identified for the charges and fee collection and road spending scheme components. However, there are a number of key feasibility issues that relate to the safety assessment and infrastructure assessment and route definition scheme components that are likely to impact upon a potential scheme. Some of these issues can be resolved in the short term with policy development (for example, through changes to the Performance Based Standards framework) while others can be resolved with further infrastructure investment and/or research. These include:

- Issues in integrating Performance Based Standards with an incremental pricing scheme needs to be resolved as part of the current review of Performance Based Standards in order for the safety assessment process to be timely and cost effective;

- There is limited existing information on the impact of higher mass loads on road pavement wear. In addition, not enough information is known about the capabilities of bridges for different vehicle types at high mass levels in order to make a reasonably quick and low-cost assessment of their capacity for extra mass. However, there is potential to allow incremental mass limits of around 10% above current mass limits based on road pavement capabilities. Further research in the short to medium term could potentially provide for access to higher mass increments than is available based on our current understanding of the capabilities of the road infrastructure; and

- Poor quality bridge infrastructure may be a constraining factor on some key routes. However, some bridges could be upgraded (and the upgrade cost could potentially form part of the incremental price) to remove bottlenecks and create incremental pricing routes that provide strong productivity gains for industry.

Therefore, these issues do not represent an unsurmountable constraint to the further development of a scheme. Although, research on better understanding the capabilities of road infrastructure and improving the capability of some bridges will take time and require some initial investment.

Finally, the incremental pricing scheme should be able to “mesh” or align effectively with the current charging system. This can be achieved through adjustments to the incremental pricing formula and the road use data that is used to develop the current registration and fuel charges. In addition, to ensure that the incremental charge is not recovered twice from transport operators, any revenue received under an incremental pricing scheme would need to be taken into account in the setting of the PAYGO cost base.

This paper provides a case for further assessment of an incremental pricing scheme based on the reasonably strong initial interest in a scheme from the road transport industry and a high level of confidence that there are solutions to key feasibility issues in the short term. Subject to endorsement by the Council of Australian Governments (COAG), the next step would be to further investigate the feasible options through the development of a regulatory impact statement for an incremental pricing scheme, including the economic case, which would be expected to be completed in late 2009.
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1. **INTRODUCTION**

This section will outline the following:

- The way in which incremental pricing fits into the broader road infrastructure pricing reform COAG agenda and the National Transport Policy Framework
- The current ATC pricing principles and how these may need to evolve to support incremental pricing
- The structure of this report

1.1 **Background**

The Council of Australian Governments (COAG) has outlined a plan for the development of an incremental pricing scheme, should it prove to be feasible. This plan is part of a broad reform agenda for road infrastructure pricing and investment. This reform plan is well aligned with the objectives and principles in the new National Transport Policy Framework approved by Transport Ministers in 2008, which forms the basis for the next wave of national transport reform.

1.1.1 **COAG decision**

Following the Productivity Commission inquiry into road and rail freight infrastructure pricing (December 2006), COAG at its meeting in April 2007, considered the Productivity Commission’s recommendations and agreed to a long term reform plan. This plan aims to ensure that policy and regulatory settings for infrastructure pricing and investment are able to promote timely and efficient investment in and use of land transport. This will enable Australia to meet the growing freight task and maximise economic growth.

The reform plan for road infrastructure provision focuses on developing the building blocks for a future possible mass-distance location-based road charging system for heavy vehicles. This system would involve road users being charged based on their use of the road network taking into account the mass of the vehicle, the distance travelled and the use of different parts of the road network. In addition, the revenue from this system would be returned to the road network under an efficient investment framework that would link the revenues from a particular road or network of roads to infrastructure spending on those roads.

COAG’s road reform plan involves three phases. The first two phases focus on:

- Developing the building blocks for mass-distance location based charges through research and policy development
- The development of an incremental pricing scheme (should it prove feasible and the benefits clearly outweigh the costs). An incremental pricing scheme focuses on charging for mass above the current mass limits with the aim of increasing productivity and increasing payloads per trip. The development and evaluation of an incremental pricing scheme is scheduled for 2009, and
Other heavy vehicle reforms, such as improving and implementing Performance Based Standards and a new heavy vehicle charging determination.

The third and final phase of the reform plan involves a feasibility study of mass-distance location-based charges, with a targeted completion date of December 2011 and, should it prove feasible, full implementation of a scheme by December 2014.

In this context, COAG outlined two key deliverables for incremental pricing in its reform plan. The first is a component of phase one of the reform plan and consists of the following:

“Detailed review, including trials (building on the Intelligent Access Program) to assess the impact and feasibility of incremental pricing schemes for higher mass and other innovative vehicles which allow access to parts of the road network from which they are currently excluded.” (Council of Australian Governments, 2007)

The second deliverable is due in late 2009 and consists of an evaluation study of potential incremental pricing schemes.

1.1.2 National transport policy framework

In February 2008, The Australian Transport Council (ATC) agreed that there is a need for a national approach to transport policy and endorsed the National Transport Policy Framework (ATC 2008). The Australian Transport Council consists of transport ministers from federal, state and territory governments. It is the ministerial forum for the coordination and integration of transport policy issues at a national level.

Following the meeting in February, the ATC agreed to a vision, policy objectives and policy principles in May 2008. These are reproduced in Appendix 1. Importantly, the ATC’s vision for Australia’s transport future states:

“*Australia requires a safe, secure, efficient, reliable and integrated national transport system that supports and enhances our nation’s economic development and social and environmental well-being.*”

In developing an incremental pricing scheme, there are several principles and objectives agreed to by transport ministers that are particularly relevant:

*Principles:*

- **Economic:** To promote the efficient movement of people and goods in order to support sustainable economic development and prosperity.

- **Transparency:** Transparency in funding and charging to provide equitable access to the transport system, through clearly identified means where full cost recovery is not applied.

*Objectives:*

- **Infrastructure pricing:** sending the appropriate signals to influence supply and demand for infrastructure.

- **National regulation:** a national perspective should be adopted where regulation is required.
Incremental pricing is well aligned with these principles and is an early step towards broader mass-distance location-based pricing and the establishment of an efficient infrastructure pricing and investment framework.

As part of ATC’s National Transport Policy Framework, nine working groups have been established to investigate priority areas identified by ATC. The Economic Framework for an Efficient Transportation Marketplace Working Group has been established to progress Australia further towards a seamless national marketplace. The development of an incremental scheme forms part of the work plan for this working group.

1.1.3 ATC pricing principles

In addition to the COAG requirements outlined in section 1.1.1, the NTC, in recommending national heavy vehicle charges to recover costs of heavy vehicle road use, is currently bound by a set of Road Use Pricing Principles (approved by ATC in August 2004). The pricing principles are:

“National heavy vehicle road use prices should promote optimal use of infrastructure, vehicles and transport modes. This is subject to the following:

- full recovery of allocated infrastructure costs while minimising both the over and under recovery from any class of vehicle
- cost effectiveness of pricing instruments
- transparency
- the need to balance administrative simplicity, efficiency and equity (e.g. impact on regional and remote communities/access)
- the need to have regard to other pricing applications such as light vehicle charges, tolling and congestion.”

These principles are not entirely inconsistent with the National Transport Policy Framework. However, it should be noted that these ATC principles have been developed with a view to guiding pricing in a world in which charges are developed based on the current costing and charging framework (including PAYGO cost base\(^2\)). These principles apply to the base charges, that is the registration and fuel charges. An incremental pricing scheme is a significant step into the new world of charging and the principles for its development will evolve beyond these ATC principles in a way that does not compromise the base charges.

1.2 Objective and structure of the report

This report aims to provide an overview of how an incremental pricing scheme could be developed (including guiding principles and options) and the feasibility of a scheme in the context of the different scheme options and demand from the transport industry for such a scheme. The report will provide the basis for further industry and government

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\(^2\) The current approach to setting heavy vehicle charges (registration and fuel charges) involves establishing a PAYGO cost base, which is based on estimating the annual cost of road service provision through the collection of historic expenditure data for the whole road network across Australia. Note that the reference to the PAYGO (Pay-As-You-GO) system in this paper refers to not only the PAYGO cost base but also the cost allocation model which is used to allocate cost to different vehicle classes.
consultation in early 2009 with the objective of developing a regulatory impact statement (RIS) by the end of 2009.

In this context, the report is structured into the following key areas for discussion:

- **Outline of concept (section 2)**
  - What is incremental pricing and what are the benefits?

- **Transport industry interest (section 3)**
  - What interest is there from transport operators in accessing higher mass levels on the road network?

- **Incremental pricing framework (section 4)**
  - What are the components and guiding principles of a scheme?

- **Entry conditions to the scheme (section 5)**
  - How would vehicles and the road infrastructure be assessed to determine whether entry into the scheme is appropriate?

- **Pricing framework (section 6)**
  - How should the price be set?

- **Fee collection and road spending (section 7)**
  - How will funds collected be spent?

The options for each of these components have been explored with reference to the progress of state governments in conducting trials. The state governments that have been intending to operate trials include Queensland, New South Wales, Victoria and South Australia. At the time of writing this report, none of these state governments has a trial that is operational. Consequently, the report has been unable to include any post-trial assessment, which has somewhat limited the assessment of the feasibility of different options. Nonetheless, a lot of preparatory work has been undertaken in moving towards an operational trial, which has been taken into account in determining the key options and potential issues with their implementation.

In addition, a substantial amount of further research has been undertaken to augment the preliminary findings from the trials. This includes a broad industry survey, targeted industry consultation and consideration of the Saskatchewan Transportation Partnership Program. There will also be references made to an existing arrangement in Western Australia which allows for higher loads on a designated route under an arrangement with a private mining company.

A detailed outline of the state government trials is presented in Appendix 2 and a detailed outline of the Saskatchewan Transportation Partnership Program is presented in Appendix 3.

### 1.2.1 Consultation and research

The development of this report has taken into account the following consultations and research:
government consultation

- Government reference group. This reference group consists of all of the state governments and some other governmental departments and representative bodies

- State government incremental pricing trials

- Targeted consultation with experts. This refers mainly to pricing policy advisors and road infrastructure engineers

industry consultation

- Targeted consultation with industry groups and some private sector companies

- NTC commissioned survey of road transport operators and owners of goods

- Saskatchewan Transportation Partnership Program

- review of existing literature, especially relating to road pricing

- the joint National Transport Commission and Austroads\(^3\) project referred to as “Understanding Wear and Cost Implications of Incremental Loads on the Road Network”. This project is not yet completed.

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\(^3\) Austroads is the association of Australian and New Zealand road transport and traffic authorities which aims to promote improved road transport outcomes.
2. OUTLINE OF THE CONCEPT

This section will:

- provide a definition of an incremental pricing scheme
- outline the relationship between an incremental pricing scheme and a comprehensive mass-distance location-based scheme
- outline the benefits to transport productivity of an incremental pricing scheme

2.1 Description of incremental pricing

Road transport freight operators can currently carry loads up to regulated mass limits. This is generally represented by the General Mass Limits (GML), however operators also have the ability to access higher mass loads under a range of circumstances, including:

- under the Higher Mass Limits (HML) scheme
- being granted access under an individual permit, a notice or a general access scheme (e.g. concessional loading scheme as in Western Australia).

These concepts are explained in more detail in Appendix 4.

An incremental pricing scheme will establish a base mass limit, reflecting what operators pay for under the current charging scheme. Operators would then be charged an additional amount based on the extra road wear caused by carrying mass above the established mass limit. There are a number of options for setting this base limit which will be discussed later in section 6.1.1. Therefore, incremental pricing is not intended to be a substitute for the current charging system. It is a charge in addition to the current registration and fuel based charges that allow transport operators to access higher loads.

An example of the incremental pricing concept is outlined in Box 1.

**Box 1. Incremental pricing example**

In the following example, it is assumed that a transport operator with a B-double truck has access to Higher Mass Limits on a declared Higher Mass Limit route. This means that, based on the maximum axle loads available under Higher Mass Limits, the total mass limit for the B-double is 68 tonnes.

Under an incremental pricing scheme, the road infrastructure provider may allow the operator to increase its mass limit on a particular road or network of roads by 1.5 tonnes for the second axle grouping (tandem axle) and 2.5 tonnes for the third and fourth axle groupings (tri-axles). This will create a new total mass limit of 74.5 tonnes. Therefore, the incremental mass allowance is 6.5 tonnes (74.5 – 68 tonnes).

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4 For the purposes of this paper GML shall be taken to include Restricted Access Vehicles (RAV) as defined under the national transport laws.
2.2 Relationship with mass-distance location-based charging

An incremental pricing scheme charges only for access to mass above a base mass limit. In contrast, under a comprehensive mass-distance location-based (MDL) charging scheme (which is planned for phase three of the COAG road reform plan), the charge for road use would apply for all levels of road use in terms of mass.

The relationship between a comprehensive mass distance location-based charging scheme and an incremental pricing scheme for the mass component of road use is illustrated in Figure 1. This outlines a hypothetical linear relationship between mass increments and the price that is charged for additional mass. The graph illustrates that an incremental pricing scheme is a partial form of a comprehensive mass distance location-based charging scheme, in that it only applies to mass increments above a base mass limit (referred to as regulated maximum mass limits in Figure 1).

As such, an incremental pricing scheme will deliver a partial move towards the efficient outcome that would be achieved under a more complete mass distance location-based based pricing structure.

Figure 1. Direct and incremental pricing of mass

Note that a linear relationship is used only for illustrative purposes and the types of relationships outlined later in this document show an increasing cost for each additional unit of mass.
2.3 Productivity benefits of incremental pricing

An incremental pricing scheme should deliver road transport operators with the ability to pay to carry mass above the current regulated mass limits on routes that are currently being accessed, which would include the ability to pay to access roads that are currently restricted. Therefore, an incremental pricing scheme should deliver improved productivity through higher payloads per trip and allow transport operators to make more optimal economic decisions around the appropriate mass load taking into account road wear and damage. This may be particularly useful in addressing “first” or “last” mile issues, which can have large impacts on productivity. In terms of the National Transport Policy Framework, incremental pricing should lead to a more efficient movement of goods across the nation and more optimal use of the road infrastructure.

In terms of road transport productivity, there are potentially quite large productivity benefits for freight operators that should result from such a scheme (Box 2) and large benefits have already been illustrated as part of the Saskatchewan Transportation Partnership Program which has stated that there are annually recurring economic benefits of around $84 million (in Australian dollars), which is a quantification of the savings in total freight costs for transport companies participating in the program. In addition, an existing arrangement between the Western Australian government and a mining company, which has enabled higher loads on the tri-axle group than currently allowable (an increase from 20 to 23.5 tonnes) on a designated route, has led to annual transport savings in the order of $12 million.

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6 One issue that may need to be addressed is that allowing access to roads that are currently restricted may require road upgrades which may enable higher productivity vehicles not necessarily wishing to travel with higher mass to access these routes. This could potentially create a “free-rider” effect.

7 This equates to 76 million Canadian dollars as outlined in Saskatchewan Government (2007), 2006/07 Annual Report, Saskatchewan Highways and Transportation.

8 The $84 million includes partnership program outcomes that have been achieved historically as indicated in Government of Saskatchewan’s annual reports for Saskatchewan Highways and Transportation.
Box 2. Productivity benefit example

The benefits of incremental pricing can be demonstrated by considering the example provided in Box 1. A nine-axle B-double is currently operating on a Higher Mass Limits (HML) route transporting 68 tonnes between Melbourne and Sydney 200 times a year. It is assumed that the operator only carries a full load one way such that 50% of trips are unloaded and 50% are loaded.

Essentially, the loaded mass increases by 9.6% (from 68 to 74.5 tonnes) which results in lower freight costs (taking into account vehicle operating and capital costs) as a result of less trips for the same freight task but higher road agency costs resulting from the additional road wear\textsuperscript{9}. The overall impact of this is a 5.5% decrease in total costs per tonne-kilometre. Taking into account the cost reduction to the transport operator only (therefore excluding additional road wear costs), total costs per tonne-kilometre fall by 9.4%.

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\textsuperscript{9} The analysis has been based on average PAYGO unit costs for mass related components and adjustments are made to fuel costs to take into account the higher fuel consumption rate associated with operating at higher mass levels to ensure that there is no double-counting. Also of note is that set up costs associated with monitoring and compliance have not been taken into consideration in the analysis.

The estimation of road use costs is based on average equivalent standard axle (ESA) unit costs which may be lower for some pavements types and higher for others. This example is a demonstration of how incremental pricing can provide net benefits when applied to a specific general situation. In order to determine the overall costs and benefits of incremental pricing schemes a more detailed analysis needs to be undertaken.
3. TRANSPORT INDUSTRY INTEREST

This section will outline the following:

- the results of a broad industry survey to assess interest in carrying loads above current regulated mass limits
- the results of state government engagement with the transport industry in developing trials

3.1 Industry survey

In mid-2008, NTC engaged a market research company to conduct a phone survey to assess the level of interest in incremental pricing among businesses in the road freight transport industry. The survey sample involved 321 companies across Australia covering both operator businesses (hire and reward operators and ancillary operators) and non-operator businesses (freight forwarders and owners of goods that hire other businesses for transport). The companies surveyed were chosen at random across all operator and non-operator businesses.

The major issues considered in this survey are as follows:

- incidence of businesses operating at or near the regulated mass limit
- interest in additional mass above this limit, including the type of truck, the types of products being carried and the types of routes
- the perceived benefits of accessing additional mass for their operations and the reasons for not wanting to access additional mass
- the willingness of businesses to pay to access the additional mass.

A summary of the findings is outlined below.

**Incidence at or near the mass limit**

A high proportion of businesses surveyed are operating at or near the current regulated mass limit on a regular basis. This is illustrated in Figure 2 which shows that:

- Around 65% of companies surveyed reported that 50% of their loaded trips were at or near the current mass limit
- Around 24% of companies surveyed reported that at least 95% of their loaded trips were at or near the current mass limit.

An alternative option to carrying additional mass on the existing vehicle is to upgrade to a larger vehicle. However, only a small minority of companies had considered upgrading to a larger vehicle. Such action would be relatively expensive for companies, and an incremental pricing scheme could offer a more cost-effective option.

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10 Based on the sample size, the survey is accurate to +/- 5% at a 95% confidence level for results that are presented for all participants. This increases to 7% when referring just to operators and 8% when referring just to non-operators.
Interest in carrying additional mass

This high proportion of respondents operating at or near the mass limit appears to translate into reasonably strong interest in carrying additional mass above the current mass limit. This is illustrated in Figure 3, in which around 28% of respondents indicated that they were “very interested” in carrying mass above the current limits and more than 60% indicated at least some interest.\(^\text{11}\)

Figure 3. Interest in vehicles carrying additional mass

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\(^{11}\) It should be noted that the concept of “incremental pricing” of additional mass was a very new concept for a number of operators and their assessment of interest has to be placed in this context.
The survey also revealed interest from all industry segments (Figure 4)\textsuperscript{12} and across all truck types (Figure 5), although survey respondents that were interested in carrying additional mass were more likely to nominate larger vehicles (such as B-doubles).

\textbf{Figure 4. Interest in additional mass, by industry segment}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{interest_in_additional_mass_by_industry_segment.png}
\caption{Interest in additional mass, by industry segment}
\end{figure}

\textbf{Figure 5. Nominated vehicle to carry additional mass, by truck type}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{nominated_vehicle_to_carry_additional_mass_by_truck_type.png}
\caption{Nominated vehicle to carry additional mass, by truck type}
\end{figure}

In addition, the survey revealed reasonably strong interest in carrying additional mass in all Australian states with about two thirds of companies nominating New South Wales (60\%) and Queensland (62\%), half nominating Victoria (47\%) and a third (32\%) each nominating South Australia and Western Australia. In terms of the remaining state and territories, Tasmania was nominated by 14\% of companies, Australian Capital Territory (17\%) and Northern Territory (14\%)\textsuperscript{13}.

\textsuperscript{12} The interest from different industry segments is meant to be an indication of interest since for some segments only a handful of market participants were surveyed.

\textsuperscript{13} The differences in each state could be a reflection of the amount of access that is currently granted to the road network in each state through the Higher Mass Limits scheme and other schemes or permit arrangements. This also highlights that future expansion of the Higher Mass Limits network may restrict the need to access higher loads from some transport operators.
The routes nominated for travel by vehicles with increased mass were also varied, covering long distance trips, regional roads, highways and main roads, and within metropolitan areas (Figure 6).

Figure 6. Nominated typical route to carry additional mass

![Graph showing nominated typical route to carry additional mass]

The survey also revealed that there is a range of different increments that would be sought by different types of trucks and quite a high proportion that are interested in five tonnes or more.

Figure 7. Nominated additional tonnes by truck type

![Graph showing nominated additional tonnes by truck type]

Perceived benefits

Those companies interested in carrying higher loads saw benefits in more efficient or fewer trips, and savings in costs. Those companies that were not interested generally fell into two categories: those for whom an increase in mass or access to roads was not needed (particularly for those companies who were volume constrained); and those who had specific concerns about an incremental pricing type of scheme. Specific concerns included the cost of setting up the scheme, safety issues, the need for the scheme to be well monitored, the introduction of further rules/paper work, and privacy issues around GPS tracking.
A number of companies that initially expressed a lower level of interest commented that their interest would depend on further information about the scheme. This indicates that the strength of interest among some companies could increase if a scheme is promoted in more detail.

**Willingness to pay**

More than 50% of companies surveyed indicated some willingness to pay to carry loads above the current limits with similar proportions for operators compared to non-operators. This indicates that there is a perceived financial benefit to a lot of operators from carrying additional mass.

### 3.2 State government trials

The state governments have used a number of different approaches to engage with industry in the development of incremental pricing trials. However, all states have found a number of operators interested in participating in the trials.

Queensland and Victoria both engaged in initial discussions with industry associations to gain an understanding of the interest in an incremental pricing scheme. In Queensland this has resulted in discussions with three transport operators in regards to proposed routes and vehicles for use in the trial.

In Victoria this resulted in four companies submitting formal expressions of interests, including proposed routes and vehicles to be used in the trial. These operators represent a range of industries, including containers and bulk goods and have identified improved productivity as a key reason for participating in the trial.

As South Australia has focussed its trial on Higher Mass Limits, tri-axle B-double vehicles that operate on intra-regional routes, it has taken a different approach to industry engagement. Preliminary research suggests around seven to ten operators carrying wine, beers, grain and petroleum products could potentially be involved in the trial, with around 250-300 vehicles being used. However, no formal engagement with industry has been undertaken as yet.

In addition to the trials, NTC has had discussions with different industry participants from a reasonably wide section of the freight sector and reasonably strong interest exists in the concept of incremental pricing. In addition to the freight sector, the bus industry is keen to explore the potential for incremental pricing of loads above current mass limits in order to ensure that it can maximise the carrying capacity of buses.
4. INCREMENTAL PRICING FRAMEWORK

This section will:

- outline the components that make up an incremental pricing scheme
- outline the guiding principles underpinning an incremental pricing scheme

4.1 Scheme components

There are a number of components of an incremental pricing scheme (Figure 8). These components relate to: entry considerations; charging; and fee collection and road spending, which would each be established under a legal framework. This document will outline options for key issues in these components as well as outlining a preliminary assessment of the feasibility of different options where appropriate.

Figure 8. Components of an incremental pricing scheme

<table>
<thead>
<tr>
<th>Legal Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Operator</td>
</tr>
<tr>
<td>Entry Considerations</td>
</tr>
<tr>
<td>Safety Assessment</td>
</tr>
<tr>
<td>Infrastructure Assessment &amp; Route Definition</td>
</tr>
<tr>
<td>Charging</td>
</tr>
<tr>
<td>Pricing and Monitoring System</td>
</tr>
<tr>
<td>Fee Collection &amp; Road Spending</td>
</tr>
<tr>
<td>Fee Calculation &amp; Collection</td>
</tr>
<tr>
<td>Funds Distribution</td>
</tr>
<tr>
<td>Road Spending</td>
</tr>
</tbody>
</table>

4.2 Guiding principles of a scheme

This section outlines guiding principles for an incremental pricing scheme (Table 1), which will be used to guide the development of options for the scheme components. The guiding principles have been developed taking into account the COAG directions and National Transport Policy Framework and some initial consultation with both governments and industry.
Table 1. Guiding principles of an incremental pricing scheme

<table>
<thead>
<tr>
<th>LEGAL FRAMEWORK</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal Framework</td>
<td>Nationally consistent and integrated. The scheme should be established based on uniform national laws in order to maximise the capacity of the scheme to withstand legal challenge. These laws should integrate with the national law previously approved by the Australian Transport Council</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENTRY CONSIDERATIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Assessment</td>
<td>Nationally consistent process using Performance Based Standards for safety. The process to assess the safety of the vehicle should use the nationally agreed Performance Based Standards methodology and be applied in a consistent manner. The Performance Based Standards for safety and the process through which they are applied should be structured to allow for efficient assessment of large numbers of common vehicle configurations</td>
</tr>
<tr>
<td>Infrastructure Assessment</td>
<td>Access up to maximum road infrastructure capacity. Access to additional mass should be provided up to but not beyond the maximum capacity of the road infrastructure. This should take into account an appropriate buffer to manage the risks of surpassing the maximum capacity of the infrastructure. Nationally consistent outcomes. Infrastructure assessment should be applied in a nationally consistent manner</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHARGING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Methodology</td>
<td>Efficient, nationally consistent and simple. The incremental price should promote the efficient, safe and sustainable use of infrastructure, vehicles and transport modes. Prices will therefore be based on efficiency principles (including total cost recovery) as far as is practical taking into account the mass, distance travelled and location of vehicles using a nationally consistent pricing methodology and formula. The pricing structure should be administratively simple and transparent for users. Align with the applicable current charging system (currently PAYGO). There must be an appropriate alignment or “meshing” of the incremental pricing methodology and the current charging system to ensure that there is no double-counting of data and that an incremental pricing scheme does not charge for a service already provided through the current charging system</td>
</tr>
<tr>
<td>Mass, Distance and Location Monitoring System</td>
<td>Monitoring of mass, distance and location. The monitoring system should measure or record the distance, mass and location of the vehicle on a periodic basis (in order to provide the basis for charging and/or compliance). The systems output should be auditable and scalable as well as meeting evidentiary standards. Privacy. The standard of privacy control for monitoring systems</td>
</tr>
</tbody>
</table>
that generate personal information should be at least equivalent to the Intelligent Access Program (IAP).

<table>
<thead>
<tr>
<th>FEE COLLECTION AND ROAD SPENDING</th>
</tr>
</thead>
</table>
| **Fee Calculation and Collection** | - Accurate and timely. Data collection, processing and billing should be accurate and timely  
- Transport operator friendly. The process and system should be easy for operators to understand and to interact with  
- Scalable and flexible. The system should be scalable to allow for expansion of the pricing system to include larger numbers of trucks and accommodate any future changes to the pricing structure  
- Effective debt management. The system should ensure that there is appropriate protection against outstanding debts |
| **Funds Distribution** | - Funds directed back to road infrastructure service provider. An amount of funds that is equivalent to the funds collected via charging should be directed back to the road infrastructure service provider responsible for the roads used as part of the scheme |
| **Road Spending** | - Road spending to ensure service level. Infrastructure used in the scheme should be funded in a way that ensures agreed service standards (as supported by the incremental price) are met during the agreed period of the scheme |

The COAG requirement of national consistency is pervasive through the guiding principles. A nationally consistent scheme will help to remove distortions in pricing signals across jurisdictions which result in inefficient outcomes. Consistency in rules and processes across state borders will also increase the simplicity of the scheme for participants. This requirement flows from the COAG agreement with recommendation 12.14 from the Productivity Commission Report which states that:

“Incremental pricing, building on the Intelligent Access Program, would provide a base for testing direct road user pricing and could deliver potentially large efficiency benefits in its own right. As provided for in Phase One of the Productivity Commissions' proposed reform agenda, COAG should sponsor further investigation of the feasibility of incremental pricing, focussing on:

- how incremental charges would mesh with the PAYGO system;  
- charging technologies; and  
- a process for determining and applying incremental charges in a 'nationally consistent manner'”. (Productivity Commission, 2006, p.358)
5. ENTRY CONSIDERATIONS

This section will explore the different options under which vehicles and road infrastructure are assessed for access under an incremental pricing scheme in line with the guiding principles (Table 2). This assessment process will determine whether a vehicle with loads greater than the current regulated limits is safe and does not exceed the maximum road infrastructure capacity. This will also determine the routes available to the vehicle under the scheme.

Table 2. Guiding principles for entry considerations

| Safety Assessment | Nationally consistent process using Performance Based Standards for safety. The process to assess the safety of the vehicle should use the nationally agreed Performance Based Standards (PBS) methodology and be applied in a consistent manner. The Performance Based Standards for safety and the process through which they are applied should be structured to allow for efficient assessment of large numbers of common vehicle configurations |
| Infrastructure Assessment | Access up to maximum road infrastructure capacity. Access to additional mass should be provided up to but not beyond the maximum capacity of the road infrastructure. This should take into account an appropriate buffer to manage the risks of surpassing the maximum capacity of the infrastructure. Nationally consistent outcomes. Infrastructure assessment should be applied in a nationally consistent manner |

There are two key aspects of the assessment process for an incremental pricing vehicle:

1. **Safety assessment**: This involves determining whether a vehicle with a total mass greater than the current loading limits meets the Performance Based Standards for safety.

2. **Infrastructure assessment and route definition**: This involves assessing whether a vehicle will exceed the load carrying capacity of the road infrastructure and defining the route for the vehicle to travel under the scheme.

5.1 Safety assessment

The guiding principle for safety assessment involves vehicles being approved to the Performance Based Standards for safety (refer to Box 3). These are national standards which were approved by the Australian Transport Council in October 2007.7

Box 3. Performance Based Standards (PBS)

Performance Based Standards is a method by which heavy vehicles are granted approval to operate with vehicle dimensions and mass levels that are outside of the current regulated limits provided that the vehicle meets a set of safety and infrastructure standards. Typically, the Performance Based Standards process is used to assess vehicles that have ‘innovative’ vehicle designs and which may be a bit longer or taller than the current regulations. The assessment process focuses on ensuring that the performance of the vehicle is no worse than vehicles typically operating on the network.
The Performance Based Standards assessment process is currently administered by the Performance Based Standards Review Panel (the Panel) and consists of the following process:

- The applicant seeks advice from road authorities on appropriate routes, after which the vehicle is assessed by the Panel. The Panel approves a vehicle as meeting the standard to operate on one of several road networks that have been classified (e.g. Level 1, 2 etc.). Each vehicle is assessed individually via physical testing and/or computer modelling.
- Once the Panel has approved the vehicle as meeting the standard for access to a particular network, access approval must be obtained from the relevant state or local government by way of permit.
- The Panel has some discretion as to whether a standard should be applied depending on the circumstances of the application.

The Performance Based Standards for safety incorporate a range of different aspects such as assessment of vehicle stability, controllability under braking, excess swing, excessive roll during manoeuvres, impact on vehicle handling, manoeuvrability around corners, acceleration capability, ability of steer axle to change course and impact on starting and maintenance of speed on hills. The standards related to braking and stability are particularly important in assessing the safety of a vehicle with higher loads.

The state government trials and the Saskatchewan Transportation Partnership Program have taken slightly different approaches to safety assessment (see Box 4). While the overall intent for the Australian state governments is to use a Performance Based Standards assessment process, alternative approaches are intending to be taken to provide for a more cost effective and timely outcome.

**Box 4. Approaches to safety assessment**

The approach that is intended to be taken for safety assessments as part of the incremental pricing trials in Australia varies. Queensland’s safety assessments will be based on the Performance Based Standards safety requirements, while South Australia will require compliance with Higher Mass Limits operating conditions. The use of a Performance Based Standards assessment was not chosen in South Australia because of the time and cost of such an assessment. Victoria will use a variation of both of these, requiring compliance with the Performance Based Standards static roll-over threshold as well as the mass management condition specified under Higher Mass Limits (the National Heavy Vehicle Accreditation Scheme).

NSW may require participants in their trials to meet the Performance Based Standards safety standards depending on the identified risks. In addition, NSW will impose a number of entry and operating conditions including a requirement for vehicles to be fitted with Road Friendly Suspension and registered in the Intelligent Access Program.

The vehicle safety assessment process for the Saskatchewan Transportation Partnership Program (TPP) is conducted by engineering experts from the Ministry of Highways and Infrastructure. For standard vehicle types, internal knowledge of heavy vehicles and the network is used to assess how such vehicles would perform with additional mass. For irregular vehicle types, computer simulation of vehicle performance is undertaken (e.g. to assess static roll-over threshold). One of the objectives of the Saskatchewan program was to improve safety. This was achieved in various ways such as speed restrictions.
The application of Performance Based Standards for safety applied as part of the entry assessment raises several issues that will need to be addressed in order for the current standards and the Panel process to be feasible for assessing vehicles for incremental pricing. These issues can be summarised as:

1. **The requirement for individual assessment of each vehicle.** Under the current process each individual vehicle combination undergoes a detailed computer assessment and/or physical tests which are reasonably expensive (to some degree this may be due to the lack of accredited Performance Based Standards assessors) and have an assessment time of several weeks. This appears appropriate for the current type of vehicles that are being assessed since they are typically new innovative vehicles with configurations and features that are different to the standard vehicles already on the road. However, incremental pricing could potentially involve a large number of vehicles as indicated by the level of interest indicated by the survey in section 3.1 of this report. This process may therefore have a significant impact on the feasibility of an incremental pricing scheme since it will not be able to efficiently assess large numbers of common vehicle configurations and will probably result in a cost prohibitive assessment process for many potential vehicles. One solution to this is the development of “blueprint” vehicles, which represent a common vehicle configuration, as a way of enabling efficient assessment. Vehicles that match the “blueprint” characteristics would not necessitate a detailed computer assessment and/or physical test, although it is expected that some tests would be required. The current blueprints that have been developed are very rigid in that a vehicle would have to exactly meet the specifications of the blueprint vehicle to be approved. Therefore, an improved blueprint process would need to be developed.

2. **The potential for inconsistent access approval by state and local governments.** Until very recently, access has been assessed on a case by case basis. This introduced the potential for inconsistent access approvals since there was potential for different governments to make different assessments of a transport route that may traverse a number of governmental geographic boundaries. However, in late 2008 Performance Based Standards network maps were made electronically available on the internet for the first time. This has reduced the uncertainty over access approvals. Nonetheless, there is still potential for inconsistencies, especially where a route traverses local government geographical boundaries. In addition, the network is not yet comprehensive in a way that provides for improved access to all relevant major freight routes.

3. **The Performance Based Standards and operating conditions may need to be reviewed.** The current Performance Based Standards and operating conditions may need to be reviewed to ensure that they adequately address all of the safety issues associated with vehicles carrying very high loads. In addition, new operating conditions will need to be associated with consideration given to additional driver training and the impact on driver safety.

NTC is currently undertaking a review of the Performance Based Standards scheme which will address the issues outlined above. This is a separate process to the development of an incremental pricing scheme, although clearly the two processes will need to be aligned.
5.2 Infrastructure assessment

There are two critical issues under this section:

1. How to determine the maximum road infrastructure capacity.
2. How routes will be determined under an incremental pricing scheme.

Both of these issues will need to integrate and align with the Performance Based Standards infrastructure assessment process to ensure consistency. The way in which the Performance Based Standards infrastructure assessment process can evolve is discussed as part of the discussion on these two critical issues.

Essentially, there are four components in the Performance Based Standards infrastructure standards assessment process:

1. Pavement vertical loading
2. Pavement horizontal loading
3. Tyre pressure contact distribution
4. Bridge loading

5.2.1 Maximum road infrastructure capacity

Theoretically, the maximum infrastructure capacity would be set by road infrastructure providers at the level at which road pavement and bridge infrastructure can no longer safely bear additional mass and/or the point at which severe road infrastructure damage begins to occur. This would need to take into account the risk level that the infrastructure provider is willing to bear and whether more frequent road maintenance requirements represents an optimal use of resources.

ROAD PAVEMENTS

There are a number of different options for assessing the capability of road infrastructure to carry additional mass, which will be categorised into two meaningful options:

1. Case by case assessment
2. System-wide rules

Option 1: Case by case assessment

This option would require all roads used in an incremental pricing scheme to be assessed on a case by case basis to determine the maximum mass limit for roads to be used under the scheme. This limit would take into account the risk of severe road damage which will vary across pavement types, climatic zones, and in some cases times of the year. This option is similar to the current process regarding the carriage of excess mass by road vehicles. Currently, state and local governments can grant access to vehicles carrying mass above General Mass Limits or Higher Mass Limits upon case-by-case assessment of the needs of the freight operators.
Fit with principles and feasibility

Although this option can be catered for under existing processes, this option is likely to result in an inconsistent assessment of the maximum capacity of road pavements across Australia due to differing assessment methodologies and processes. This impact would be reduced if consistent methodologies were used to assess the maximum capacity.

Option 2: System-wide rules

Under this option, system-wide rules are established which are used by all road infrastructure providers to provide a consistent level of access above the current regulated mass limits. These system-wide rules could consist of one of the following:

- **A set increase above the current regulated mass limits (that is, General Mass Limits and Higher Mass Limits) for different axle groups.** An example of this approach is represented in Box 5. Note that this recommends maximum increases for three axle group types. Further work would be required to assess other axle group types.

- **A national road pavement classification system.** Under this system, different pavement classes are assigned different maximum mass limits based on an understanding of the performance of different pavement classes at increasing mass levels.

This option could also allow for case by case assessments of the road pavements outside of the system-wide rules where appropriate, for example, to access loads above the set increases allowable under the scheme or to access roads that have not been classified under a national road pavement classification system.

Box 5. Austroads Pavement Review Panel (APRP) recommended mass limits

In September 2007, the Austroads Pavement Review Panel set out recommended maximum increases in mass under an incremental pricing scheme. Austroads recommended maximum increases in axle loads of between 9% and 12.5% depending on axle configuration above the existing General Mass Limits and Higher Mass Limits specifications. The table below shows the proposed Austroads increases.

<table>
<thead>
<tr>
<th>Axle Group Type</th>
<th>Maximum Increase in Mass (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-axle with dual tyres</td>
<td>1.0 tonne</td>
</tr>
<tr>
<td>Tandem-axle with dual tyres</td>
<td>1.5 tonnes</td>
</tr>
<tr>
<td>Tri-axle with dual tyres</td>
<td>2.5 tonnes</td>
</tr>
</tbody>
</table>

The impact of these increases is shown in the example below for a B-double vehicle.
<table>
<thead>
<tr>
<th>Higher Mass Limits by axle</th>
<th>6t</th>
<th>17.0t</th>
<th>22.5t</th>
<th>22.5t</th>
<th>= 68.0t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austroads max. increase in</td>
<td>0t</td>
<td>1.5t</td>
<td>2.5t</td>
<td>2.5t</td>
<td>= 6.5t</td>
</tr>
<tr>
<td>mass by axle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austroads incremental</td>
<td>6t</td>
<td>18.5t</td>
<td>25.0t</td>
<td>25.0t</td>
<td>= 74.5t</td>
</tr>
<tr>
<td>mass limit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The state government trials have taken slightly different approaches to road pavement infrastructure assessment (see Box 6). South Australia and New South Wales intend on applying system-wide rules while Victoria and Queensland are essentially assessing the maximum limit on case-by-case basis. However, South Australia would be applying case-by-case assessment beyond some predefined limits. System-wide rules have not been used by most states for the trials since their intention was to target a small number of interested transport operators and get them to nominate routes.

**Box 6. Road pavement assessment approaches**

In developing trials, state governments have developed a number of ways for assessing the road pavement infrastructure that will be used in the trials.

Queensland plans to undertake case-by-case assessments on the trial routes due to the complexity of the road network. Victoria has yet to undertake infrastructure assessments along the routes requested but the intention is to assess the routes on a case by case basis. This will be done in conjunction with a number of local governments and toll road operators. However, generally speaking, the routes identified comprise Higher Mass Limits or B-double networks, which will make the assessment process reasonably easier.

Similarly, South Australia’s trials are planned to be conducted entirely on the Higher Mass Limits network and the incremental pricing mass limits for this network will be based on axle types. However, case-by-case assessments will be applied for vehicles wishing to go above these limits. It is expected that these case by case assessments will take longer as the mass increases.

New South Wales intends on applying the Austroads Pavement Review Panel recommended maximum increases in mass.

**Fit with principles and feasibility**

The establishment of system-wide rules would result in a reasonably consistent approach across Australia to determining the maximum mass limit for road pavements. However, the ability to provide access to mass levels close to the maximum road capacity is dependent on the nature of the system-wide rules. If it is based on set increases by axle group this would result in an outcome that is probably a reasonable amount less than the maximum mass limit since it does not take into account road types, as would be achieved under a national road classification system.
Although a national road classification system appears optimal, it would require a significantly improved understanding of the road network, how different road types respond to increasing mass levels and national agreement on a classification system. In contrast, set increases by axle group could be agreed upon based on known empirical knowledge in a reasonably short period of time.

The application of system-wide rules would enable the establishment of an “incremental pricing road network” based on a set of easily understood and transparent rules compared to a case by case assessment approach in which a network would evolve based on each subsequent assessment. This is discussed further in section 5.2.2.

**Integration with Performance Based Standards infrastructure standard process**

The pavement vertical loading standard currently limits individual axle group loads to those that presently apply, such as General Mass Limits, Concessional Mass Limits (CML) and Higher Mass Limits. This means that the Panel cannot approve vehicles that are above these limits. If the Performance Based Standards infrastructure standards are used to assess incremental pricing vehicles from an infrastructure perspective, the vertical loading standard would need to be replaced with either case-by-case assessment or system-wide rules. In addition, the current review of the Performance Based Standards scheme will need to determine how to address any other issues that are specifically related to assessing a road network’s capacity to accommodate the additional mass of incremental pricing loads.

**BRIDGES**

The options that could be applied to assess the capacity of bridges to carry loads under an incremental pricing scheme are similar to road pavements – case-by-case assessment or system-wide rules. This type of framework is already provided under the current infrastructure standards that apply under Performance Based Standards for bridges, which allows for either:

- a bridge formula to be applied
- a comparison to a reference vehicle, or
- a case-by-case assessment of each bridge and/or vehicle along a chosen route.

The bridge formula is intended to give a general indication of whether a vehicle can operate across bridges, whilst the second option was intended to allow assessment of common vehicle configurations which may allow for a more accurate fitting of the vehicle to the bridge capabilities. The most common assessment method appears to be the third option (case-by-case assessment) and this is reflected in the approaches taken by the state governments for the trials and the Canadian case study (refer to Box 7).

**Box 7. Approaches to bridge assessment**

The state governments involve in running trials and the Saskatchewan provincial government in Canada have generally used case by case assessments for assessing additional loads on bridges. Some state governments are intending on taking a case by case assessment approach because of the incomplete understanding of the capabilities of all of the bridges along a proposed route while for others the issue has been that the bridge formula is not well suited to apply at high mass levels. One of the issues with
this assessment process in the case of the state governments has been the time required to perform these assessments, especially when there are many bridges along a route as has been the case in some of the routes that were assessed in New South Wales.

Some states have indicated that knowledge of the capabilities of bridges in their state is not well understood, and even less so for local governments, while others have indicated that in their states there is a reasonably good understanding of the capabilities. Another aspect that has been indicated from the progress of the trials is that bridges are quite often the major infrastructure constraint which limits the ability of the road infrastructure provider to allow higher mass along many routes.

**Fit with principles and feasibility**

The bridge formula provides a quick and cost-effective process of evaluating each vehicle against a bridge. However, this formula is only intended to give a general indication of the suitability of a vehicle to operate on bridges since it was developed based on short-span bridges at somewhat conservative mass limits. Therefore, using system-wide type assessment process for all bridges is likely to produce conservative estimates as to the mass capabilities of bridges.

Indeed, a generic assessment of bridges for very high loads is problematic since there are a number of factors that may play a role in assessing the bridge capability including design, construction, age and the operating environment. A case-by-case assessment approach would address these issues. However, it is likely to increase application time and costs and potentially inhibit new entrants into the scheme, especially for those governments that do not currently have the capabilities or resources to perform cost effective assessments (e.g. local governments). The reference vehicle approach also raises issues, as it is only applicable for a limited number of vehicles on a limited number of bridges.

This creates significant implications for the feasibility of an incremental pricing scheme and emphasises the need for road infrastructure providers to develop an improved understanding of the capabilities of bridges in their network. This is particularly important since there is currently a certain degree of overloading across the network. Therefore, allowing access to higher loads could result in severe distress for some bridges if transport operators overload above an even higher allowed mass limit. It is this concern that highlights the need for effective mass compliance strategies as part of an incremental pricing scheme. In addition, the progress from the trials indicates that the success of an incremental pricing scheme may rely upon the ability of road infrastructure providers to upgrades bridges. These upgrades could be built into the incremental price (refer to section 6.1.1), although it is not apparent whether the price would be prohibitively high for transport operators.

### 5.2.2 Route definition

A number of options exist for determining vehicle access and available routes, which will be categorised into two options:
1. Access approval on a case-by-case basis

2. Development of an incremental pricing network

**Option 1: Access approval on a case by case basis**

This option would involve determining route access on a case-by-case basis, with assessment of the route conducted for each individual application. This is similar to the existing process for special vehicle permit applications. Operators wishing to take part in the scheme would submit the routes they wish to travel on for assessment by road infrastructure providers. The infrastructure provider would then undertake an assessment and determine access availability. Some examples of how this approach is planned to be applied for the trials is outlined in Box 8. The application of a case-by-case access approval approach could be used to define an incremental pricing network based on each subsequent approval.

<table>
<thead>
<tr>
<th>Box 8. Approaches – case by case route assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the incremental pricing trials in Queensland, Victoria and New South Wales transport operators have been asked to put forward their preferred routes for the trials, which have then undergone infrastructure assessment. This is similar to the route assessment process used in the Saskatchewan Transportation Partnership Program (TPP).</td>
</tr>
</tbody>
</table>

**Fit with principles and feasibility**

This option can be accommodated under existing state and local government processes for determining routes. However, it is clearly more costly to administer than a pre-defined incremental pricing network and may reduce certainty of the application process for potential applicants. Nonetheless, this option may have a significant impact on the number of routes available, create more flexibility for operators and, therefore, increase road user productivity.

**Option 2: Development of an incremental pricing road network**

This option would involve the development of an incremental pricing road network, comprising a network of pre-assessed roads and bridges with specified incremental mass limits. Operators wishing to participate in an incremental pricing scheme could then operate on the specified maximum network up to the allowable mass limit. This is similar to the system that currently operates for B-doubles and Higher Mass Limits. An example of how this approach is planned to be applied for the trials is outlined in Box 9.

The application of system wide rules in assessing whether a vehicle can “fit” with the road network would enable the establishment of an “incremental pricing road network” based on a set of rules.

<table>
<thead>
<tr>
<th>Box 9. Road network approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the trial in South Australia (SA) the intention is to develop a pre-defined incremental pricing network. One of the perceived benefits of this approach is that it will streamline the route assessment process.</td>
</tr>
</tbody>
</table>

**Fit with principles and feasibility**
The development of a road network would provide certainty for operators wishing to participate in incremental pricing as access within the network would be assured given vehicle approval. However, limiting incremental pricing operators to a set network may limit the potential benefits available to operators, particularly where “last mile” issues exist.

Developing a network will take some time and cost as assessment and classification of the road infrastructure would need to be undertaken. A solution to this in the short term could be to develop an incremental pricing network based on our current understanding of the load carrying capacity of the road network with the capacity to allow for case by case assessment of roads outside of this network. In addition, in the short term, an incremental pricing network could align itself with the Performance Based Standards network, where there is a good understanding of the road infrastructure. Over time, an incremental pricing network could develop based on demand from transport users.
6. CHARGING

This section will outline the different options for developing incremental prices and the potential monitoring systems available to allow for charging and/or compliance under the scheme. This has been developed in line with the guiding principles (Table 3).

6.1 Pricing and monitoring system

Table 3. Guiding principles for pricing and monitoring system

| Pricing Methodology | Efficient, nationally consistent and simple. The incremental price should promote the efficient, safe and sustainable use of infrastructure, vehicles and transport modes. Prices will therefore be based on efficiency principles (including total cost recovery) as far as is practical taking into account the mass, distance travelled and location of vehicles using a nationally consistent pricing methodology and formula. The pricing structure should be administratively simple and transparent for users
| | Align with the applicable current charging system (currently PAYGO). There must be an appropriate alignment or “meshing” of the incremental pricing methodology and the current charging system to ensure that there is no double-counting of data and that an incremental pricing scheme does not charge for a service already provided through the current charging system
| Mass, Distance and Location Monitoring System | Monitoring of mass, distance and location. The monitoring system should measure or record the distance, mass and location of the vehicle on a periodic basis (in order to provide the basis for charging and/or compliance). The systems output should be auditable and scalable as well as meeting evidentiary standards
| | Privacy. The standard of privacy control for monitoring systems that generate personal information should be at least equivalent to the Intelligent Access Program (IAP)

The development of a pricing and monitoring system takes into account five different components:

1. **Pricing methodology**: This section will outline the different pricing approaches that can be applied to establish marginal costs, which can be used to generate incremental prices.

2. **Monitoring systems**: This section will discuss how the charging parameters can be measured or recorded in order to provide the basis for charging and/or compliance.

3. **Align with current charging system**: This section will outline the adjustments or allowances needed for the current charging system and the new incremental pricing system to align or “mesh” appropriately. These adjustments relate to either the incremental price or to the current charging system (consisting of registration and fuel charges).
4. **Alternative pricing methodologies:** This section outlines alternative approaches to the development of incremental charges.

5. **Price setting:** This section will discuss the different options for who could be responsible for setting the incremental charges.

It is important to note that the legal design of the pricing and monitoring system will need to be structured so as to immunise it as far as possible against legal challenge (for example, on the basis it represents a tax in the form of an excise – able to be levied by the Commonwealth only - or is insupportably discriminatory and protectionist). These legal design issues will need to be resolved in the next phase of development of a scheme as part of the development of a regulatory impact statement (should COAG agree to proceed to phase two of the road reform plan).

### 6.1.1 Pricing methodology

**Economic efficiency**

The guiding principles for the pricing methodology state that the incremental prices should be based on efficiency principles. A typical definition of economic efficiency is:

> “Economic efficiency is defined as a state of affairs in which, given the values of resources utilised, one has taken advantage of every available opportunity to increase the economic welfare of consumers through the provision of larger quantities of outputs, better products, or a mixture of outputs better adapted to consumer preferences” (Bishop, 1995, p.255).

Economic efficiency requires satisfaction of productive, allocative and dynamic efficiency:

- **Maximum productive efficiency** requires that goods and services be produced at the lowest possible cost. This is a question of the input mix used to produce the output of any good or service.
- **Maximum allocative efficiency** requires the production of the set of goods and services that consumers value most, from a given set of resources. This is a question of the output mix of the economy.
- **Greater dynamic efficiency** means that consumers are offered, over time, new and better products, and existing products at lower cost” (Productivity Commission, 2005, p.10).

From this concept of efficiency, the implications for road infrastructure pricing is that **prices should be set at the marginal social cost for additional units of road use** in a way that reflects the economic costs of providing infrastructure services. The pricing approaches in this paper will also assume that efficiency includes total cost recovery, which is consistent with the Productivity Commission’s definition of economic efficiency. This is also consistent with the directions given by the Council of Australian Governments for the 2007 Heavy Vehicle Road Charging Determination which was based on applying a methodology that ensures “ongoing delivery of aggregate cost-recovery” and the “removal of cross-subsidisation across heavy vehicle classes” (Council of Australian Governments, 2007, p.14).

Therefore, the pricing structure should reflect both marginal costs and the desire to recover the total costs associated with additional mass on a vehicle that would not
otherwise have been incurred had the heavy vehicle not been allowed to access the additional mass.

The marginal social costs of road use are typically defined as equal to the sum of the marginal costs of:

- infrastructure wear and damage
- externalities (such as congestion, road accidents and environmental impacts)

Whilst externalities are acknowledged as being a valid cost, the appropriateness of capturing this cost through a mass based charge is being considered through the review of externalities under phase one of the COAG road reform plan. Therefore, the issue of externalities will be dealt with in the development of the regulatory impact statement in phase two of the COAG road reform plan taking into account of this review.

As a result, the marginal social cost of road use for this document will exclude externalities and only include infrastructure wear and damage and, therefore, reflect the cost of bringing forward planned road expenditures as a result of an additional unit of road use.

Achievement of allocative efficiency will also require road infrastructure providers to assess the most appropriate routes for an incremental pricing scheme taking into account demand from the transport industry in order to obtain the best use of available resources.

Marginal cost pricing approaches

This section outlines the different pricing approaches used to estimate the marginal road costs of additional units of mass above the current regulated limit. There are two key aspects of establishing marginal costs:

1. short-run versus long-run marginal costs
2. the type of marginal costing approach

(a) Short-run versus long-run marginal costs

Marginal costs can be defined as being either short-run marginal costs (SRMC) or long-run marginal costs (LRMC). The definitions of these concepts are as follows:

- short-run marginal costs will be defined as the cost of meeting an incremental change in demand, holding asset capacity (and related expansionary capital investment) constant
- long run-marginal costs reflects the cost of meeting an incremental change in demand assuming all factors of production can be varied.

In the context of roads, short-run marginal costs is essentially the cost of repairing and maintaining a road as a result of higher loads on a heavy vehicle in order for the road to be returned to the same road standard and condition prior to the additional load. This road standard could be considered to be the design standard at the time of construction of the road or when the road last had an improvement to its standard, which is typically measured with reference to structural characteristics of the road including its “strength” and remaining useful life. The condition of the road is typically measured by reference to factors such as roughness of the road and rutting. The roughness of the road is
important since it affects vehicle operating costs and travel time. Both roughness and remaining useful life are used to determine the timing of the next road maintenance intervention.

In contrast, in addition to the cost of repairing and maintaining the road, long-run marginal costs is the “expansionary” cost associated with improving the standard of the road as a result of higher loads on a heavy vehicle. The cost of repairing and maintaining the road under this calculation would include not only the future expansionary costs but also the impact that the expansionary cost has on the cost of maintaining the road since an upgraded standard may actually result in lower ongoing maintenance costs associated with higher loads.

These two options (short-run marginal costs versus long-run marginal costs) are consistent with the way in which a comprehensive mass-distance location-based pricing system could be structured to achieve both marginal cost pricing and total cost recovery; for example, this future system could be structured as follows:

- A variable charge reflecting the short-run marginal costs (of those road use factors that impact on road costs, e.g. mass, distance) plus a fixed or variable charge that reflects residual costs in order to recover total costs, or
- A variable charge reflecting long-run marginal costs (of those road use factors that impact on road costs, e.g. mass, distance) plus a fixed or variable charge that reflects residual costs in order to recover total costs

Consistent with the potential future comprehensive mass-distance location-based pricing system, under an incremental pricing scheme the focus would be on developing a pricing structure which consisted of a variable charge either reflecting the short-run marginal costs or long-run marginal costs associated with additional mass.

The state government trials have each taken a similar marginal costing approach for road pavements (see Box 10).

**Box 10. SRMC versus LRMC approaches**

The state government trials, at this stage, are all intending on taking a short-run marginal cost approach to determine the marginal cost of road pavement wear. The predominant reason for this approach is that short-run marginal costs are easier to estimate since they exclude ‘expansionary costs’ from the cost base and because there will be no ‘expansionary costs’ required for the length of the trials (which may only last for one to three years). The Saskatchewan program takes a long-run marginal cost approach which is estimated based on the change in the future costs with associated with a deeper pavement as a result of the higher loads on the nominated route.

**Fit with principles and feasibility**

Short-run marginal costs is usually argued to be the more technically correct form of marginal costs to be used for efficient pricing since it measures the impact that one marginal unit has on infrastructure if it is repaired straight after it incurs wear. However, short-run marginal costs will not necessarily recover costs, because for road infrastructure, short-run average costs (SRAC) are likely to be above short-run marginal costs for much of the time since capacity is likely to be increased before average and
marginal costs converge\textsuperscript{14}. Therefore, in order to recover total road costs using a short-run marginal cost pricing structure in an incremental pricing scheme, the most ideal solution would be to recover the shortfall residual costs (if they exist) in a way that does not distort road use (e.g. a fixed charge for access to the incremental pricing route).

However, there is much debate among economists as to the appropriateness of short-run marginal costs as the basis for pricing. Indeed, some economists argue that LRMC pricing results in better price stability than short-run marginal costs and gives a better reflection of future costs, which is important if investment decisions are linked to the longer term. More importantly, it may result in more of the road costs associated with additional mass being represented in a variable long-run marginal cost price since it takes into account expansionary expenditure. This may not be an issue if the road infrastructure is easily capable of taking the additional mass and does not require future or up-front expansionary road expenditure – in which case short-run marginal costs and long-run marginal costs may become close to being equal.

Importantly, even long-run marginal costs may not achieve total cost recovery since, if it is constructed based on future costs, once the expansion is completed the investment is sunk and the expansionary costs would not form part of economic marginal costs. One solution to this dilemma is to calculate long-run marginal costs under a method that establishes prices at a point in time which would apply for a number of years. These prices would be established in a way that ensures that expansionary road costs that results from the impact of the higher loads are recovered.

\textbf{(b) Type of marginal costing approach}

Three different approaches have been considered to develop marginal costs\textsuperscript{15}:

1. \textit{direct approach}
2. \textit{indirect approach}
3. \textit{econometric approach}

The differences between these three approaches in estimating the marginal costs of mass levels above the regulated limits are outlined in Table 4.

\textbf{Table 4. Marginal costing approaches}

<table>
<thead>
<tr>
<th>Approach</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>The direct approach attempts to discount future road costs in response to postulated increases in masses above the prescribed mass limits.</td>
</tr>
<tr>
<td></td>
<td>- The marginal cost is the change in the net present value (NPV) of future road costs as a result of a marginal increase in mass. This change in net present value can be converted to an annuity, which is a series of fixed annual costs reflecting the underlying annual economic cost.</td>
</tr>
<tr>
<td></td>
<td>- Typically, this approach makes use of a pavement</td>
</tr>
</tbody>
</table>

\textsuperscript{14} This is a common feature of natural monopoly infrastructure.

\textsuperscript{15} This is similar to the approaches outlined in Bruzelius (2004), \textit{Measuring the marginal cost of road use, An international survey}, Swedish National Road and Transport Research Institute.
management system (PMS) to estimate the marginal cost of increases in mass.

- As an example, the following diagram illustrates that higher loads on a heavy vehicle will most likely result in future road repairs and maintenance being brought forward in order to ensure that the standard of the road is maintained at a certain level. The difference in the net present value of the future costs under both options is the marginal cost (assuming that the increment is one additional unit of mass).

![Road Life Cycle Diagram]

### Indirect

The indirect approach makes use of the assumption that the marginal cost is the average cost; typically the cost per SAR-kilometre. Note that SAR (standard axle repetitions) is a measure of road wear (explained in more detail later in this section). There are a three key methods to develop a cost base which can be used to generate average costs (e.g. average cost per SAR-kilometre) for each vehicle type:

- **Cash Accounting Method** – This method would involve developing a cost base in which costs are accounted for in the year they are incurred. This is akin to the current “PAYGO” approach, albeit the current approach to estimating the cost base is via a seven year average of real historical road costs.

- **Traditional Building Blocks Method** – This method attempts to establish a cost base on the basis of estimating efficient economic costs for each of the different road cost components that are relevant. For example, under this approach efficient road maintenance operating costs could be estimated via benchmarking the cost of particular types of maintenance activities.

- **Annuity of Future Lifecycle Costs Method** – This method establishes a cost base using an annuity of future road costs which takes into account the future lifecycle road costs which have been established to achieve optimal road maintenance

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16 Under this approach, the cost base would need to be allocated to different parameters (such as SAR-kilometres), similar to the current PAYGO approach, in order to determine the proportion of costs that are directly related to the gross mass of the vehicle.
strategies. The purpose of an annuity would be to turn future road costs, which would typically be characterised by quite different expenditure needs in any one year depending on the point in the lifecycle, into a series of recurring annual fixed payments, reflecting the underlying annual economic cost.

**Econometric**
The econometric approach establishes a relationship between mass and road costs based on analysing historical road expenditure and road usage in terms of mass.

These approaches can be applied using either short-run or long-run marginal costs. Therefore, there are a number of different combinations that could be applied to develop marginal costs (refer to Appendix 5 for details). For example, using the indirect approach with a cash accounting method (such as the current PAYGO system) in a way that generates ‘long-run marginal like’ costs would involve estimating the average cost from a cost base estimated using a cash accounting approach. The road costs under this approach would include expenditure that not only return the road to its current standard but also incorporate ‘expansionary expenditure’, which provides for future growth in the carrying load of vehicles.

There is a mixture of marginal cost approaches that are intended to be used for the trials (indirect and direct approaches). There is also an Austroads project that is developing a sophisticated model of marginal costs using the direct approach (see Box 11).

### Box 11. Marginal cost approaches
Various approaches are planned to be undertaken by different jurisdictions for the trials. South Australia and Victoria are intending to use an indirect approach that is a version of the current PAYGO cost base that is tailored for their states, while Queensland has been considering both direct and indirect approaches and New South Wales has been focused on direct approaches. It can be observed from the work done to date that the direct approaches appear to require significant model building to produce meaningful results. This is because they are attempting to model the changes in future road maintenance costs that are associated with additional mass on vehicles, which can be challenging in terms of the assumptions and cost to road wear relationships that underpin the modelling.

This is also evident in a current Austroads project called ‘Understanding Wear and Cost Implications of Incremental Loads on the Road Network’ which is developing a model that uses the direct approach for a number of different Australian road types. The first part of this project is expected to be completed in late 2008. The Saskatchewan program is more of a direct approach since it is based on estimating the additional annuitised costs as a result of the higher loads on the nominated route. This is based on a model that estimates the future costs associated with the higher loads, which is applied to the specific route for which access to higher loads is being sought.

### Fit with principles and feasibility
The direct approach is considered the most efficient of the three options, since it attempts to analyse the different impact that each increment of mass has on road costs. Therefore, it should in theory closely aligns the incremental price with the true underlying marginal cost of additional mass, reflecting the actual additional road wear
costs as a result of the extra vehicle mass. This would especially be the case if the direct approach was applied to a specific road rather than being based on an average of roads of a similar type.

In contrast, the indirect approaches are based on using average costs. This means that they will not necessarily accurately reflect the impact that higher mass levels has on road costs and may result in an underestimation of the true impact of additional mass, especially at very high mass levels. The econometric approaches could deliver reasonably efficient results. However, this has not typically been a successful approach to developing marginal costs due to the difficulty in establishing robust relationships between variables using historical data.

In terms of simplicity, the indirect approaches are reasonably simple in nature since they could be constructed in a similar way to the current costing models (the “PAYGO system”) which generate average costs. In contrast, the direct approaches involve constructing complex models which discount future cash flows under different scenarios. These also involve the development of sophisticated rules around the timing of maintenance interventions as a result of additional mass on the vehicle.

In terms of comparing the different indirect methods that can be used to estimate the average cost, all of the three methods should over time recover the same level of costs. However, the cash accounting approach could generate inter-temporal issues if future road costs are expected to increase. This is because the cash accounting approach recovers road expenditure in the year it is spent and maintenance expenditure on roads can be “lumpy” from one year to the next. In this context, the traditional building block approach and the annuity of future lifecycle costs could generate better current economic costs in dealing with inter-temporal issues such as lumpy road spending and therefore avoid price shocks. In addition, the cash accounting approach appears less appealing if long-run marginal costs are calculated based on one road or a small number of roads. This is because the incremental price would potentially have large spikes and troughs given that expansionary capital costs would be reflected in the year they are spent.

The lifecycle costing approach introduces some challenges since it relies on estimating future costs. This would require good estimation techniques and potentially future adjustments if actual expenditure differs from forecast expenditure. In addition, this approach assumes that future forecast expenditure is efficient and optimal, which may not be the case. Finally, the traditional building block approach involves estimating a number of key variables including the regulatory asset value, depreciation, appropriate rates of return and, quite probably, determining efficient operating costs. Just like future costs, estimating these variables would require significant effort and analysis.

It should also be noted that there are hybrid models which could be applied which use a combination of the cash accounting, traditional building block and annuity of future cost methods.

**Bridge Costs**

Although the marginal cost pricing approaches outlined above can apply to both road pavements and bridges, it should be noted that even more so than road pavements, the impact of higher loads on an existing bridge is an evolving area of research and can vary substantially due to design, construction and environment.
Generally, existing bridges are regarded as either being capable of taking a vehicle at a particular mass level (and with a particular configuration, e.g. axle spacings) or not being capable. The incremental cost of using a bridge is therefore very low until it reaches a point at which bridge fatigue begins to occur and the structure of the bridge experiences severe damage. This potentially causes the incremental cost to effectively spike.

Under an incremental pricing scheme, a bridge may need to be upgraded so that it is capable of carrying higher mass levels. The construction cost of this upgrade could be costed under a long-run marginal cost approach. This would allow for “expansionary capital” which is required to change the standard of the infrastructure. At this stage, none of the state government trials will be estimating the incremental costs of higher loads on bridges in order to establish an incremental price. Although, none of the trials will involve upgrading a bridge.

**Administration costs**

The guiding principle for ‘pricing methodology’ is based on achieving total cost recovery. Therefore, the administration costs of operating the incremental pricing scheme should also be incorporated into the incremental price. Administration costs will include the initial scheme set-up costs and ongoing operating and maintenance costs (including computer systems). The administration cost could be represented in the incremental pricing structure as a charge per kilometre travelled.

**Pricing Model Characteristics**

A number of pricing model characteristics need to be developed in order to transform marginal costs effectively into incremental prices. These characteristics have been categorised into six key areas:

- **Types of road pavement costs**
  The types of costs that can be used in development of marginal costs.

- **Road use parameters**
  The road use parameters options (e.g. SAR-kilometre) that could be applied.

- **Estimation of standard axle repetitions**
  The estimation of standard axle repetitions, which are typically the most accepted method of measuring road wear. These can then be linked to road costs.

- **Base mass limit**
  The options for setting the base mass limit for charging.

- **Charging parameters**
  The way in which an incremental price is charged to transport users.

- **Road type**
  The ways in which different road types are taken into account.
**TYPE OF ROAD PAVEMENT COSTS**

The different pricing approaches in section 6.1 all involve using road cost data to develop marginal costs. There are a number of costs that can be considered under each approach. These are listed below:

1. **Routine maintenance.** This type of maintenance includes any that cannot be put off in the short-term, typically to address public safety concerns. It is normally characterised by minor repairs such as repairing pot-holes and shoulder disintegration and sealing cracks.

2. **Preventative periodic maintenance.** This type of maintenance includes those that are required to return or improve the road pavement’s functional integrity to a specified level. This involves periodic works on the pavement and includes activities such as re-surfacing, re-sealing, surface patching and other treatments which will reduce future deterioration and reduce the need for expensive rehabilitation.

3. **Rehabilitation.** This comprises those asset management tasks that restore not only the functional integrity of the asset, but also the structural integrity of the asset. Rehabilitation could include activities such as overlays and major patching. For example, an overlay is often used to either correct a defective surface condition (which will reduce the roughness of the road) or to improve the load carrying capacity of the road pavement (which will probably result in a thicker pavement being overlayed).

4. **Reconstruction** includes major overhaul and full reconstruction of the asset. Essentially reconstruction is relevant where the asset, through gradual wear over time, has reached the end of its structural life or, through significant impacts, has experienced severe distress.

One of the key issues to note is that different costs are relevant under each marginal cost pricing approach. For example, costs that are of an expansionary nature (such as overlays that improve the load carrying capacity of the road pavement) relate only to long-run marginal costs.

Another issue is that economic theory on the marginal costs of higher loads has focused on the impact of mass on rehabilitation costs such as overlays with less emphasis or clarity on the impact on preventative periodic maintenance (such as re-sealings) and routine maintenance, even though these costs will be affected depending on the typical maintenance approach.

**ROAD USE PARAMETERS**

Road use parameters are used to develop a relationship between mass and cost, which can be constructed based on the vehicle type (e.g. rigid truck, B-double) or on the axle group (which can be common across different vehicle types). There are a number of ways in which this can be achieved:
The direct approach to pricing typically uses SAR-kilometres\textsuperscript{17} as the basis for determining cumulative road wear, which drives the timing of intervention points (that is, road repairs and maintenance). SAR relates to standard axle repetitions which is a measure of road wear. The use of a standard axle repetition relationship will result in increasing costs with each additional unit of mass. SAR-kilometres is equal to the number of standard axle repetitions multiplied by kilometres. Under certain conditions, standard axle repetitions is commonly referred to as equivalent standard axles (ESAs).

The indirect and econometric approaches have tended to use a combination of SAR-kilometres and AGM-kilometres (AGM is average gross mass of a vehicle). For example, the current charging system uses four road use parameters as the basis for allocating different road costs to different vehicle classes, including ESA-kilometres, AGM-kilometres, PCU-kilometres (PCU is passenger car units) and VKT (vehicle kilometres travelled).

In this context, the road use parameter options that could be typically applied under the indirect and econometric approaches are:

1. SAR-kilometres/ESA-kilometres
2. AGM-kilometres
3. A combination of both SAR-kilometres/ESA-kilometres and AGM-kilometres – For example, under the indirect approach, using a combination of both mass related parameters would be carried out by allocating different costs to each of the parameters.

All state governments are using SAR-kilometres as the major road use parameter for the purposes of determining a relationship between mass and costs.

The three options outlined above reflect the currently accepted relationships on mass and road wear. However, the understanding of the relationship between mass and costs is an ongoing area of research, especially at mass levels in the range that will apply to incremental pricing – that is, above current regulated mass limits. Therefore, significant further research is required into the impact of mass increases on different axle types and pavement types to understand whether the existing road use parameters (e.g. SAR-kilometre/ESA-kilometre) remain relevant at very high mass levels.

Each of the marginal cost pricing approaches in section 6.1 requires data on these road use parameters in order to develop a model that could generate incremental prices. The current source of data for these parameters is the Australian Bureau of Statistics Survey of Motor Vehicle Use, which collects data at a state level. However, if the pricing structure is based on a road classification system with different prices for different road types, data on road use parameters at a lower level of detail would be needed.

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\textsuperscript{17} Standard Axle Repetitions (SAR) is a measure of road wear damage caused by a standard vehicle axle group coming into contact with the road. Theoretically the accumulation of SARs eventually leads to the need for road maintenance activities. The SAR formula is

\[
SAR = \sum_{i=1}^{m} \left( \frac{L_i}{SL_i} \right)^n
\]

where \(L_i\) = load carried by axle group type, \(i\) (kN), \(SL_i\) = standard load for axle group type \(i\), \(m\) =number of axle groups, \(n\) is the power that it is raised to. SAR is equal to Equivalent Standard Axles (ESA) if \(n = 4\) (which has typically been used in the current PAYGO model). ESA is broadly acceptable internationally as representing the average relationship as a method to measure road wear.
This data is typically lacking for most roads and would probably require the use of data that is averaged across many roads (e.g. using ABS data), at least in the short term until more sophisticated approaches can be developed to collect data. More detailed data could come from the incremental pricing scheme itself depending on the monitoring system option that is applied.

**ESTIMATION OF STANDARD AXLE REPETITIONS**

There are essentially two standard axle repetition estimation options available for the incremental pricing scheme:

1. **One standard axle repetition power rule**\(^{18}\) across all road types. For example, the current charging system (currently PAYGO) uses a fourth power rule for the standard axle repetition formula in estimating charges. Under this condition, standard axle repetitions is commonly referred to as equivalent standard axles (ESAs).

2. **Different standard axle repetition power rules for different pavements**, relative to the level of damage likely to result from increase loads. This could include the third power rule, which has been advocated in research by the ARRB Group (Jameson, 2006) or, at the other extreme, 8 and 12 power rules where the road would be anticipated to break down faster.

Standard axle repetition estimation is an important part of general road engineering and planning and, as previously mentioned, is used as part of heavy vehicle charging under the current charging system (PAYGO). However for an incremental pricing scheme, getting the process right is even more critical. As has previously been discussed in this paper, the rate at which pavements breakdown is significantly greater at higher mass levels. Therefore the costs of getting the formula wrong in terms of cost recovery are potentially larger.

In terms of efficiency, using different power rules for different pavement types could be considered to best reflect the differences in mass and damage relationships across different road pavement types (Jameson, 2006). However the research on the most appropriate standard axle repetition value for each road type is still evolving and this needs to be taken into consideration.

**BASE MASS LIMIT**

The incremental charge will apply for use of mass above a base mass limit. One obvious option would be to set the base limit at the current General Mass Limits/Higher Mass Limits (refer to Figure 9). This would ensure that operators do not already pay for the access that they have already purchased through registration and fuel charges which provides them with the right to operate at mass levels up to General Mass Limits/Higher Mass Limits. The intention with an incremental pricing scheme is not to charge for access to the current Higher Mass Limit network providing that a vehicle is part of the Higher Mass Limits scheme.

\(\text{SAR} = \sum_{i=1}^{n} \left( \frac{L_i}{S_i} \right)^n\)

\(^{18}\) As outlined previously, \(n\) is the power that the ratio of (load to standard load) is raised to in the following SAR formula:
However, there are a number of considerations that would need to be taken into account when setting the base limit. For example, a number of governments have allowances which in certain circumstances allow transport operators to access mass levels above General Mass Limits/Higher Mass Limits. Therefore, the setting of the base limit will need to take these allowances into consideration if they were to continue under an incremental pricing scheme.

**CHARGING PARAMETERS**

The charging parameters should align with the Road Use Parameters (SAR-kilometres and AGM-kilometres), discussed in section 6.1, and refer to the way in which an incremental price is charged to transport users.

There are a number of options:

1. **Charge per incremental SAR/ESA-kilometres** – This would involve charging based on the number of ESA’s that relate to road wear above the regulated maximum mass limit (or the “incremental ESAs” above the base mass limit)

2. **Charge per unit of incremental mass-kilometres** – This would involve charging based on the level of mass above the regulated maximum mass limit (or the “incremental mass” above the base mass limit)

3. **Combination of the above two options.**

An example incremental charge calculation is presented in Box 12.

**Box 12. Incremental charge example**

Using the same example as in Box 2, under which a B-double travels approximately 180,000 kilometres each year and is loaded 50% of the time, using the current PAYGO mass-related average costs (i.e. average gross mass cost per-kilometre and equivalent standard axle cost per-kilometre) and assuming that the truck is charged only for the loaded leg, the incremental charge would equal approximately $10,700 annually or $107 per loaded trip¹⁹.

The charging parameters could also depend on the method of mass measurement, which is discussed in the next section. The options outlined above assume that the actual mass is measured. If the charging structure is based on transport users purchasing a “block”

¹⁹ Note that this calculation has not taken account the fuel adjustment as outlined in Box 19.
of incremental mass, the impact of this would most likely be to reduce the pricing to a charge per kilometre. This option is outlined in 6.1.1.

An incremental charge per SAR-kilometres could be quite complicated for transport operators to understand since standard axle repetitions (or even equivalent standard axles) is not a widely understood concept. A solution would be to convert a charge per SAR-kilometres to a charge per incremental mass-kilometre to simplify the charging process. The road use parameters in section 6.1 must be aligned in a way that results in the desired charging parameters.

**ROAD TYPES**

Once the incremental pricing routes or road network have been established, the incremental price can be structured to take into account location based aspects of road maintenance and construction costs through the development of a road classification system. Road classes could take into account a number of attributes, for example:

1. **Climate**, for example dry, temperate, or wet.
2. **Traffic levels**, which involve the density of traffic in and around a specified part of the road network influencing the frequency of road use and accumulation of damage. This could influence the preferred road design and level of service required along a road.
3. **Pavement types** refers to both:
   - Structure, which includes the physical design of the road, including elements such as overlay depth, substrate, etc., and
   - Materials, which include the physical properties or ingredients that makes up the road in a particular location.
4. **Provider costs** which reflect the underlying costs of the road infrastructure provider’s road maintenance and construction activities of a specific road network. Underlying costs may differ from one provider to another due to a number of factors, including respective organisational sizes, characteristics of the geography and economies of scale.

In this way, under any of the pricing approaches in section 6.1.1 there could be different charges per incremental SAR-kilometre or per incremental mass-kilometre for different road types. The state government trials have taken slightly different road type approaches (see Box 13).

**Box 13. Road type approaches**

All of the state governments have indicated that in some way they will be taking into account the different types of roads that are being used for the incremental pricing trials. This ranges from a more structured approach such as is intended in South Australia with a limited road classification of the Higher Mass Limits network that will be used for the trials compared to what is being intended in other states under which roads would be classified based on the routes that are eventually agreed to be used in the trials. This later approach is similar to the Saskatchewan program approach. This approach is more of a “partnership” with industry to work through the most appropriate routes that can add benefit to the transport task and then pricing the routes on a case by case basis.
The more road type attributes that are taken into account, the closer the pricing methodology is to accurately reflecting the future underlying marginal costs on each individual road. However, offsetting this is the greater complexity and cost in developing the pricing methodology.

Therefore, the key challenge in achieving the most efficient pricing structure taking into account road types will be to find the appropriate balance between accurately reflecting marginal costs at one extreme, and ensuring the charging system is simple and cost effective enough to implement, as well as being uncomplicated for transport operators to understand. Ultimately, the information that would be required to implement certain road type options at a detailed level would require the collation of relevant data and set up of appropriate systems.

The inclusion of road types in the pricing structure would mean that a nationally agreed classification system would need to be developed in order to allow for cross-border transport movements involving incremental pricing routes. The development of road classification types is linked to section 5.2, since there would be different maximum mass limits for different pavements and in different climatic zones.

### 6.1.2 Monitoring system

To be able to calculate an appropriate charge under an incremental pricing scheme, data will need to be estimated or captured via a monitoring system on the three key charging components: mass, distance and location. This section will consider how to measure or record the mass or distance of each of these elements and how the location aspect can be incorporated.

**Mass**

The concept underpinning incremental pricing is that operators pay to carry additional mass above what they are entitled to under the current registration scheme. This can mean either carrying higher mass on current routes or travelling at current mass beyond currently approved routes. What is important with mass measurement or recording is to periodically track the mass and location of the truck as it travels with the additional mass.

It should also be noted that there is a difference between measuring the mass of a vehicle and the mass of each axle group on a vehicle. If only a vehicle’s total mass is known in order to estimate the standard axle repetitions for a vehicle, a distribution of the total mass of a vehicle will have to be estimated or assumed for the vehicle in order to calculate each axle group’s contribution to the total vehicle standard axle repetition value.

There are two key ways to charge for mass:

1. **Charging based on actual mass measurement**

2. **Purchase of a block of incremental mass**, in which the transport user purchases the right to operate (or is granted the legal entitlement) below a mass level that is above the base mass limit (e.g. General Mass Limits, Higher Mass Limits).
Option 1: Actual mass measurement

For an incremental pricing structure to be based on a charge per additional increment of actual mass or standard axle repetitions (as outlined in section 6.1.1) there needs to be a way of measuring the actual mass of the vehicle to calculate the applicable incremental charge. In this situation, where a device is being used to measure mass for the purpose of charging, the provisions of the Uniform Trade Measurement Legislation (UTML) currently apply. These provisions prohibit the use of an unapproved measuring instrument for determining the amount payable as a charge.

The effects of the Uniform Trade Measurement Legislation may be avoided by:

- reliance on a device currently approved for use in trade, or
- obtaining a pattern approval for the use of such a device.

The proposals for measurement under this paper are more accurate than the assumptions that generate the base registration and fuel charges. However, they are only able to be applied by meeting the requirements of the Uniform Trade Measurement Legislation. Therefore, consideration should be given to amending the Uniform Trade Measurement Legislation to allow these issues to be regulated under transport laws that deal with base registration and fuel charges. The Uniform Trade Measurement Legislation is being replaced by a single commonwealth law regulating trade measurement.

There are two options that could apply to achieve actual mass measurement:

- On-board mass measurement, or
- Non-telematic mass measurement

(a) On-board mass measurement

Under this option, the actual mass of the vehicle would be measured on a continuous basis and in real time, using an on-board mass measurement device. The data would be stored and transmitted along with distance and location data.

Fit with principles and feasibility

This measurement of actual mass on a continuous basis enables the calculation of a charge that reflects road wear attributable to the carriage of the additional mass over the whole journey. A key advantage of using an on-board mass monitoring system is the potential for accurate, automated measurement and reporting of vehicle mass, alleviating the burden and reliance on alternative options such as self declaration and reporting by the operator.

There are currently a number of on-board mass measurement devices on the market which use load cell or air pressure transducer technology. The development of these devices has been driven primarily by increased accountability for mass compliance, such as through the introduction of chain of responsibility legislation. However, none of the current on-board mass products have been certified for charging purposes. The more immediate feasibility issues are:

- accuracy – tests on current technology have shown that accuracy of the measurement is highly dependent on factors such as the installation and maintenance of the equipment and the conditions under which the measurement is taken. For this technology to be suitable for charging, procedural
requirements for measuring mass and installation, calibration, repair and maintenance regimes will need to be developed.

- tamper-evidence – a major point of difference between on-board mass systems currently being used in a voluntary capacity and those that may be used for mass-distance charging is, in the latter case, a greater incentive for tampering. Before any agreement on the use of regulatory on-board mass monitoring systems may be reached, robust, cost-effective tamper-evident options will need to be developed. These would need to provide regulators with sufficient assurance for the integrity of on-board mass measurements, data storage and communication.

Transport Certification Australia, an independent organisation appointed by the state and territory governments, is currently undertaking a program of testing and trials of current on-board mass technology to assess these feasibility issues. Preliminary results have been promising, with more conclusive findings due in 2009.

Beyond the immediate feasibility issues identified above, the development of policy for the storage, communication and reporting of data must also be addressed before a regulatory on-board mass monitoring system and scheme may be implemented. This would also need to address potentially some privacy concerns as mass levels and location details are being continuously recorded throughout the journey. Measures would need to be introduced to ensure access and use of this information complies with the relevant privacy protection legislation. It should be noted that the development of policy for data management and privacy considerations would, to at least some extent, be able to draw on existing policy development for the Intelligent Access Program scheme.

Once these issues have been addressed, the device will need to be certified for use in trade measurement. However, manufacturers are only likely to submit their products to the certification process if they can be confident that there would be a market of sufficient size to recover the associated costs. These would include the certification fee, as well as research and development costs. The demand for such devices will be highly dependent on the design of the incremental pricing scheme and the anticipated take-up.

Therefore, for on-board mass measurement to be considered as a feasible option in the future, a program of further research and policy development would need to be undertaken and include resolution of trade certification issues. This could be expected to take several years.

It should be noted that there is one on-board mass measuring device approved for use as a trade measurement device (the NORAC Model AU20L4 local cell). However, the lawful use of this device is limited to the measurement of net loads delivered from a weighing platform, which may limit its usefulness for a broader incremental pricing scheme.

The cost of on-board mass monitoring systems to transport operators may limit the viability of this option. An “off the shelf”, heavy vehicle on-board mass monitoring system approved for mass-distance charging would cost at least some thousands of dollars. However, the final figure would depend on the extent of any additional, technical requirements imposed by policy makers. In addition to the purchase cost, operators would also incur ongoing maintenance and data service fees.
(b) Non-telematic mass measurement

Under this option, the actual mass would be measured using certified weighbridges at the points where mass levels change i.e. loading and unloading. The data from the weighbridges could be either kept in a log book (manual or electronic) or extracted from bills of lading and matched with distance and location information to determine a charge. Specifically, this option could be managed by self-reporting of mass by transport operators to road infrastructure providers on the basis of information from a certified weighing device (which would entail follow-up auditing of information that is reported). There are currently a number of public weighbridges certified across Australia, which can be used by the general public. Additionally, there are numerous private certified weighbridges which can be used by the owner for trade measurement purposes.

**Fit with principles and feasibility**

This option is dependent on certified weighbridges being in reasonable proximity to the points when the changes in mass levels are likely to occur. However, with only a limited number of weighbridges around Australia this will not always be viable. Additionally, there are limitations in what types of weighing some public weighbridges are certified to perform. This includes limit restrictions (ranging from 30t to 60t) and being unsuitable for end-to-end measurements, which may be required for longer vehicles. Both of these limitations could pose problems for the vehicles likely to participate in an incremental pricing scheme.

Indeed, the use of the Intelligent Access Program to ensure route compliance is currently being considered as an operating condition for gaining approval as part of the Performance Based Standards process.

The implementation costs associated with this option are different in nature to a telematic system. However, it would require the development of systems by jurisdictions and operators to process and manage the additional mass data and may also require the installation of additional weighbridges, depending on the extent of the incremental pricing scheme as well as a route and mass compliance system.

**Implications for route compliance**

This option measures the actual vehicle mass on a periodic basis at the point where the mass level changes. However, it does not provide information on where this additional mass is being carried. This information would need to be derived or estimated separately and will have implications for route compliance, which could include more regular road side checks, auditing of bills of lading, or telematic route compliance (such as the Intelligent Access Program).

**Option 2: Block of incremental mass**

This option assumes that a transport operator purchases the right to operate below a mass level that is above the base mass limit (e.g. General Mass Limits, Higher Mass Limits). It is assumed that the vehicle is always travelling at the new incremental mass level and is akin to the purchase of an option to operate at a higher mass level. This is similar to how the current Higher Mass Limits scheme operates, with operators being allowed to operate at higher mass limits on certain routes provided they meet certain

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Certified under the provisions of the Uniform Trade Measurement Legislation (UTML).
conditions, such as participation in the National Heavy Vehicle Accreditation Scheme (NHVAS). The requirement that Higher Mass Limits scheme vehicles are fitted with road friendly suspension offsets additional road wear and, therefore, there is no associated charge.

This option would not require compliance with the Uniform Trade Measurement Legislation (UTML) since the actual mass of the vehicle is not being used for charging purposes.

**Figure 10. New incremental mass level**

![Diagram of new incremental mass level](image)

**Fit with principles and feasibility**

This option does not involve any mass measurement for charging purposes and because an operator pays for access to a block of incremental mass it does not match the exact road wear impact with the incremental charge since the actual mass of the vehicle will lie somewhere between the base mass limit and the revised level. However, this option could include differentiation of different increments in terms of the incremental charge to take into account the different incremental road costs, which would more accurately align the road wear impact with the charge.

This is a reasonably low cost option compared to the others and limited privacy implications exist as the actual mass is not being recorded by location.

**Implications for route compliance**

Similar to the non-telematic option outlined above, this option does not provide information on where this additional mass is being carried, which will have implications for route compliance. This can be addressed by more regular road side checks, auditing of bills of lading, or telematic route compliance (which would be under the Intelligent Access Program).

**Comparison of mass options**

There is a mixture of mass monitoring approaches that are intending to be used for the state government trials (refer to Box 14).

**Box 14. Mass monitoring system approaches**

At this stage, none of the state government trials will be using on-board mass measurement to charge for mass for reasons outlined previously in this document when discussing the feasibility of this option. However, some state governments (Victoria, South Australia and Queensland) do intend to record the actual mass of the vehicle via self-reporting of mass supported by information from weighbridges and transport documentation such as bills of lading and audits. In contrast, New South Wales intends
to allow operators to purchase a block of incremental mass which would allow operators
to operate up to this new higher mass level. The approaches taken by state governments
have been largely driven by simplicity given that they are developing a short-term trial
rather than a scheme. The Saskatchewan program uses self-reporting of mass supported
by periodic audits of the information that has been reported.

In terms of compliance, some state governments intend to use telematic monitoring to
ensure route compliance. This approach is also taken by the Saskatchewan program.

**Distance**

In addition to information on mass levels, to calculate an incremental charge the
monitoring system needs to be able to estimate or capture information on the distance
travelled on the incremental pricing route(s) and, if charging is based on road types, on
what roads the additional mass is being carried.

There are two broad options for monitoring distance under an incremental pricing
scheme which vary according to accuracy in measurement and location:

1. **Actual distance measurement, using a device**
2. **Estimated distance**

**Option 1: Actual distance measurement**

This option would capture information on the actual distance being travelled by a
transport operator on the incremental pricing route. As with actual mass measurement,
the provisions of the Uniform Trade Measurement Legislation (UTML) will apply to a
device being used to measure distance and location for the purpose of charging. There
are two options for actual measurement of distance:

a. Telematic (GPS) system
b. Non-telematic distance measurement

**(a) Telematic (GPS) system**

Under this option, the location of the vehicle would be constantly monitored using an
on-board global positioning system unit. This data could then be used to determine the
distance travelled on different road types throughout the journey. The data could be
refined within the on-board unit itself or transmitted to a back office for processing.
Many vehicles are already equipped with global positioning system units for fleet
management purposes. Additionally, the Intelligent Access Program (IAP) has come
into operation in 2008 which collects global positioning system data for route
compliance purposes.

**IAP compliant**

Under the Intelligent Access Program (refer to Box 15), service providers are accredited
to provide on-board GPS units and to process the data generated by these units for route
compliance purposes. To be accredited, the service provider must prove that their
equipment meets the standards for accuracy and tamper-evidence required under the
Intelligent Access Program. Using Intelligent Access Program compliant equipment for
charging purposes has the advantage of the data already being subject to stringent
validity checks. The disadvantage of this option is that there are currently a limited
number of service providers accredited under Intelligent Access Program. Additionally, as the equipment is being used for the purpose of calculating a charge, it will still need to be certified for trade measurement purposes.

Box 15. Intelligent Access Program

The ‘Intelligent Access Program’ (IAP) refers to the national policy, and legislative and governance arrangements under which Australian jurisdictions and industry have collaborated to facilitate the introduction of on-board telematics as a mechanism for enhancing heavy vehicle compliance in Australia.

The Intelligent Access Program applies a comprehensive system of certification, privacy control and enforcement powers in respect of the various parties who perform key functions in the provision of telematics services, notwithstanding that the adoption of telematics-based compliance services is currently largely voluntary.

Intelligent Access Program implementation has been directed towards monitoring exceptional route compliance arrangements. It fulfils this function through the generation by third party service providers of exception reports which are transmitted to road authorities for the limited purposes of enforcing the permit/notice governing the enhanced access. Indeed in some states, access to the Higher Mass Limits scheme network is contingent upon enrolling under the Intelligent Access Program.

Third party service providers are certified by the Transport Certification Authority (TCA).

If the incremental pricing scheme is based on continuous (rather than exception-based) monitoring and reporting of the distance travelled by a participating vehicles as well as route compliance, it needs to be recognised that the former is an application which the Intelligent Access Program has not yet specifically addressed. Adaptation to this purpose may require additional policy and technical developmental work to be completed in conjunction with Transport Certification Authority and other stakeholders. Similar comments are applicable to any intended application of the Intelligent Access Program to managing compliance with continuous monitoring of additional mass allowances.

Non-IAP compliant

The alternative to the Intelligent Access Program is to use the GPS units that are already in use on many trucks for fleet management purposes.

Fit with principles and feasibility

The telematic system would effectively measure the distance travelled and allows for the continuous monitoring of the vehicle, thereby providing an accurate measure of distance travelled throughout the journey, across the different road types. However, there are likely to be privacy concerns under this option as it continuously monitors the location of the vehicle. Measures would need to be introduced to ensure that access to this information is restricted to specific purposes. These measures are already in place under Intelligent Access Program legislation but not for non-Intelligent Access Program compliant devices.

Devices certified under the Intelligent Access Program have already been required to meet high standards of accuracy and tamper-evidence for route compliance purposes. It
is likely that these standards will be sufficient for trade measurement certification; however the device will still need to be subject to the certification process.

In addition to these issues, the Intelligent Access Program has been developed for route compliance and not for charging purposes. Therefore, changes to its purpose, supporting legislation and responsibilities of the Intelligent Access Program service providers would be required to make it suitable for distance measurement.

The advantage of using non-Intelligent Access Program compliant devices is that the equipment is already in place and accepted by operators. A disadvantage is that there are not any accuracy requirements or validity checks on the GPS data collected. In addition, it may introduce evidentiary and enforcement uncertainty. The equipment would also need to be certified for trade measurement purposes. More importantly, the use of non-Intelligent Access Program compliant devices would require a new regulatory framework for the same result as has been achieved under the Intelligent Access Program regulatory framework.

Finally, the telematic options (Intelligent Access Program and non-Intelligent Access Program) are likely to include a number of costs including the cost of purchasing and installing the necessary equipment and the costs associated with the additional data processing beyond what is currently collected and reported under Intelligent Access Program and required to convert this data into a charge.

**(b) Non-telematic system**

Under this option, there are a number of approaches that could be considered for measuring distance. Two of the key approaches are as follows:

- **One-off measurement of particular route**
  For supply chains that travel along a constant route (for example mining) it would be possible to measure the distance of that route once\(^{21}\). The operator could then keep a record of the number of trips they take on that route (using a log book or bills of lading) and use this to calculate the distance travelled.

- **Odometer/hubometer readings at the points where mass levels change**
  For those operators who do not travel along constant routes an alternative option is to record the odometer/hubometer reading at the point where mass levels change, i.e. when mass levels are measured at a certified weighbridge. Under this option, regular audit checks would be required to ensure that operators are keeping accurate records. Additionally, the odometer/hubometer would need to be certified for trade measurement purposes.

These approaches could be managed by a self-declaration process. Under this process, the operator reports the distance travelled to the road infrastructure provider. This could be associated with an audit/verification or compliance assurance process (such as NHVAS – National Heavy Vehicle Accreditation System which would ensure that processes are in place so that operators know the mass of the vehicle and distance travelled).

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\(^{21}\) Using a measuring device certified under the provisions of the Uniform Trade Measurement Legislation (UTML).
Fit with principles and feasibility

This option records the distance travelled, however, it does not provide information on where this travel has taken place. This is unlikely to present a significant route compliance issue for those supply chains in which the routes travelled are fixed. There are unlikely to be significant privacy issues with this option.

An issue with implementation of this option is that neither odometers nor hubometers have been certified for trade measurement purposes in Australia. Industries that currently use odometers for charging such as taxis and hire cars have been specifically exempted from the scope of the Trade Measurement Legislation. This may be a consideration for an incremental pricing scheme.

The implementation costs for this option includes the cost of the purchase, fitment and maintenance of the measuring device and if necessary, Uniform Trade Measurement Legislation certification costs.

Option 2: Estimated distance

Under this option the operator would estimate the distance that a vehicle is likely to travel at the new incremental mass level. The estimated distance would then be used to calculate an incremental charge.

Fit with principles and feasibility

This option is clearly the simplest and lowest cost of all of the options. However, it is based on an estimate of distance travelled; therefore, it does not measure or record distance for the purpose of determining the charge as required under the guiding principles.

Comparison of distance options

There is a mixture of mass monitoring approaches that are intending to be used for the state government trials (refer to Box 16).

Box 16. Distance monitoring system approaches

None of the state government trials will be using telematic measurement of distance. There are several reasons for this including that Intelligent Access Program, the existing platform for route compliance, has been developed for solely route exception reporting and not for measuring distance for charging purposes. In this context, South Australia is intending to use non-Intelligent Access Program global positioning system tracking to measure distance while other states (Queensland, Victoria and New South Wales) are intending to rely on self-reporting of distance (with reference to a non-telematic measuring device) supported in some cases by checks such as audits, entry into NHVAS or remote monitoring systems. The later approaches are intended to be taken for simplicity given that they are developing a short-term trial rather than a scheme. The Saskatchewan program uses self-reporting of distance travelled supported by periodic audits of the information that has been reported.

6.1.3 Align with Current Charging System

This section will outline adjustments that should be made either to the incremental price or the current charging system (also known as the PAYGO system) in order to ensure appropriate alignment or “meshing” between the two systems:
- Adjustments to the incremental price required to integrate with the current charging system.
- Adjustments required to the current charging system. Both of these will be explored in the following sections.

**Adjustments to formula required to integrate with the current charging system**

In order for the incremental price to successfully integrate with the current charging system, the following considerations should be made in developing the incremental price:

- Incremental mass is calculated as the additional (or incremental) mass above the current maximum regulated mass limit
- An adjustment must be made for the impact on higher fuel consumption due to operating at a mass increment above the current regulated mass limit.

Essentially, the first adjustment is necessary to ensure that there is no double counting of costs since the current registration and fuel charges entitle the transport operator to operate with a mass up to the prescribed limit.

In terms of the second adjustment, a higher fuel consumption rate due to incremental mass results in higher fuel charges for the transport operator. Therefore, if an incremental charge is applied based on the impact of the incremental mass on road wear, the additional cost to the transport operator resulting from the increased fuel consumption rate should be deducted from the incremental price. The fuel adjustment is discussed in more detail in Appendix 6.

All of the state government trials are intending to apply the first adjustment but not the second.

**Adjustments to the current charging system**

Assuming that the introduction of the incremental pricing scheme does not impact the overall demand for road transport, there are four identifiable impacts on the current charging system ("PAYGO system") as a result of the operation of an incremental pricing scheme:

- **Total distance travelled** for vehicle classes that have vehicles participating in an incremental pricing scheme will decrease overall since the same freight task can be completed with fewer trips.

- **The average gross mass (AGM)** for vehicle classes that have vehicles participating in an incremental pricing scheme will increase since they will be carrying higher loads.

- **The number of heavy vehicles** will be less for vehicle classes that have vehicles participating in an incremental pricing scheme since the same freight task can be completed with a lower number of heavy vehicles.

- **Total fuel consumption (litres)** for a vehicle class will be impacted by two offsetting impacts since a decrease in total distance travelled will decrease total fuel consumption while a increase in the average vehicle mass for a vehicle class
will increase total fuel consumption since there will be an associated increase in the fuel consumption rate.

Overall, changes in these road user parameters (distance travelled, average gross mass, number of vehicles and fuel consumption) will impact both the overall costs allocated to heavy vehicles (compared to light vehicles), the costs allocated to each vehicle class and the resulting registration and fuel based charges. On the basis that the PAYGO cost base does not include the road costs associated with an incremental pricing scheme (since they will be charged for separately through the incremental price), this will result in either under or over-recovery of costs in aggregate or at the vehicle class level.

This is because the reduction in distance travelled will contribute to aggregate under-recovery (since less costs will be allocated to heavy vehicles compared to light vehicles than would be the case without the incremental pricing scheme) while the increase in average mass will contribute to aggregate over-recovery. Therefore, the overall impact on aggregate cost recovery will depend on the reduction in overall distance travelled relative to the increase in average mass.

The impact on the current charging system is likely to be quite small if the scheme only involves a small number of vehicles. However, if an incremental pricing scheme does start to have a sizable number of participants, the charging model could be adjusted to effectively offset the impact that incremental pricing has on road use data in the following way:

- The decreased total distance travelled that results from allowing operators to access a higher mass level could be added back to vehicle kilometres travelled as published in the Australian Bureau of Statistics Motor Vehicle Survey. This would involve the impact on total distances travelled for vehicles participating in the incremental pricing scheme.

- Average gross mass can re-estimated by firstly calculating the average gross mass of non-incremental pricing scheme vehicles using the average gross mass data and total number of vehicles as derived from the Australian Bureau of Statistics Motor Vehicle Survey and the average gross mass and total number of vehicles participating in the incremental pricing scheme. This can then be used to estimate a revised average gross mass of vehicles that would have occurred without the incremental pricing scheme since information will exist on the average gross mass and number of incremental pricing vehicles prior to entering the scheme through information collected as part of the scheme.

---

22 Average gross mass of vehicles not participating in the incremental pricing scheme can be calculated by unravelling the following formula:

\[
\text{Average gross mass with incremental pricing scheme} = \text{(number of vehicles participating in the incremental pricing scheme x average gross mass of vehicles in scheme)} + \text{(number of non-incremental pricing scheme vehicles x average gross mass of vehicles not participating in scheme)}
\]

23 Average gross mass of all vehicles prior to the introduction of the incremental pricing scheme can be estimated by the following formula:

\[
\text{Average gross mass without incremental pricing} = \text{(number of vehicles required for incremental pricing scheme vehicles prior to entering scheme x average gross mass of vehicles in scheme prior to entering scheme)} + \text{(number of non-incremental pricing scheme vehicles x average gross mass of vehicles not in scheme)}
\]
- The decrease in number of heavy vehicles that results from allowing operators to access a higher mass level could be added back to the number of heavy vehicles as published in the Australian Bureau of Statistics Motor Vehicle Survey. This would involve assessing the impact on vehicle numbers as a result of the incremental pricing scheme.

- The change in fuel consumption that results from allowing operators to access a higher mass level could be added back or deducted (depending on the overall impact) from fuel consumption as published in the Australian Bureau of Statistics Motor Vehicle Survey. Fuel consumption could be estimated based on the change in the mass levels of the heavy vehicle as a result of the scheme (as per formula in Figure 13).

It should be noted that if demand for road transport changes as a result of the productivity benefits associated with accessing higher loads the recommended adjustments may not hold. This would need to be monitored to assess whether any further adjustments may be required for any specific routes that are part of the incremental pricing scheme.

Finally, any revenue received under an incremental pricing scheme will need to be taken into account in the setting of the PAYGO cost base. This is necessary to ensure that the incremental charge is not recovered twice from transport operators.

### 6.1.4 Alternative pricing approaches

In developing this options paper, some alternative approaches have been presented during the consultation process. Two of these approaches are presented below, which are intended to be additional components of the incremental charge as determined by the pricing approaches in section 6.1.1:

1. **Sharing of the freight savings.** Under this approach, the private benefits which can be realised by an asset user from being able to access a particular piece of infrastructure in a particular way are shared in some way with the road infrastructure service provider. This approach was used in the Saskatchewan program until September 2008, when it ceased.

2. **Incentive component.** Under this option, an incentive charge is established that reflects a vehicles use of the road network in terms of the ratio of ESA/gross vehicle mass (could also be referred to as a “sustainability pricing factor”). This is done in order to achieve a quicker transition to a more optimally sustainable vehicle fleet mix than would occur in the absence of a fully direct pricing system (that is, mass-distance location-based system that applies to all mass levels).

Whilst a detailed comparison of these approaches will not be undertaken, it should be stated that the first approach would contradict the principle of recovering no more than costs and the second approach, which attempts to provide an incentive to move to a more sustainable fleet mix, is similar in nature to the previous B-double subsidy that existed prior to the 2007 NTC road charging determination. The risk with the incentive component approach, which is one of the reasons why the B-double subsidy approach was removed, is that it could create perverse outcomes and be hard to remove in the future since it may provide a benefit to particular road users. Therefore, these options would appear to be outside of the scope of what has been requested by COAG.
6.1.5 Price setting

Price setting is the process of constructing and updating the pricing methodology and appropriate charges overtime. Three general options are possible for those responsible for setting the incremental prices:

1. a central organisation
2. state government
3. both state and local governments

It is assumed that options 2 and 3 would involve each government applying a nationally agreed pricing methodology to set incremental prices.

Fit with principles and feasibility

Of the three options, the main issues around whether each option meets the guiding principles relates to:

- whether the charge setting process will allow for nationally consistent implementation of an agreed pricing methodology, and
- the impact of each option on the efficiency of the incremental prices.

The first option, which involves a centralised price setting body, is considered to have a high level of “fit” from the perspective of ensuring a nationally consistent pricing methodology. However, it may have an impact on efficiency if it results in an outcome that does not sufficiently take into account localised issues, such as different road costs in different parts of Australia.

In contrast, the decentralised options (the second and third options) have the potential to result in different approaches to price setting, even if there is agreement as to a national pricing methodology. However, this approach could arguably result in the setting of more efficient prices since each government may attempt to more closely tailor prices with the costs of localised road provision. However, the most challenging issue for the decentralised price setting options is that prices may be set differently in different parts of a transport movement, making it quite complex for the transport industry to understand the prices and potentially to achieve productivity benefits.
7. FEE COLLECTION AND ROAD SPENDING

This section will explore the different options under which charges/fees can be collected, distributed between levels of government and spent on roads (Table 5).

Table 5. Guiding principles for fee collection and road spending

| Fee Calculation and Collection | • Accurate and timely. Data collection, processing and billing should be accurate and timely  
| • Transport operator friendly. The process and system should be easy for operators to understand and to interact with  
| • Scalable and flexible. The system should be scalable to allow for expansion of the pricing system to include larger numbers of trucks and accommodate any future changes to the pricing structure  
| • Effective debt management. The system should ensure that there is appropriate protection against outstanding debts |
| Funds Distribution | • Funds directed back to road infrastructure service provider. An amount of funds that is equivalent to the funds collected via charging should be directed back to the road infrastructure service provider responsible for the roads used as part of the scheme |
| Road Spending | • Road spending to ensure service level. Infrastructure used in the scheme should be funded in a way that ensures agreed service standards (as supported by the incremental price) are met during the agreed period of the scheme |

7.1 Fee calculation and collection

Fee collection arrangements refer to the invoicing and payment options available to an incremental pricing scheme. A summary of the type of options that will need to be considered in the scheme, and some examples, are outlined in Table 6.

Table 6. Fee calculation and collection options

<table>
<thead>
<tr>
<th>Function</th>
<th>Options</th>
</tr>
</thead>
</table>
| Invoicing         | • *Frequency*: e.g. weekly, monthly, quarterly  
|                   | • *Level of detail*: e.g. per trip, accumulated totals  
| Payments          | • *Payment method*: e.g. B-pay, credit card payments  
|                   | • *Timing of payment*: pre-paid or post-paid  
| Debt management   | • *Options*: e.g. fees for late payment; flexible payment options to avoid cash flow issues; and possible suspension from the incremental pricing scheme or of registration for serious non-payment problems |

The options outlined will be influenced by the type and complexity of the overall incremental pricing scheme and would therefore need to be considered in the broader scheme context. In addition, the functions are somewhat linked – for example, if
participants were required to pre-purchase the right to travel at a set higher mass, debt management would be more easily managed. Fee collection arrangements also need to take into consideration their suitability to transport operators. There is, therefore, a need to ensure that the invoicing and payment systems available are easy for operators to understand and interact with.

The approaches intended to be used for the state government trials and being used in the Saskatchewan program is compared in Box 17.

<table>
<thead>
<tr>
<th>Box 17. Fee calculation and collection approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A number of different approaches to fee calculation and collection are proposed for the incremental pricing trials. In Queensland, transport operators will be required to calculate charges based on spreadsheets provided by the state government and payments will be forwarded on a monthly basis. This approach has been taken since the trials are meant to be a first step in the process of the development of a scheme and this type of administrative purpose is considered cost effective for very small volumes of heavy vehicles. A similar process is intended to be utilised in New South Wales.</td>
</tr>
<tr>
<td>In Victoria, transport operators will be required to estimate incremental road usage for a 12 month period and fees will be charged up-front on a quarterly basis. South Australia envisages using ‘real time’ technology to collect fees, assuming this is the resultant method chosen for the trial, and payment options will comparable to those available for vehicle registration.</td>
</tr>
<tr>
<td>Under the Saskatchewan program, transport operators pay quarterly based on self-reported distance travelled and vehicle mass of each load and the payment of fees are randomly audited.</td>
</tr>
</tbody>
</table>

### 7.2 Funds distribution

An operational incremental pricing scheme would require a body or bodies to be responsible for:

- calculating the incremental charges
- collecting these charges
- distributing the corresponding revenue to the road infrastructure owners (if the funds are collected by another body or government department in the first instance)
- spending the revenue generated by the incremental charges

There are two primary options under which this can operate:

1. **A centralised approach**, under which a single centralised body is responsible for some or all of these functions. This could be either an existing governmental organisation or a new body.

2. **A decentralised approach**, under which several bodies are responsible for some or all of these functions. An example of this would be state and local governments assuming responsibilities.
If a centralised approach is used, it is likely that a central body would collect and distribute funds for road spending to state and local governments. Alternatively, the centralised body could actually be another department within a state government that is responsible for collecting state revenues. In these cases, funds would be distributed or allocated to the state and local governments for spending on roads.

The funds distribution guiding principle states that equivalent funds to what is collected via charging must be distributed back to the relevant road infrastructure provider. This means that a road infrastructure provider should receive the same amount of money from an incremental pricing scheme as the operator using the road infrastructure has paid as part of the scheme. However, under a centralised approach which distributes funds to state and local governments, the timing of this distribution may not need to be immediate; rather it may depend on the needs of the road network. This would provide flexibility in the way funds are distributed, while ensuring that road infrastructure providers have adequate funding to maintain the network to an agreed service level.

Under phase two of the Council of Australian Governments (COAG) road reform plan, there is an action item that focuses on examining alternative institutional arrangements to better link road freight revenues to investment. This is requested by COAG to be completed by July 2010. If the development of substantially new institutional arrangements for the purpose of incremental pricing revenue are delayed until after this date, an interim framework will need to be developed to deal with the flow of funds that arises from cross-border transport movements (including across state borders and where there is an interaction with local governments) and potentially within state governments if road charging revenue is not directly received by the government department directly responsible for road infrastructure provision.

In developing the state trials, clear arrangements for distribution of funds between state and local government bodies have not yet been determined by the state governments, although some trials are intending that the funds be distributed between different road infrastructure providers (e.g. state and local governments) according to the different amount of usage on their respective roads.

### 7.3 Road spending

Under current institutional arrangements, there is no systematic linkage between the revenues that are collected from road users and the funds made available for investment in roads. The current arrangements involve recovering historical road expenditure rather than charging for future expenditure. In addition, for the most part, revenues collected by road authorities are directed to Treasury consolidated revenue, rather than to road authorities. Once collected by Treasury, road authorities have to effectively bid for funds.

Under the guiding principles of an incremental pricing scheme, the connection between charges, revenue and road expenditures is strongly established since roads used in a scheme are funded in a way that maintains a certain standard of service during the operating period of the scheme. This means that the road infrastructure provider would guarantee a minimum standard of service for the roads used under the scheme.

Therefore, funds collected under an incremental pricing scheme would be directed back to the road infrastructure provider to be spent firstly on maintaining service levels along the routes used within the scheme. However, over time there may be a shortfall or
surplus of funds collected from incremental charges required to achieve the guaranteed service level. This can be dealt with as follows:

- If over time there is a shortfall, there will need to be a re-allocation of funds from other areas to ensure that the service level is met.

- If over time the funds collected are greater than required to achieve the service level, the surplus funds could be allocated to other parts of the road network. In addition, the incremental price could be adjusted downwards so that fewer funds are collected in the future.

The approaches intended to be used for the state government trials and being used in the Saskatchewan program is compared in Box 18.

**Box 18. Road spending approaches**

All state governments intend to use the funds collected as part of the trials to be spent on maintaining the roads used in the trial if that is practical.

In the Saskatchewan program, transport operators are involved in the process of whether the road charges from the program are to be directed back to specific roads or alternatively spent on the road network generally.

In addition, an existing arrangement between the Western Australian government and a mining company, that has enabled higher loads on the tri-axle group than currently allowable (an increase from 20 to 23.5 tonnes) on a designated route, was structured so that all of the funds derived under the arrangement were spent on maintaining or upgrading the section of the road network that was being granted access to higher loads.
8. CONCLUSION

The development of an incremental pricing scheme has the potential to provide productivity benefits for the road transport industry and the overall economy. The transport industry has shown support for the concept with an NTC commissioned survey illustrating reasonably strong interest in accessing higher loads across a broad range of operators.

A number of feasible options have been identified for the charges and fee collection and road spending scheme components. However, there are a number of key feasibility issues that relate to the safety assessment and infrastructure assessment and route definition scheme components that are likely to impact upon a potential scheme. Some of these issues can be resolved in the short term with policy development (for example, through changes to the Performance Based Standards framework and the development of nationally agreed pricing methodology), while others can be resolved with further infrastructure investment and/or research. These include:

- Issues in integrating Performance Based Standards with an incremental pricing scheme needs to be resolved as part of the current review of Performance Based Standards;
- There is limited existing information on the impact of higher mass loads on road pavement wear. In addition, not enough information is known about the capabilities of bridges for different vehicle types at high mass levels in order to make a reasonably quick and low-cost assessment of their capacity for extra mass. However, there is potential to allow incremental mass limits of around 10% above current mass limits based on road pavement capabilities. Further research in the short to medium could potentially provide for access to higher mass increments than is available based on our current understanding of the capabilities of the road infrastructure; and
- Poor quality bridge infrastructure may be a constraining factor on some key routes. However, some bridges could be upgraded (and the upgrade cost could form part of the incremental price) to remove bottlenecks and create incremental pricing routes that provide strong productivity gains for industry.

Therefore, these issues do not represent an unsurmountable constraint to the further development of a scheme. Although, research on the capabilities of road infrastructure and improving the capability of some bridges will take time and require some initial investment.

Finally, the incremental pricing scheme should be able to “mesh” or align effectively with the current charging system. This can be achieved through adjustments to the incremental pricing formula and the road use data that is used to develop the current registration and fuel charges. In addition, to ensure that the incremental charge is not recovered twice from transport operators, any revenue received under an incremental pricing scheme would need to be taken into account in the setting of the PAYGO cost base.

This paper provides a case for further assessment of an incremental pricing scheme based on the reasonably strong initial interest in a scheme from the road transport industry and a high level of confidence that there are solutions to key feasibility issues in the short term. Subject to endorsement by the Council of Australian Governments (COAG), the next step would be to further investigate the feasible options through the
development of a regulatory impact statement for an incremental pricing scheme, including the economic case, which would be expected to be completed in late 2009. Table 7 outlines a more detailed work plan.

**Table 7. Proposed future timeline for development of a national scheme**

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Expected Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase one of COAG road reform plan</td>
<td></td>
</tr>
<tr>
<td>Feasibility paper</td>
<td>December 2008</td>
</tr>
<tr>
<td>Phase two of COAG road reform plan*</td>
<td></td>
</tr>
<tr>
<td>Draft regulatory impact statement</td>
<td>July 2009</td>
</tr>
<tr>
<td>Final regulatory impact statement</td>
<td>December 2009</td>
</tr>
<tr>
<td>* note that proceeding to phase two is subject to COAG approval</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 1: NATIONAL TRANSPORT POLICY FRAMEWORK

Source: ATC 2008.

Vision for Australia’s Transport Future

Australia requires a safe, secure, efficient, reliable and integrated national transport system that supports and enhances our nation’s economic development and social and environmental well-being.

Transport Policy Objectives

To achieve this vision, Australia’s Transport Ministers commit to the following policy objectives:

- **Economic**: To promote the efficient movement of people and goods in order to support sustainable economic development and prosperity.
- **Safety**: To provide a safe transport system that meets Australia's mobility, social and economic objectives with maximum safety for its user.
- **Social**: To promote social inclusion by connecting remote and disadvantaged communities and increasing accessibility to the transport network for all Australians.
- **Environmental**: Protect our environment and improve health by building and investing transport systems that minimise emissions and consumption of resources and energy.
- **Integration**: Promote effective and efficient integration and linkage of Australia’s transport system with urban and regional planning at every level of government and with international transport systems.
- **Transparency**: Transparency in funding and charging to provide equitable access to the transport system, through clearly identified means where full cost recovery is not applied.

Transport Policy Principles

Australia’s transport policy framework is underpinned by the following guiding principles:

- **Infrastructure pricing**: sending the appropriate signals to influence supply and demand for infrastructure;
- **Competitive markets**: establishing competitive markets wherever possible to minimise the need for regulation;
- **Private sector**: involve the private sector, where it is efficient to do so, in delivering outcomes;
- **National regulation**: a national perspective should be adopted where regulation is required;
- **National markets**: encourage national markets where possible; and
- **Customer**: Customer – focussed. Equitable access for all users.
APPENDIX 2: STATE GOVERNMENT INCREMENTAL PRICING TRIALS

Phase one of the COAG road reform involved state governments volunteering to develop incremental pricing trials. Four different state governments are at varying stages of developing these trials. This section outlines the progress of each of the four state governments and the intended approach to each of the different scheme components. The four state government trials that have been documented include:

1. Queensland
2. New South Wales
3. Victoria
4. South Australia

The information presented in this section on the trials has been based on information and assistance provided by each of the state governments listed above.
State government: Queensland

Overview: The Queensland incremental pricing trial is still under development. The framework for how the trials will operate has been largely identified and discussions with potential trial participants are continuing. There are still a number of implementation issues that require further work including finalisation of a detailed fee structure, consultation with other infrastructure managers (e.g. local governments and toll operators) and route assessments. Table 8 below provides further detail on the proposed operations of the trial. The Queensland trial is being managed by Queensland Transport Department and the Department of Main Roads (Qld).

Table 8. Queensland incremental pricing scheme details

| Objectives of Trial | The objectives of the trial are to assess the potential efficiency benefits from improving signals to road users about incremental costs and signals to road agencies about demand for road capacity and quality. Due to the potentially small number of participants in the trial, it is envisaged that the trial will mainly be used to assess the willingness of road agencies to ‘open-up’ the network to restricted routes in return for certainty in funding the road infrastructure being used in the trials. |
| Industry Engagement Process | Initial industry engagement involved the Queensland Trucking Association (QTA) which provided a list of operators that may be interested in participating in the trial. As a result, individual operators were invited by letter to participate in the trial. Following several discussions with a small number of operators, Queensland has been in discussion with three transport operators with regard to proposed routes and vehicle types for assessment. |
| Legal Framework | Existing Queensland regulation (Transport Operations (Road Use Management – Mass, Dimensions and Loading) Regulations 2005) allows operators to carry safe additional mass in exchange for paying for the additional wear of infrastructure attributed to the additional mass via a permit system. |
| Safety Assessment | The safety assessment will be based on the current Performance Based Standards (PBS). These assessments will be conducted by desktop simulation and operating conditions will be guided by the results of the assessments. |
| Infrastructure Assessment and Route Definition | The maximum mass limit for the trials has been allowed to go above the limits agreed by the Austroads Pavement Review Panel (as per section 5.2.1) on the basis of an assessment of the capability of the roads that would be used in the trials. Routes will be determined and approved based on routes proposed by transport operators. Current applications involve state and local roads. Infrastructure mass limits will be assessed on a case by case basis due to the complexity of the road network. The length of time involved in the infrastructure assessment depends on several factors including the number and complexity of vulnerable assets along the proposed route as well as availability of |
resources to process applications. Queensland envisages that the assessments of state controlled infrastructure for the trials may take several months depending on the availability of skilled engineers. An infrastructure assessment of one proposed route indicated that there was not enough bridge and road infrastructure capacity to carry the higher mass.

Additionally, there is uncertainty about the availability of local government resources with respect to route assessments.

### Pricing

It is expected that short-run marginal costs will be used as a basis for pricing of road pavements while bridges will be excluded as the short-run marginal costs of bridges cannot easily be determined. There are a number of methods that are being assessed to develop prices, including:

- PAYGO unit cost rates (an indirect cash accounting approach), similar to the national costing model used to generate the current registration and fuel based charges.
- “Bring-forward costs” (a direct approach) using a model that would incorporate roughness, traffic and pavement types
- Lifecycle costing model (an indirect annuity of future lifecycle cost approach) which would develop “equivalent” annualised costs.

### Monitoring System

Monitoring will involve self declaration of mass and distance travelled and adoption of the National Heavy Vehicle Accreditation Scheme (NHVAS) Mass Management by transport operators. This would likely be supported by certified weighbridges as the measuring device for mass.

The primary monitoring mechanism will be self declaration of mass and distance. The Intelligent Access Program was initially proposed. However, this requirement was withdrawn in order to encourage interest from industry as a result of the high costs of participation using this approach.

### Fee Calculation and Collection

Participating operators will be supplied with spreadsheets containing an embedded incremental charge calculation formula. Fees would then be calculated when the operator enters mass distance travelled and number of trips into the spreadsheets via a self-declaration process. At the end of each month, the operator will send the completed spreadsheets together with payment to Queensland Transport.

### Fee Distribution and Road Spending

Revenue generated from the trial will be forwarded to the state government and relevant local governments. The revenue received by state versus local governments will be apportioned based on relative ownership of the infrastructure used in the trials.

Fees collected from the trial are intended to be spent on maintenance of the routes used as part of the trials.
State government: New South Wales

Overview: The New South Wales incremental pricing trial is still under development. The framework for how the trials will operate has been largely identified and discussions with potential trial participants are continuing. There are still a number of implementation issues that require further work including finalisation of a detailed fee structure, some internal systems development and route assessments. Table 9 below provides further detail on the proposed operations of the trial. The New South Wales trial is being managed by the Roads and Traffic Authority, New South Wales (RTA).

Table 9. New South Wales incremental pricing scheme details

<table>
<thead>
<tr>
<th>Objectives of Trial</th>
<th>The objective of the trials is to test the feasibility of implementing a direct road user charge to recover the cost of additional road wear associated with heavy vehicles operating at axle weights that exceed current statutory load limits.</th>
</tr>
</thead>
</table>
| Industry Engagement Process | The RTA invited expressions of interest from transport operators who have:  
  - previously indicated that a mass concession above existing statutory limits would be desirable for their operations  
  - a good compliance record  
  - a freight task with a nature and location that is suited to an incremental pricing application, including being restricted to operations on state-owned roads to minimise the need for local councils to assess and approve their roads.  

The trials operations that are being considered to participate in the trial include coal transport, mobile cranes, buses (route and long distance) and glass manufacturing. |
| Legal Framework | New legislation was passed by the New South Wales Government in order to enable the operation of an incremental pricing scheme. Specifically, the Road Transport (General) Amendment (Heavy Vehicle User Charges) Bill 2007 received assent on 13 December 2007. Section 28A of the Road Transport (General) Act 2005 now provides for the making of regulations in relation to incremental pricing schemes. These regulations are not yet in place. |
| Safety Assessment | Vehicles seeking access to participate in the trials will need to be registered as roadworthy, may be required to meet the Performance Based Standards safety standards (depending on the identified risks) and would be required to meet the following entry and operating conditions:  
  - the heavier load must not result in the vehicle exceeding the manufacturers’ gross vehicle mass or gross combination mass rating  
  - be accredited under the NHVAS Mass Management Module, including suspension maintenance  
  - be fitted with Road Friendly Suspension  
  - be registered in the Intelligent Access Program (IAP). |
The safety assessment operating requirements may vary according to identified operational risks (e.g. signage).

**Infrastructure Assessment and Route Definition**

The maximum mass limit for the trials has been limited to the mass limits agreed by the Austroads Pavement Review Panel (as per section 5.2.1). Pavement and bridge infrastructure and route assessments have been undertaken on a case-by-case basis as operator interest in incremental pricing appears to be route and load specific. The assessments have taken a number of weeks.

In terms of the one route assessment that has been completed on a Higher Mass Limits route, the incremental load capacity that could be safely approved for the nominated route was less than the maximum increases possible under the Austroads Pavement Review Panel recommended limits due to bridge constraints.

**Pricing**

Three different methods were considered for developing incremental pricing estimates:

- The Freight Axle Mass Limits Investigation Tool (FAMLIT) which has been developed by ARRB Group Ltd for Austroads.
- A pavement management system (PLATO) developed by ARRB Group Ltd.
- A simplified model developed by the Roads and Traffic Authority (NSW).

Each of these models is attempting to apply a direct approach to developing marginal costs involving life cycle costing models. The models developed by ARRB require more detailed data and were considered less appropriate with the currently available aggregated data set. Consequently, the discussion in this section will focus on the Roads and Traffic Authority model.

The increased life cycle costs were compared with a base life cycle cost reflecting the standard axle loads or design traffic. Increased traffic load was taken into account by increasing the number of ESAs on the pavement. The increased ESA was calculated by considering the various vehicle types and their axle and tyre configurations.

The incremental price is the life cycle cost increase for a unit equivalent standard axle (ESA) increase. The incremental pricing is expressed in cents for each ESA km.

Incremental prices have been estimated for a number of different road categories, reflecting environmental regions, pavement types, traffic loading regimes, remaining life categories and for flexible versus rigid pavements. These will form the basis for developing appropriate prices for each incremental pricing trial route. A separate tool has been developed to create a link between ESAs and

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24 This tool also forms the basis for the joint National Transport Commission and Austroads project referred to as “Understanding Wear and Cost Implications of Incremental Loads on the Road Network”
freight (load) for each truck type.

The incremental pricing estimate does not take into account the costs associated with bridges. This will be considered in the next phase of the costing work.

| Monitoring System | During the trial phase, the distance information for charging purposes will rely on self-declaration by the operator. In terms of mass, charging would be simplified by basing charges on the maximum load increase for the route approved under the incremental pricing agreement. This would substantially reduce the need for RTA reporting and monitoring mass and route data except to identify and where necessary prosecute vehicles travelling overmass or off-route. Operators would be charged for the full mass increment for that part of the journey that the vehicle was exceeding statutory mass limits. Actual trip data would be reconciled with the pre-paid amount (see below). For variable load operations, such as route buses, an agreed rate would be negotiated that reflected the percentage of the trip that the vehicle exceeded mass limits and the maximum allowable mass.

The Intelligent Access Program might be used for route compliance as part of the trials, which is appropriate given that it has currently been developed for compliance purposes. |
|---|---|
| Fee Calculation and Collection | The current intended approach is for the operator to pre-pay the incremental price for the approved vehicles for agreed mass and distance parameters. At the end of the billing period (monthly or quarterly depending on the number of vehicles and scale of operations) the actual distance and charges due will be reconciled with the pre-paid amount and a credit or debit will be applied to the next pre-payment.

The billing process during the trial phase may be limited to a paper-based arrangement with each approved operator. |
| Fee Distribution and Road Spending | In the trial phase, the Roads and Traffic Authority will receive the incremental pricing charges directly from operators, which will be held in a separate road fund. At this stage, the trials do not include local government roads. The incremental pricing revenue will be spent on road and bridge infrastructure maintenance related to freight movements under the incremental pricing trials. However, revenue will not be tied to a specific route. |
State government: Victoria

Overview: The Victorian incremental pricing trial is still under development. The framework for how the trials will operate has been largely identified and discussions with potential trial participants are continuing. There are still a number of implementation issues that require further work including finalisation of a detailed fee structure, consultation with other infrastructure managers (e.g. local governments and toll operators) and route assessments. Table 10 provides further detail on the proposed operations of the trial. The Victorian trial is being managed by VicRoads and the Department of Transport (Vic).

Table 10. Victorian incremental pricing scheme details

| Objectives of Trial | The objective of the Victorian trial is to determine the feasibility and effectiveness of direct user charging for mass above the general mass or higher mass limits and test the administrative systems that are involved in implementing incremental pricing. In addition, the trial is also aimed at evaluating the commercial viability of the scheme from an industry perspective, taking into account the willingness of the road transport industry to pay for additional mass. |
| Industry Engagement Process | VicRoads has sought assistance from the Victorian Transport Association in identifying operators that are interested in the trial. At this stage, four companies have formally submitted an expression of interest, mainly with the intent of improving efficiency and productivity. The companies represent a range of industries including containers, bulk goods (grain and liquid dry) and break-bulk. One operator saw the trials as an opportunity to operate an innovative vehicle. |
| Legal Framework | As a result of legal considerations, trial vehicles will operate under permit conditions and be charged a “Maintenance Security Fee”, which will be used to fund actual damage of road wear caused by vehicles participating in the trial. As a result, all funds collected from the trials will be held in a “Maintenance Security Fund”. |
| Safety Assessment | The trial will be limited to vehicle configurations that are already approved for operation in Victoria. Trial vehicles will need to:  
  - comply with Performance Based Standards Static Rollover Threshold;  
  - be accredited under National Heavy Vehicle Accreditation Scheme for mass management; and  
  - operate under the Intelligent Access Program. |
| Infrastructure Assessment and Route Definition | The routes identified by transport operators to date include multiple owners such as VicRoads, Local Government and toll operators. Route assessments still have to be undertaken and consultation with local government as well as toll operators is yet to occur. Generally, the routes identified by transport operators are B-double or Higher Mass Limits scheme routes. Some of the route assessments that have been undertaken for the trials have |
highlighted bridge constraints as a major issue, which has eliminated a number of the suggested possible routes.

<table>
<thead>
<tr>
<th>Pricing</th>
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<tbody>
<tr>
<td>The pricing schedule has not been finalised but will focus on recovering the difference between the amount of damage caused by a vehicle participating in the trial and a similar vehicle operating at the mass limit. The price will be based on the incremental cost per ESA-kilometre and will reflect additional short-run average maintenance costs using a PAYGO cost base tailored for Victorian roads. The price is considered to be close to long-run marginal costs, which theoretically may be more ideal, since the proposed network on which the higher mass vehicles will be permitted to operate is not currently at capacity or expanding.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitoring System</th>
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</thead>
<tbody>
<tr>
<td>Transport operators will be required to keep detailed records on the vehicles operating under the incremental pricing trial and vehicles will be subject to on-road enforcement by VicRoads and Victoria Police as well as inspections at checking stations and roadside inspections. The records will be audited every six months by an independent auditor at the expense of the operator and a report provided to VicRoads of any non-conformances. All records must be available for inspection by VicRoads on request. VicRoads will require quarterly reporting on vehicle movements and audits will be undertaken by independent auditors on a six monthly basis. Should the Intelligent Access Program not be available, trial vehicles will be required to install a global positioning system device by an accredited company, which incorporates a system that is able to identify:</td>
</tr>
</tbody>
</table>
| • ‘Off-route’ travel; and  
• Any form of tampering or interference with the in-vehicle unit. |

<table>
<thead>
<tr>
<th>Fee Calculation and Collection</th>
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</thead>
<tbody>
<tr>
<td>The transport operator will be required to estimate usage for the first 12 months and fees for the first quarter will be required to be paid up-front based on this estimate. Subsequent to the first quarter, reporting of actual usage (by quarter) will be used as the basis for charging. This will include reporting information for each trial vehicle such as the distance travelled on the approved route, the number of vehicle trips and the vehicle mass (axle and gross). VicRoads will then issue an invoice based on the report. Invoices will be adjusted by VicRoads based on the actual usage data.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fee Distribution and Road Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fees will be placed in a “Maintenance Security Fund”. After subtracting administrative costs, fees will be used to fund additional maintenance on the routes used during the trial.</td>
</tr>
</tbody>
</table>
State government: South Australia

Overview: The South Australian incremental pricing trial is still under development. The framework for how the trials will operate has been largely identified. Table 11 provides further detail on the proposed operations of the trial. The trial is being managed by the Department of Transport, Energy and Infrastructure (South Australia).

Table 11. South Australian incremental pricing scheme details

| Objectives of Trial | To allow eligible vehicles to carry additional mass above their currently regulated mass limits, in exchange for the payment of a fee representing the cost of additional road wear caused by that extra mass. The South Australian trial will be focussed on providing additional mass for tri-axle B-doubles on pre-assessed routes that form a subset of the Higher Mass Limits network. This approach is being taken to minimise administrative costs and maximises synergies between the Higher Mass Limits scheme and incremental pricing (e.g. in the areas of infrastructure and safety assessments). |
| Industry Engagement Process | The trial will be focussed on the operation of Higher Mass Limits tri-axle B-doubles and preliminary work suggests that the identified trial would attract seven to ten operators with approx. 250-300 vehicles carrying mainly wine, beer, grain, mining and petroleum products on inter-regional routes. This approach will minimise administrative costs and maximises synergies between the Higher Mass Limits scheme and the incremental pricing trial (e.g. in the areas of infrastructure and safety assessments). At this stage, no formal industry engagement process has been undertaken. Preliminary estimates indicate that the trials have the potential to deliver freight savings of at least 12% or at least $3 per tonne. |
| Legal Framework | Each vehicle in the scheme is intended to run under permit. The current South Australian legislation (Road Traffic Act 1961) and subordinate regulations does not allow the application of a charge for ‘road use’ under permit. Rather, this will require a change to the Road Traffic Act and its regulations. |
| Safety Assessment | The proposed trial is restricted to Higher Mass Limits vehicles in order to most efficiently deal with safety aspects. Such vehicles are already specified for higher mass and must satisfy a number of pre-entry conditions to operate under Higher Mass Limits, including accreditation in mass management, maintenance management and route compliance. The safety assessment will be based on the Higher Mass Limits safety requirements. Requiring a Performance Based Standards assessment for all incremental pricing vehicles was considered to be prohibitive due to costs and time (3 months) involved. |
| Infrastructure Assessment and Route Definition | It is envisaged that maximum mass limits will be identified for a specific road network (see table below). For operation outside these network mass limits, individual Performance Based Standards vehicle assessment and route assessment will be required. This approach has been taken since it is considered more cost-effective to establish a network of mass limits that requires one assessment |
rather than the assessment of individual routes. As the trial will be focussed on routes that are currently assessed for Higher Mass Limits tri-axle B-doubles, pavement assessments have largely been completed and structural assessments (e.g. bridges, culverts) are still being undertaken. The reason for establishing a network for the trials was primarily to reduce cost to operators and to provide enough information to operators so that they can make their own commercial assessment of potential incremental pricing opportunities. In addition, it is perceived that the bulk of the extra mass market could be satisfied in this way (i.e. predefined route network), with detailed assessments devoted to truly exceptionally high mass requests.

<table>
<thead>
<tr>
<th>Axle Group Type</th>
<th>Maximum Increase in Mass (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steer Axle</td>
<td>0.0 t</td>
</tr>
<tr>
<td>Single Axle with Dual Tyres</td>
<td>1.0 t</td>
</tr>
<tr>
<td>Tandem Axle with Dual Tyres</td>
<td>1.5 t</td>
</tr>
<tr>
<td>Tri-axle with Dual Tyres</td>
<td>2.5 t</td>
</tr>
</tbody>
</table>

**Pricing System**

The incremental price will be based on using the current PAYGO cost base approach (tailored for South Australian roads) to develop an average cost per ESA-kilometre, which will vary by a limited number of road types. The reason that South Australia has taken this approach for the trials is to ensure that the price reflects a fee for service in order to satisfy legal requirements and to keep the framework simple.

**Monitoring System**

Monitoring is envisaged to involve global positioning system satellite tracking for distance and location as well as self reporting of mass, supported by a weighbridge certificate (where available). Mass is intended to be audited within the arrangements for mass accreditation and verified against any road traffic count and on-road enforcement data. It is proposed the SA trial be used to test various on-board mass measurement technologies in parallel with self-reporting. Ideally, these technologies should link with global positioning system satellite reporting.

The legal implications and costs of monitoring have not yet been assessed.

**Fee Calculation and Collection**

Full specifications of fee calculation and collection systems (and associated costs) have not been completed, however it is envisaged that “real time” technology will be used and payment options will be in line with those available for vehicle registration.

**Fee Distribution and Road Spending**

It is envisaged that the state government will initially receive funds. Detailed distribution of funds has not been determined but distribution would adhere to the “money follows the truck” principle. The time lag between collection of funds and expenditure has been identified as one of the key issues to be resolved.
APPENDIX 3: SASKATCHEWAN TRANSPORTATION PARTNERSHIP PROGRAM (TPP)

In the province of Saskatchewan in Canada, the Transportation Partnership Program (TPP) is an initiative that is operated by the Saskatchewan Government Ministry of Highways and Infrastructure. This initiative gives heavy vehicle operators the opportunity to operate at higher mass and larger vehicle dimensions beyond normal regulated limits. The program has been in operation since 1996.

The program was originally created to forge partnerships with private sector companies to reduce truck transportation costs, enable transport companies to be more competitive, and provide new revenue for highway projects. The initial objectives of the program were to:

1. support economic development by increasing transport productivity
2. enhance the safety of vehicles participating in the program
3. achieve commercial arrangements with transport operators so that there is no subsidisation by taxpayers
4. deliver revenue to the Saskatchewan Province at a 50% share of any additional efficiency benefits an operator can generate by being able to participate in the program.

The customers involved in the Transportation Partnership Program are largely concerned with the movement of heavy bulk freight, with interest in running both over weight & dimension.

To date the program has been able to deliver:

- around $4 million (in Australian dollars) annually in new revenue for highway projects from Transport Partnership Agreements
- five times the level of safety for vehicles operating under the program, and
- annually recurring benefits of around $84 million (in Australian dollars) in additional economic development across the transportation related industry

In September 2008, the structure of the Transportation Partnership Program was changed. The fourth objective of the program, which related to sharing the freight savings, has been removed from the program. This change was largely due to a recent change in Government and an enhanced transport budget for the province. Following discussions with the Saskatchewan Ministry of Highways and Infrastructure the details of the scheme are outlined in terms of the different components in Table 12.

Table 12. Saskatchewan incremental pricing scheme details

<table>
<thead>
<tr>
<th>Industry Sector Participation</th>
<th>A majority of the customers of the Transportation Partnership Program are involved in the movement of heavy bulk freight.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Assessment</td>
<td>In conducting safety assessments, the department relies on internal expert knowledge of heavy vehicles and understanding of the network. When the vehicle centre of mass is particularly high, applications for the Transportation Partnership Program incur greater scrutiny from a safety perspective. The assessment process</td>
</tr>
</tbody>
</table>
is essentially two-tiered:

- For standard vehicle types, assessment of acceptable limits is typically performed using existing internal knowledge of how standard vehicles perform with additional mass.
- For irregular vehicle types, assessment of acceptable limits is done by simulating a vehicle’s performance when put through appropriate tests. For example, the static roll-over threshold test.

Furthermore, the benchmark for approval of Transportation Partnership Program nominations is for “improved” operational safety levels beyond the general requirements. This could be in the form of speed restrictions being placed on vehicles operating at higher mass and may require speed recording devices such as tachographs or global positioning systems to be installed to monitor compliance.

**Infrastructure Assessment and Route Definition**

Above legal weights, infrastructure limits are assessed and approved by the responsible area manager based on empirical assessments for pavements. For bridges, relevant bridge engineers within the ministry perform case by case bridge assessments where necessary.

Industry participants can nominate their preferred routes in their Transportation Partnership Program application. Nominated routes are either considered to be:

- restricted – where the participant operates on a specific route, for example from point A to point B, or
- unrestricted – where the participant has access to a defined network. Should access to a nominated route not be granted, alternative routes may be offered.

**Pricing and Monitoring System**

**Pricing**

As there is now no sharing of freight savings, the charge for additional mass is based on achieving cost recovery.

Specifically the charge is determined on a case by case basis using the following methodology:

1. The charge is determined by comparing two different annuitised lifecycle costs.
2. The first annuitised lifecycle cost (first LC) is based on existing traffic loads.
3. The second annuitised lifecycle costs (second LC) is based on improving the structural condition of the road through a deeper pavement and includes the resultant change in ongoing repairs and maintenance as a result of the improved structural condition. The improved structural condition is based on achieving the same remaining life of the road (in terms of cumulative equivalent standard axles) with the additional mass as there was without the additional mass.
4. The marginal cost (which is used as the basis for the price) is
equal to the second LC minus the first LC. This is essentially a form of long-run marginal costs since it involves improving the structural capabilities of the road.

5. The estimated costs to improve the structural capability of the road include the materials required to undertake the treatment (i.e. per tonne / kilometre of asphalt), labour inputs and equipment to conduct the road works.

6. Charges are set on an annual basis and amortised over the design life of the new road, with material, labour, and equipment cost inputs indexed each year.

7. When charges are reset, the incremental charge in the new lifecycle of future road costs credits the additional costs of the first lifecycle to enhance structural condition, treating them as sunk costs.

8. Charges are calculated based on usage – cost per tonne-kilometre or cost per tonne.

9. Costs are adjusted based on various drivers of demand.

**Bridge Costs**

Incremental bridge costs are not assessed – only a pass/ fail grading of whether the bridge can support the load is considered. However, if a bridge has to be upgraded/strengthened to accommodate the heavier load, the Transportation Partnership Program participant is charged for these costs.

**Monitoring**

TPP participants record the mass and hours / distance travelled and report this to the Saskatchewan Government for charging. The Saskatchewan Government uses Bills of Lading as an audit measure to verify the reported information. Telematic tracking systems such as GPS and tachographs are also used to monitor route compliance and/or adherence to any speed restrictions imposed by individual TPP agreements.

**Fee Calculation and Collection**

Fees are paid into the Transportation Partnerships Fund which is used to fund highway improvement projects. Participants pay fees quarterly based on usage and the charges set in individual Transportation Partnership Program agreements. The payment of fees is randomly audited to ensure companies are paying the correct amounts.

An annual administration fee is paid when Transportation Partnership Program access permits are renewed each year.

**Fee Distribution and Road Spending**

Transportation Partnership Program participants have some involvement in how the charges are spent. Charges can be directed back to specific roads used in the program or generally allocated across the road network on other projects.
APPENDIX 4: CURRENT MASS RESTRICTIONS

- **General Mass Limits (GML)** are determined with reference to the Road Transport Reform (Mass and Loading) Regulations 1995 and refers to the maximum mass limits with reference to: the number and type of axles that make up a truck configuration; the total mass of the vehicle (including trailers); and the manufacturer’s rating. In addition, for the purposes of this paper General Mass Limits shall be taken to include Restricted Access Vehicles (RAV) as defined under the national transport laws, which applies to vehicles such as B-doubles and road trains.

- **Higher Mass Limits (HML) scheme** allows operators to carry mass additional to General Mass Limits on approved Higher Mass Limits routes subject to a vehicle being fitted with road friendly suspension. The scheme provides operators additional mass of up to 0.5 tonnes on a tandem axle group and 2.5 tonnes on a tri-axle group above General Mass Limits. There is no extra charge for Higher Mass Limits participation, but participation in the National Heavy Vehicle Accreditation Scheme (NHVAS) Mass Management Module is required. Higher Mass Limits operates on the assumption that the extra vehicle mass is offset by the road friendly suspension so there is no additional impact on road wear from Higher Mass Limits compared to General Mass Limits.

- **Concessional Mass Limits (CML)** allows mass increases of up to 5% above General Mass Limits depending on the size and axle configuration of the vehicle. Admission to Concessional Mass Limits requires proof that the vehicle’s suspension is maintained to a high standard and that mass carried does not exceed the vehicle’s manufacturer’s standards. There are no additional costs for participating in Concessional Mass Limits.

  Concessional Mass Limits was introduced in July 2006 and allows operators to maintain the excess weight that was allowed as a tolerance prior to July 2006 provided that the vehicle is part of the NHVAS Mass Management Module and maintains suspension requirements. The suspension maintenance requirement for Concessional Mass Limits is intended to reduce the road impact of additional mass allowed under Concessional Mass Limits. Concessional Mass Limits is currently available in all states and territories excepting Western Australia.

- **Concessional Loading Schemes** exist solely in Western Australia and allow operators to carry additional mass which is dependent on axle type. Additional compliance requirements are placed on operators using these schemes and the total vehicle weight must not exceed manufacturers gross combination mass.

- **Permits and Notices** granting extra mass to vehicle operators are available from state and territory road authorities. The duration of these permits can be for either a single trip for a period of time up to 12 months. The permits generally specify the additional mass allowed to be carried under the permit and the road network access granted under the permit. An administrative fee is generally charged for permits, which does not cover any additional road damage caused by the increased mass.

  These permits are often made available to certain industries on a case by case basis. For example, the Livestock Loading Scheme allows vehicles to be loaded on the basis of animal numbers rather than weight. Grain Harvest Management
Schemes also operate in some states which allow overloading during harvest when transporting grain from the paddock to the receiver. Notices apply to the general fleet and general grant additional mass based on certain requirements or vehicle characteristics.
APPENDIX 5: PRICING APPROACH OPTIONS

This section outlines the different combinations of options that results from combining the different marginal cost approaches (direct, indirect and engineering) with the short-run and long-run marginal cost approaches outlined in section 6.1.

Table 13. Pricing approach options

<table>
<thead>
<tr>
<th>Option</th>
<th>Approach</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>Direct - SRMC</td>
<td>This determines the marginal costs by estimating the impact that each additional unit of mass has on road costs in order to return the road to the same standard prior to the impact of the additional mass on road wear.</td>
</tr>
<tr>
<td>Option 2</td>
<td>Direct - LRMC</td>
<td>This determines the marginal costs by estimating the impact that each additional unit of mass has on road costs in order to improve the standard of the road to cater for the higher levels of mass on the road.</td>
</tr>
<tr>
<td>Option 3</td>
<td>Indirect – Cash Accounting – SRMC Like</td>
<td>This estimates the average cost (assumed equal to the marginal cost) from a cost base estimated using a cash accounting approach which only uses costs that return the road to its current standard (“steady state expenditure”).</td>
</tr>
<tr>
<td>Option 4</td>
<td>Indirect – Cash Accounting – LRMC Like</td>
<td>This estimates the average cost (assumed equal to the marginal cost) from a cost base estimated using a cash accounting approach which uses costs that includes expenditure that not only return the road to its current standard but also incorporates “expansionary expenditure”, which provides for future growth in road use.</td>
</tr>
<tr>
<td>Option 5</td>
<td>Indirect – Traditional Building Block – SRMC Like</td>
<td>This estimates the average cost (assumed equal to the marginal cost) from a cost base estimated using a traditional building block approach using estimated efficient operating costs (which could be regarded as “SRMC like” since there is no capital component).</td>
</tr>
<tr>
<td>Option 6</td>
<td>Indirect – Traditional Building Block – LRMC Like</td>
<td>This estimates the average cost (assumed equal to the marginal cost) from a cost base estimated using a traditional building block approach using estimated efficient operating costs plus a capital component (estimated using a regulatory asset value) which ensures appropriate capital returns (which could be regarded as “LRMC like” since it includes a capital component).</td>
</tr>
<tr>
<td>Option 7</td>
<td>Indirect – Annuity of Future Lifecycle Costs – SRMC Like</td>
<td>This estimates the average cost (assumed equal to the marginal cost) from a cost base estimated using future lifecycle costs which are converted to an annuity, which only includes costs that return the road to its current standard (which could be regarded as “SRMC Like” since it is based on “steady state expenditure”).</td>
</tr>
<tr>
<td>Option 8</td>
<td>Indirect – Annuity of Future Lifecycle</td>
<td>This estimates the average cost (assumed equal to the marginal cost) from a cost base estimated using future lifecycle costs which are converted to an</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Option 9</th>
<th>Econometric – SRMC Like</th>
<th>This estimates the relationship between mass and road costs based on econometric analysis of historical road use and cost data, but only including cost data that returns the road to its current standard (which could be regarded as “SRMC Like” since it is based on “steady state expenditure”).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 10</td>
<td>Econometric – LRMC Like</td>
<td>This estimates the relationship between mass and road costs based on econometric analysis of historical road use and cost data, including both “steady state” and “expansionary” road costs (which could be regarded as “LRMC Like”).</td>
</tr>
</tbody>
</table>

Costs – LRMC Like annuity, which includes costs that not only return the road to its current standard but also incorporates “expansionary expenditure”, which provides for future growth in road use (which could be regarded as “LRMC Like” since it includes “expansionary expenditure”).
Appendix 6: Fuel adjustment

In effect, a higher fuel consumption rate (litres per kilometre) will be incurred by transport operators as a result of the carrying mass of the vehicle being greater than the current regulated mass limits. Therefore, if an incremental charge (as per outlined in Box 12) is applied that is based on a relationship between mass and road costs, the additional costs incurred by the transport operator, due to the increased fuel consumption rate, should be deducted from the incremental price in order to ensure that there is no double counting.

This is because the higher litres per kilometre resulting from the higher mass will result in additional costs for transport operators through the fuel charge, which is an existing charging mechanism. Therefore, in effect, the transport operator would pay an incremental charge via the fuel charge (as a result of the additional mass); albeit in a way that is not reflective of the actual road wear resulting from the additional mass.

As a result, a fuel adjustment is required in order to ensure that the operator does not “double pay”. The fuel adjustment can be expressed simply as per Figure 11. This formula takes into account the differences in fuel charges paid by the transport operator at the proposed or actual mass (which takes into account the incremental mass) and the fuel charges paid at the base limit (e.g. current regulated limit) through the incremental change in the fuel consumption rate.

**Figure 11. Fuel adjustment**

\[
\text{Fuel Adjustment} = \text{Incremental Fuel Consumption Rate} \times \text{Current Fuel Charge} \times KT
\]

\[
\text{where} \quad \text{Incremental Fuel Consumption Rate} = \frac{\text{Fuel consumption rate at proposed or actual mass}}{\text{Fuel consumption rate at base mass limit}}
\]

\[
\text{where} \quad KT = \text{kilometres (or distance) travelled}
\]

The kilometres travelled would only refer to distance travelled with mass levels above the prescribed limit. The fuel consumption rate (litres per kilometre) is normally expressed as fuel use (litres per 100 kilometres). Therefore, the conversion from fuel use to the fuel consumption rate is as per Figure 12.

**Figure 12. Fuel consumption rate**

\[
\text{Fuel consumption rate} = \left(\frac{\text{Fuel use (litres per 100 km)}}{100}\right)
\]

The derivation of fuel use could be based on a regression of average fuel consumption against average gross mass (based on the data used in the national costing and charging models). The regression equation of fuel usage against average gross mass for existing truck vehicle classes (excluding buses) provides the following result as per Figure 13:
Figure 13. Fuel use (litres per 100 kilometre)

Fuel Use = 25.7 + (0.688 x Mass)

An example of how the fuel adjustment is estimated is shown in Box 19.

Box 19. Fuel adjustment example

As an example of how to calculate the fuel adjustment for a B-double vehicle, the following situation is presented (similar example as in Box 2):

- the current fuel charge is 19.633 cents per litre
- the vehicle travels 180,000 kilometres
- the vehicle currently operates up to a gross mass of 68.0 tonnes and wishes to increase the mass of the vehicle to 74.5 tonnes

Under this example, the fuel adjustment is calculated to be $1,590 (refer to Figure 14) based on fuel usage (litres per 100 kilometre) increasing from 72.5 to 77.0.

Figure 14. Fuel adjustment example calculation

\[
\text{Fuel Adjustment} = (0.77-0.725) \times 0.19633 \times 180,000 = $1,590
\]
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