Defining Service Levels for a User-focused Access Market: Final Report

Project No: 006363-04-03

by Adam Ritzinger, Freek Faber, Dr Charles Karl, Dr Ian Espada & Dr Tim Martin

for Heavy Vehicle Charging and Investment Reform Office
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for Heavy Vehicle Charging and Investment Reform Office

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006363-04-03
September 2013
DEFINING SERVICE LEVELS FOR A USER-FOCUSED ACCESS MARKET: FINAL REPORT
SUMMARY

The Heavy Vehicle Charging and Investment Reform Office (HVCI) is currently reviewing the national systems for providing and using roads for heavy vehicles, with a view to implementing regulatory reforms which encourage more appropriate and efficient road infrastructure investments, creating more opportunities for increases in heavy vehicle productivity and access for the future.

ARRB Group Ltd (ARRB) has been engaged by the HVCI to provide technical input to the Regulatory Impact Statement (RIS), specifically relating to the development of a service level framework, which will link vehicles, roads, and access arrangements into a framework where prices reflecting the cost of road use can be set for individual transport tasks, and also provide a clear indication to transport operators and their customers regarding the quality of service they can expect.

The stages of work conducted have delivered outcomes relevant to the three goals of the project, and a service level framework has been provided on the basis of input from the transport industry and jurisdictions (via the project working group), and material uncovered via the literature review. The following text provides a brief outline of the main findings and recommendations of the report.

Developing the Service Levels

The initial discussion of services and service levels provided definition of those concepts, and outlined how service levels can be used as part of regulatory reforms to improve the heavy vehicle charging system in Australia. A comparison of the service levels of other industries (e.g. rail, water, electricity) showed that the service levels adopted tended to represent the services of networks directly relevant to the commodity itself, for example loss of water supply, or failure of electricity connection.

This is a key point of differentiation as the service levels developed under this project are broader in their scope, and cover infrastructure management (e.g. provision of access, traffic conditions), and aspects of the network infrastructure (e.g. road roughness). In this context, the service levels developed here represent a unique approach when compared to other industries.

The discussion on considerations in developing service levels outlined key factors for consideration, and refined these into a series of key success factors for assessing the service level framework, which was used to guide the development of the service level framework throughout the remainder of the report.

A concept for the service level framework was identified and presented, and the subsequent research needs were outlined, being a suitable classification system (in order to provide a variation in service level definition across vehicle types or road classes) and the service attributes and performance indicators, as outlined below.
Classification Method

The classification system was considered first. The various options for the classification system considered were access arrangement, vehicle class or characteristic, vehicle performance level, and road class. An assessment of each against the applicable key success factors led to the classification by access arrangement using the Heavy Vehicle National Law Act 2012 (Qld), hereafter referred to as ‘HVNL’, classes emerging as the preferred option, using vehicle class as a sub-category to provide further refinement. The three classes specified in the HVNL are:

- **Class 1** – special purpose vehicles such as mobile cranes and concrete pump trucks, agricultural vehicles, vehicles carrying or designed specifically to carry a large indivisible item
- **Class 2** – B-doubles, road trains, livestock vehicles, and buses that exceed the prescriptive mass and dimension limits for general access
- **Class 3** – all other restricted access vehicles, such as high-productivity (PBS) vehicles.

The sub-classes proposed are based on splitting the separate classes of restricted access by notice/gazette (Classes 2 and 3) and by restricted access by special permit (Class 1), resulting in the refinement of the classification concept as shown in the table below, which received broad support from the working group.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Sub-classification</th>
<th>Service level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Service level 1</td>
</tr>
<tr>
<td><strong>General access</strong></td>
<td>Rigid trucks and buses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semi-trailers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access</strong></td>
<td>Oversize and overmass vehicles</td>
<td></td>
</tr>
<tr>
<td><strong>Class 1</strong></td>
<td>Special purpose vehicles (mobile crane, concrete pump, drilling rig, farming mobile plant etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access</strong></td>
<td>Multi-combination vehicles (B-doubles, road trains, B-triples, and AB-triples)</td>
<td></td>
</tr>
</tbody>
</table>
This approach is expected to be largely transferrable across jurisdictions, and also fulfils the requirements set out in the project brief of more easily facilitating applications for access, as it is defined from a vehicle access perspective, and presented no other significant disadvantage or shortcomings.

**Defining the Service Attributes and Performance Indicators**

In the task of defining the service attributes and performance indicators, jurisdictions and the industry were separately consulted in order to understand their considerations, and a literature review was undertaken to supplement the information gained via the consultations.

It emerged that service attributes can be arranged in two general groups, comprising ‘asset’ based factors, and ‘operational’ based factors. It was identified that operators tend to focus on ‘operational’ based factors, while asset owners tend to focus on ‘asset’ based factors, each outlined separately in the tables below.

<table>
<thead>
<tr>
<th>Research area</th>
<th>General factors defining level of service</th>
<th>Freeways</th>
<th>Two-lane arterials</th>
<th>Urban arterials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature</td>
<td>Travel safety</td>
<td>Speed variance</td>
<td>Percentage of time spent following</td>
<td>Ease of turning manoeuvres</td>
</tr>
<tr>
<td></td>
<td>Travel time</td>
<td></td>
<td>Percentage of time spent being followed</td>
<td>Speed variance</td>
</tr>
<tr>
<td></td>
<td>Physical and psychological comfort</td>
<td>Pavement quality</td>
<td>Travel lane width</td>
<td>Traffic density</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shoulder width</td>
<td>Pavement quality</td>
</tr>
<tr>
<td>Consultations</td>
<td>Access conditions, ride smoothness, traffic conditions (congestion, speed and travel time), traveller information, provision of amenities, overall level of road safety</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summary of findings from the literature review and consultations into level of service considerations of the transport operator
Comparison of the asset and operational based performance measured in the literature, and those used by jurisdictions

<table>
<thead>
<tr>
<th>Area</th>
<th>Literature</th>
<th>In use by jurisdictions</th>
</tr>
</thead>
</table>
| Asset-based       | - Pavement performance measures (rutting, strength, cracking, skid resistance, texture)  
                    - Smooth travel exposure  
                    - Pavement condition index  
                    - Drainage condition index  
                    - Bridge performance measures (load capacity, safety, reliability, clearances, condition)  
                    - Road-related asset performance measures (many areas – refer to Table 5.2)  
                    - Expenditure (return on investment)  
                    | Pavement performance measures (roughness, cracking, rutting, texture, structural life)  
                    - Pavement health index  
                    - Smooth travel exposure  
                    - Ride quality index  
                    - Bridge strength and width  
                    - Maintenance – preventative maintenance indicator  
                    - Reconstruction (intensity of road re-building, re-surfacing, distribution of road construction period) |
| Operational-based | - Safety measures (serious casualty and road fatality crashes, hospitalisations, social costs)  
                    - Safety index  
                    - Efficiency index  
                    - Environmental index  
                    - Travel speed and congestion measures (actual travel speed, variability and reliability of travel speed)  
                    - Traveller efficiency measures (lane occupancy rates, car occupancy rates, variability and reliability)  
                    | Safety (black spot location indicator)  
                    - Access (% of road network for heavy vehicles)  
                    - Travel speed and congestion (actual and nominal travel speed, variability or travel time) |
Outcomes and Further Work

The recommended option, incorporating access arrangements as the classification method, and defining service levels according to access conditions, ride smoothness, traffic conditions, traveller information, provision of amenities (rest areas), and road safety, and the associated performance indicators, was reviewed by the working group prior to a teleconference held on 22 February, and discussed during the teleconference.

While the recommended option was broadly supported by the working group, several specific issues were raised by the reference group, summarised in the table below. Further work in this area should focus on addressing the issues raised, summarised below.

- conduct further preliminary investigation into the defining service levels according to the full social cost of infrastructure provision
- investigate the level to which the all vehicle classes can be accommodated within the classification framework, and investigate possible alternative classification schemes
- investigate the need to revise the service level attributes, and possible inclusion of additional performance indicators
- investigate the ability of road owners to offer different levels of service ‘quality’ for the same level of access
- demonstrate how the framework will deliver productivity improvements, and link the costs for providing a service level to the performance of a road
- investigate the possible links with existing and planned service level schemes.

**Integrating the findings into the reform**

Material from a draft of this report (submitted to the HVCI in April) was used to develop an access and service level discussion paper, which was circulated to members with the intention of being discussed at a targeted workshop held on 17th June in Brisbane.

Key outcomes and recommendations from the workshop included a revised and simplified table of service level attributes and performance indicators, which was jointly developed by the HVCI and ARRB subsequent to the workshop.

Subsequent to the workshop, an internal review within the HVCI determined that the development of a simplified service level framework should be considered as a preliminary or initial solution to ensure that a framework can be applied and implemented in practice in the short term. Once the initial approach is established, sophistication could be built up over time to introduce key set of service quality attributes and performance measures.

It is currently intended that this approach will continue to be refined and developed as part of the HVCI’s on-going work program.
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1 INTRODUCTION

The Heavy Vehicle Charging and Investment Reform Office (HVCI) is reviewing the national systems for providing and using roads for heavy vehicles, with a view to implementing regulatory reforms which encourage more appropriate and efficient road infrastructure investments, and create more opportunities for increases in heavy vehicle productivity and access for the future. Within this, the specific focus of the HVCI is in the following areas (HVCI 2013):

- **investment and planning**: enabling road providers to respond to the needs of the industry, and also to make targeted infrastructure investments
- **access**: providing heavy vehicles sufficient access to the road network to support the growing freight task, and also to encourage increases in vehicle productivity
- **regulation and pricing**: implementing a pricing framework that reflects the costs of road use, and is directly linked to road funding
- **implementation**: assisting the industry to transition to a new regime.

The HVCI is preparing a regulatory impact statement (RIS) which considers three options for a new heavy vehicle charging and investment framework in order to discuss the regulatory reforms required in the areas outlined above.

ARRB Group Ltd (ARRB) has been engaged by the HVCI to provide technical input to the RIS, specifically relating to the development of a service level framework, which will link vehicles, roads, and access arrangements into a framework where prices reflecting the cost of road use can be set for individual transport tasks, and also provide a clear indication to transport operators and their customers regarding the quality of service they can expect.

This document, the final report, is the fourth deliverable of the engagement, following the inception report (Ritzinger & Karl 2013) which outlined ARRB’s appreciation of the task, formalised the project’s scope, assumptions, method and the timing of deliverables, the draft service level framework (Ritzinger et al. 2013a), circulated to the project working group for comment and feedback, and the progress report (Ritzinger et al. 2013b), which provided further technical material to support the recommendations in the draft service level framework.

The broad requirements of the project as set out in the project brief, the project scope, methodology, and subsequent staging of project tasks, and an outline of the structure of the report are provided in the following sections.

1.1 Broad Project Requirements

Material supplied by the HVCI as part of the original project brief specified three main goals of the project, as follows:

- identify methods of access decision making within jurisdictions, including road and access level classification, and the identification of proposed changes to access regimes by bodies such as the NHVR, NTC or jurisdictions
- define service levels to be applied by asset owners to the road network, underpinning investment proposals, and providing clarity to industry about the type and extent of vehicle access that can be purchased
- identify any changes that may be necessary to existing access arrangements under any or all of the three reform options outlined by the RIS, to meet the objectives of the reform and to create a more customer-oriented culture within the access regime.
The primary objective of the project was to investigate and deliver a service level framework, linking vehicle classes and levels of road access into a system where services provided in terms of road access for heavy vehicle operators can be quantified, and supporting a pricing structure being developed concurrently under a separate project.

1.2 Project Scope, Methodology and Staging of Tasks

In order to achieve the goals outlined above, ARRB developed a project scope and methodology, outlined in the project inception report (Ritzinger & Karl, 2013), and repeated briefly here. It was determined that the project be delivered in two key stages during the months of January, February and March, 2013, in line with the requirements of the project brief, with input from the working group at several stages. The members of the working group comprised representatives from the state road agencies, regulators and the national level, and industry representatives. The two project stages are outlined below.

1.2.1 Stage 1 – Industry Consultation and Service Level Definition

Due to the requirement to deliver a draft service level framework (Ritzinger et al. 2013a) to the working group by 18 February, it was decided to conduct the industry consultations as the first stage. Thus, Stage 1 of the project intended to cover the aspects of the project scope as outlined in Table 1.1.

Table 1.1: Areas of the project scope covered in Stage 1

<table>
<thead>
<tr>
<th>Operators</th>
<th><img src="https://example.com" alt="An outline of the perceived value of service levels" /></th>
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<tbody>
<tr>
<td></td>
<td><img src="https://example.com" alt="Industry views on how different factors affect level of service" /></td>
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<tr>
<td></td>
<td><img src="https://example.com" alt="Preferences for engaging with a national framework" /></td>
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<table>
<thead>
<tr>
<th>Defining and implementing service levels</th>
<th><img src="https://example.com" alt="Definition of service levels, or a set of service levels as required by each of the three reform models" /></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="https://example.com" alt="An outline of how the service levels could be applied in practice, including required changes to culture, planning procedures, and access arrangements" /></td>
</tr>
<tr>
<td></td>
<td><img src="https://example.com" alt="Options for encouraging the adoption of service levels amongst asset owners" /></td>
</tr>
</tbody>
</table>

An industry consultation program (outlined in Section 5) was undertaken, the results of which were used to guide the scope of the service levels. Separate literature reviews into the characteristics and requirements of service levels (also outlined in Section 5), methods of classification for the service level framework (outlined in Section 4), and the performance indicators for the service level framework (outlined in Section 6) were commenced, largely delivering on the first two of the three goals identified by the project brief.

The outputs of these tasks were used to develop a recommended option for the service level framework, presented in Ritzinger et al. (2013a), and reviewed by the working group. All attempts have been made to incorporate comments received by the working group on the framework, wherever possible.

1.2.2 Stage 2 – Stocktake of Current Approaches and Identification of Necessary Changes

While it may have been preferable to undertake the stocktake of current approaches prior to the definition of the service level framework, the timing requirements for the draft service level framework did not permit the stages to be undertaken in that order. As a result, the project team commenced work on Stage 2 of the project upon finalising Stage 1, and covered aspects of the project scope as outlined in Table 1.2.
A jurisdictional consultation program was undertaken (outlined in Section 5), and the literature reviews into the characteristics and requirements of service levels (also outlined in Section 5) were finalised. Material received from the jurisdictions was used to deliver the final of the three goals identified by the project brief.

However, it should be noted that while the three reform options were clearly outlined at the commencement of the project, discussions with the HVCI project team in late March indicated that the reform options were being revised in-line with the findings of separate, but related studies into the business systems required to support the reforms.

As a result of this, a discussion of the implementation of the service level framework within the context of the three reform options is not provided in this draft, but will be included in subsequent drafts pending the HVCI’s finalisation of the three reform options.

1.3 Structure of the Report

This report is structured as follows:

- **Section 2** provides background material relating to service levels, outlining the definition of services and service levels, discusses why service levels are required for road transport within the context of the reform objectives, and outlines some examples of service level frameworks from related industries.

- **Section 3** outlines considerations in developing service levels from the literature, and discusses these in relation to the project and presents a range of key success factors. A service level framework based on an asset management approach is presented, and its suitability discussed in relation to the key success factors and other considerations. The requirements of setting a classification method, and service attributes and performance factors are discussed.
Section 4 presents options for the classification method. Four potential methods of classification are discussed, including classification by access arrangement, vehicle class or characteristic, vehicle performance level, and by road class. The advantages and disadvantages of each are set out, and a recommended option is proposed.

Section 5 outlines the process undertaken and provides the results of the consultations with industry and the jurisdictions, and the literature review conducted as part of the task of defining the service levels.

Section 6 outlines the service attributes and performance indicators, incorporating both asset owner and freight transporter considerations and material from the literature, discusses these in terms of the data requirements for assessment, and presents a more detailed service level framework.

Section 7 discusses the feedback received from the working group and jurisdictions on the service level framework, and discusses identified issues relating to its practical application, options for encouraging adoption, planning and pricing considerations, governance elements, and identifies areas requiring further work.

Section 8 discusses and presents options for integrating the findings of the current project into the reform package.

Section 9 provides a conclusion and outlines recommendations for further work.
2 BACKGROUND TO SERVICE LEVELS

This section of the report provides background material relating to service levels, outlining the definition of a service, a service level, discusses why service levels are required for road transport in the context of the HVCI’s planned reforms, and outlines some examples of service levels from related industries.

2.1 What is a Service?

The distinction between services and products within the market has been the subject of considerable past research, and contemporary theory defines a scale comprising pure goods (e.g. unrefined bulk products or raw materials) at one end, and pure services (e.g. management consultancy) at the other end, with the focus on tangibles and intangibles as the primary means of characterising the two (Gustoffson & Johnson 2003, McColl et al. 1998). An example of such a scale is illustrated in Figure 2.1

![Illustration of the products and services continuum](source: McColl et al. (1998).

Within this scale, a service can be defined as an essentially intangible benefit, or as an element of a tangible product, which satisfies the needs of a customer. In this context, consideration of the road network as a tangible product, and the use of it as an intangible benefit is considered appropriate, and indicates that other aspects of commonly accepted service level theory are applicable, such as the characteristics of services and the implications this has on service level development.

2.2 What is a Service Level?

The term: ‘level of service’ is typically used to describe the quality (utility) of a service provided to a customer in relation to a specific asset, typically incorporating attributes such as quality, reliability, responsiveness, sustainability, timeliness, and cost (NAMS 2011). In order to understand the application of these attributes in the context of service levels and roads, road use needs to be considered as a ‘service’ offered by asset owners, based on the use of their ‘product’, (the road network) by the transport industry.
Thus, a service level is a classification which defines the level to which a certain road, route or network, meets the quality or utility expectations of the user, in this instance being the freight transporter. A high service level is attributed to infrastructure which meets the user’s expectations/requirements, while a low service level is attributed to infrastructure which either fails to meet, or only partially meets the user’s expectations/requirements. This concept is outlined in Figure 2.2

![Service levels and customer requirements](image)

This concept closely aligns with the conventional level of service concept advocated in accepted asset management theory (ATC 2006, NAMS 2011), and has been generally adopted in recent Australian research (Austroads 2006c, Austroads 2008), and is also discussed in previous related studies (Frontier Economics 2012).

One example of a service level using a road asset attribute is skid resistance. Road users rely on skid resistance to maintain the safe control of their vehicle, and they expect high levels of skid resistance to be provided by the road network at all times. On the basis of this user expectation, a service level for skid resistance could be defined, using the measured skid resistance of a road or area of a network.

Another example of a service level is travel time reliability. Road users’ expectations of travel time reliability vary, but would be expected to be relatively high, translating to an expectation for high travel time reliability. Thus, the service level for travel time reliability could be defined using the percentage of journeys where the duration exceeds a specified time.

It is important at this point to differentiate between the service level framework developed here, and the conventional Level of Service (LOS) concept currently used in traffic and transport theory (TRB 2010). The Highway Capacity Manual (HCM) published by the Transportation Research Board (TRB) presents the LOS concept, which is designed to convey the general quality of traffic conditions on a road facility to road users, via the calculation of numerical results using standardised performance measures for specific and measurable operating conditions such as traffic speed, traffic density and traffic volume.

As an example, to assign an LOS to a traffic facility such as a basic freeway segment, the performance indicator of traffic density, measured by vehicles per kilometre per lane, is generally used. If the traffic density is high, this means that the traffic flow will be low, with forced stopping and queuing, so the overall LOS of the freeway segment will be low. If the traffic density is low, the traffic will be free-flowing, with high travel speeds, so the overall LOS of the freeway segment will be high.
The service level framework developed here is similar to the conventional LOS concept, but expands the range of performance indicators past those typically used for standard and distinct traffic facilities such as intersections and freeway merging areas.

2.3 Why Develop Service Levels for Road Transport?

Service levels are developed as a policy tool to translate broad transport system objectives into targets which can be measured by performance indicators. The National Guidelines for Transport System Management in Australia (ATC 2006) provides a high-level overview (Figure 2.3) of how objectives and targets can be set, measured by performance indicators, and the gap between the desired and actual performance of the road network addressed by policy, planning and other initiatives.

![High-level overview of transport system objectives](image)

Source: Australian Transport Council (2006).

Service level frameworks can also be used to ensure that delivered service levels are aligned as closely as possible with customer expectations (NAMS 2011). Associated with this are the benefits that customers can be effectively informed about the attributes of the level of service offered, which allows them to assess its suitability, affordability, and equity. Secondary benefits are that asset management strategies can be developed, and costs and benefits of providing the service levels assessed.
These reasons for service level development have specific relevance to the current project. Throughout the transport industry, the collective view amongst policy makers is that the current system of charging for heavy vehicle access (on the basis of vehicle registration and the road user charge (RUC)) does not directly support the required productivity increases, and has left three critical disconnects:

- between the charges paid by road users, and the expenditure required by asset managers to provide heavy vehicle access
- between the funds received by asset owners and their road maintenance budgets
- between the planning, investment and allocation of funds for heavy vehicle access.

These disconnects effectively work against industry desires for increased productivity and access, as asset owners can be reluctant to grant longer and heavier vehicles access to the road network where the required funding to support new access arrangements is not guaranteed. An integrated package of pricing, funding and expenditure reforms has been previously recommended on the basis that it can provide economic efficiency benefits (GHD Meyrick 2010, 2012, Juturna Consulting 2012a, 2012b, National Transport Commission 2009). While a wide range of regulatory reforms are required to transition the heavy vehicle charging system into one which addresses each of the above, the service level framework will directly facilitate important links between each disconnect.

Primarily, by setting a price for the use of the road asset relative to the level of service provided, the link between charges paid by road users and the expenditure required can be demonstrated (this concept is referred to as ‘cost hypothecation’). Secondly, if used at the planning level to guide asset design or upgrade decisions, service levels can be used to justify and support cost budgets, thereby ensuring correct allocation of funds. The follow-on benefits are expected to be improved productivity and access for heavy vehicle combinations.

A report by Frontier Economics on heavy vehicle investment process options (Frontier Economics, 2012) which advocated a ‘bottom-up’ approach to facilitating efficient investment in the freight transport industry, they key steps of which are outlined in Figure 2.4, highlighted the need for service delivery targets and standards as a key aspect of that approach.

![Image](image.png)

Source: Frontier Economics (2012).

**Figure 2.4: Key steps in a ‘bottom-up’ efficient investment process**

The primary aspects of the service targets and standards noted in the report are that they be set at an economically efficient level, provide for differentiation across the network, and can take priority over other governmental processes. These aspects are discussed further in other sections of this report.
2.4 The Use of Service Levels in Other Industries

Consideration of how service levels are used in other industries is important, as a range of alternative approaches should be considered. In order to make a comparison across different industries possible, Knieps (2006) provides useful differentiation of service level arrangements between the following network levels:

- **Level 1**: Network services (e.g. air traffic, railway traffic, truck transport, shipping, production and resale of electricity or gas, telecommunications services)
- **Level 2**: Infrastructure management (e.g. air traffic control, railway traffic control)
- **Level 3**: Network infrastructure (e.g. airports, railway infrastructure, transportation and distribution networks of electricity or gas).

Similar differentiations are also referred to by Król (2009), and Pittman (2001). The importance that this has in the context of this project is that the majority of other industries, such as utilities (water, electricity, gas), transportation (rail, airline), and telecommunications (telephony, internet) tend to specify service levels at Level 1 (Frontier Economics 2012), meaning the services of the network that the retailer provides which are directly relevant to the commodity itself.

It should be noted that in the context of service levels for road transport, the retailer can be considered to be the road asset owner. This is important for the current project as service levels developed here need to relate to all levels, not just the network service level as used by other industries, in order to ensure that the correct incentives are given to the asset owners to improve the service level they provide. Further examples of service levels provided by other industries are outlined in the following sections.

### 2.4.1 Utility Industries

Examples of service levels used in the utility industry are outlined in Table 2.1.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum amount of water released before a leaking water main is repaired</td>
<td>Failure to connect within required timeframe - Distributor does not connect gas service within five business days’ notice of request from retailer</td>
<td>Electricity is not connected (or reconnected) on time</td>
</tr>
<tr>
<td>Maximum period of loss of water supply to a given number of customers</td>
<td></td>
<td>Timely response to a loss of hot water supply inquiry</td>
</tr>
<tr>
<td>Time taken to respond to a request for a water meter to be read</td>
<td>Repeat interruptions – More than four unplanned interruptions in a calendar year as a result of a fault in the distribution network</td>
<td>Warnings on planned interruption to electricity supply to your home or business</td>
</tr>
</tbody>
</table>

### 2.4.2 Rail Industry

A distinction can be made between service level for rail shippers and passengers. This is comparable to the difference in service levels between transport operators and freight owners. Metro (2013) monitors the performance of its train services in a high level of detail. The performance thresholds relate to punctuality, measured as a percentage of services arriving on time at destination and reliability, and also measured as a proportion of the timetabled train services run.
2.4.3 **Telecommunications Industries**

In packet-switched networks such as the internet, quality of service is affected by various factors, which can be divided into ‘human’ and ‘technical’ factors. Human factors include stability of service, availability of service, delays and user information. Technical factors include reliability, scalability, effectiveness, maintainability, and grade of service. The Australian Communications and Media Authority (ACMA 2006) examined the following six levels of service measures for Australian internet connections:

- download data rates on a major city and regional basis
- upload data rates on a major city and regional basis
- data rate variation by time of day
- internet service availability
- domain name server (DNS) lookup times.

In a discussion paper on monitoring and reporting on quality of service the former Australian Communications Authority (ACA 2001) proposed a number of aspects of service performance considered likely to be significant to consumers. This include service characteristics, capability and capacity (e.g. coverage, advanced call handling features, data speeds), the price of service, relative to the price of other service offerings by the same service provider and by other service providers, the time taken to install or repair services (average and maximum), reliability of services (faults and outage time per service), the capacity of service providers to meet agreed appointments (percentage missed), the quality of consumer experience when contacting the service provider for information (time to answer, time in queue, time to conclude), billing performance (time to dispatch bills, extent of back-billing, billing errors) and the level and nature of complaints about a service provider.

The key performance indicators are described in terms of definition, reason for collection of specific data, measurement method, geographical aggregation and frequency of provision of data.

2.5 **Section Summary**

This section outlined services and service levels using published industry guides and other literature, and discussed how service levels can be used as part of regulatory reforms to improve the heavy vehicle charging system in Australia.

A brief comparison of the service levels used in other industries has shown that the service levels adopted tend to be limited to the services of the network directly relevant to the infrastructure itself, and the service levels developed under this project relate to all levels, not just the network service level as used by other industries, in order to ensure that the correct incentives are given to the asset owners to improve the service level they provide.
3 CONSIDERATIONS IN DEVELOPING SERVICE LEVELS

This section of the report discusses important considerations for the development of service levels, and summarises these into a range of key success factors. On the basis of published asset management material, a service level framework is presented, and modified in order to address the requirements of the framework as effectively as possible.

There are many important considerations which need to be addressed in the development of service levels. Several key factors and the specific reasons why they are important are outlined below:

- **the need to understand the characteristics of services themselves** – services are inherently different from products, and service levels need to be developed accordingly
- **the organisational levels at which service levels can be described** – setting the degree to which linkages can be made with asset owner goals and objectives
- **the important role of consultation** – for service levels to be accepted and adopted by the industry and asset owners, wide consultation is required in the development stages
- **alignment with past, current and future practices** – service levels can only be effective where they closely align with existing and planned practices.

Each of these aspects is discussed in further detail in the following sections.

3.1 Characteristics of Service Levels

It is commonly reported that there are five characteristics of a service that serve as an important method of distinguishing them from products, and require careful consideration as they have implications for the overall success of the service levels developed under this project. The five characteristics are outlined in Figure 3.1 (Gustoffson & Johnson 2003, McColl et al. 1998), and reasons for their importance in relation to road access as a service are discussed.

<table>
<thead>
<tr>
<th>Intangibility</th>
<th>Inseparability</th>
<th>Variability</th>
<th>Transience</th>
<th>Ownership</th>
</tr>
</thead>
</table>

**Figure 3.1: Characteristics of services**

3.1.1 Intangibility

Intangibility refers to the fact that a service cannot be effectively assessed or investigated by traditional means, which makes its value inherently difficult to determine. Where a product can be inspected, handled, or tested, a service cannot be assessed in such a manner, which means that potential customers may face a level of uncertainty in selecting a particular service level, as they have little means to ensure that indications surrounding the provision of that service will be met.

This is particularly relevant to road access as a service as potential users of the service level framework may perceive high levels of risk, or rely solely on either price or personal information sources as a basis for assessing quality. Even though users will not be in a position to select an alternative service, the uncertainty involved could prevent them from readily adopting or engaging with the service level system.

This risk can be partially addressed by ensuring that the developed service levels are simple, transparent, focussing on linking service levels back to tangible qualities such as road characteristics, providing users with a clear understanding of the differences between service level offerings, and focussing on meeting the service level objectives set.
3.1.2 Inseparability

Inseparability refers to the nature of the link between production and consumption of a service. In relation to products, the producer often has little or no direct involvement with the end consumer, however, in relation to services; the producer can have significant direct involvement. This implies the potential for a relationship to exist between producer and consumer which must be carefully managed.

In relation to road access as a service, this relationship will exist between road owners and users as a direct result of the access decision making and implementation process. The transport industry is often the main driver in the provision of new access arrangements, and this means that they will often be co-producers of a particular service level, as it will be based on their requirements, which themselves are dictated by the transport task.

While not representing a specific risk, consideration of inseparability is important in defining the service levels, because if it is successfully managed, it will help to facilitate the transition to a user-focused access market, and simultaneously promote productivity gains within the industry.

3.1.3 Variability

Variability for services relates to the potential difficulties in controlling the end quality of the service offered. Products can be subject to stringent quality control procedures and only released to the market when a high degree of confidence in quality has been achieved. In contrast, there is little potential for such quality control procedures to be applied to services, which can lead to high levels of variability in the end service that the user experiences.

In relation to road access as a service, the high potential for variability has important implications. Primarily, confidence in the system will be eroded if users experience high variability, either in terms of the difference in the service received on a particular road on a daily or weekly basis, or on different roads which are marketed as having the same service level.

It may be difficult for a service level system to be designed and implemented to ensure that overall variability is low, as variability in the road network can be influenced by external factors such as extreme weather events, or traffic accidents, both of which have little potential to be effectively controlled by the road owner. A more effective approach may be to define the service levels such that variability in areas outside of the road owners’ user control is not included. The success of this approach will be largely determined by the level of expectation that service levels include those variable aspects.

3.1.4 Transience

Transience (also referred to as perishability) of a service refers to both the nature of demand for service to vary, and the difficulty or inability to store or stockpile services during times of low demand, in order to meet demand at peak times. In relation to road access, demand for services is expected to fluctuate given the needs of the transport task, which is known to be both constant throughout the course of a day, and also experience peaks at certain times of the day.

This has the potential to impact on service levels offered, as the customer demand for particular service levels may impact negatively on the quality of the service offered, particularly for time-of-day deliveries of perishable products.

Again, it may be difficult for the service level system to effectively address this, but mitigating strategies similar to those outlined above in relation to variability could be helpful.
3.1.5 Ownership

Ownership, in terms of differentiating products and services, refers to the fact that when a service is purchased, no ownership is transferred from the seller to a buyer. In relation to access levels, the buyer is simply purchasing the right to operate a permitted vehicle on a given route for a certain combination of distance or time.

The issue of ownership is not expected to be a cause for concern in relation to road access service levels, as the industry has pre-existing experience with the concept of purchasing the right to use a particular road, through the use of the various privately owned toll roads in operation throughout the country.

3.2 Organisational Levels, and Links to Asset Owner Objectives

Austroads (2006c) identifies that service levels should both reflect and support asset owner strategic goals and objectives, and highlights that service levels can be defined at three different organisational levels; the operational level, the tactical level, and the strategic level. Examples of each are shown in Table 4.1 below.

<table>
<thead>
<tr>
<th>Level of service</th>
<th>Description and examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational level</td>
<td>Generally related to specific, individual road defects, such as potholes. Levels of service can be defined as maximum response time to fix a defect, or maximum level of defect condition prior to intervention. Different levels of service and requirements can be set for different road classes. Operational service levels are often delivered by either reactive or routine maintenance programs.</td>
</tr>
<tr>
<td>Tactical level</td>
<td>Relates to road defects, but on a larger scale than specific incidents, such as at the section or road link/corridor level. Can cover network-level parameters such as road condition (e.g. roughness, rutting), or traffic flow (e.g. overtaking opportunities). Tactical service levels are generally delivered by high-level network maintenance or upgrade programs.</td>
</tr>
<tr>
<td>Strategic level</td>
<td>Defines the overall condition of the road network, using performance measures such as ‘roughness or rutting exposure’, which can be measured using average travel kilometres per year on rough or rutted roads, or ‘community perceptions of ride quality’. Strategic service levels are usually defined by the overall strategy of the asset owner in terms of their goals for asset provision.</td>
</tr>
</tbody>
</table>

Similarly, NAMS (2011) identifies that a service level framework should clearly illustrate how actions at the operational level contribute to the successful delivery of levels of service, and how these in turn directly support the wider organisational objectives.

As far as practicable, the service level framework should adopt aspects of service levels across each of the operational, tactical, and strategic levels, within the overall purpose of directly linking with and supporting the objectives of the asset owner.
3.3 Importance of Consultation

As the service level framework to be developed under this project is required to be user-focused, stakeholder consultation is of crucial importance. Austroads (2006c) and NAMS (2011) highlight that consultation can have the following purposes and benefits:

- test of acceptance for the service level concept, and communicate the expected benefits
- investigate willingness to pay for specific service level attributes
- identification of the attributes considered important by the stakeholders, and the opinions on current performance levels
- investigate the potential for consideration of trade-offs in the service levels.

In relation to this project, stakeholder consultation is required at both the industry and jurisdictional levels.

3.4 Alignment with Past, Current and Future Practices

As much as practicable, the service level framework should align with past, current and future asset owner practices and systems. In relation to past practices, consideration should be given to previous asset management processes, in order to make best use of the existing data sets and policies.

In relation to current practices, the service level framework must more easily facilitate applications for access and the associated charges. However, this presents several distinct challenges, as vehicle classes and access arrangements vary significantly across jurisdictions.

As a result, a service level framework which is designed to facilitate access applications in one particular jurisdiction, or set of closely-aligned jurisdictions, may be poorly aligned with access arrangements in others. As a result of the reform of heavy vehicle access decision-making currently being undertaken by the National Heavy Vehicle Regulator (NHVR), there may be a substantial benefit in aligning the service level classifications with the future national access framework.

In relation to future practices, the service level framework should be designed to accommodate the preferred pricing structure option, which is the subject of a separate project. As an example, if the pricing structure were to be set based on axle mass, and vary according to road type, the framework would need to be defined to specifically accommodate that arrangement.

It is worth noting that the service level framework is intended to sit alongside higher-level performance requirements on road agencies, such as clearance of roads following accidents, and downtime due to natural disasters. These performance requirements apply to all road users, and the service level framework for heavy vehicles will not replace those existing requirements.

3.5 Key Success Factors

The project inception report (Ritzinger & Karl 2013) identified five requirements of the service level framework that were considered by the working group to represent ‘key success factors’ for the project. These are outlined below:

- **Simplicity** – as the defined service levels must allow operators to make prudent decisions regarding their transport operations, they must be simple, transparent, and thereby provide operators with a clear understanding of the differences between service levels.
• **Flexibility** – due to the depth and breadth of road, geographical and environmental conditions within Australia’s transport network, service levels must be flexible enough to be applied across identical access levels, for vastly different roads. This is also related to the need for need for differentiation identified in previous studies (Frontier Economics, 2012).

• **Facilitates change** – as the service levels are at the heart of the charging and investment reform, they must be designed in such a way that effectively facilitates the change to a user-focussed heavy vehicle access market.

• **Promotes productivity** – the service levels should simultaneously encourage operators to seek more productive transport operations, and increase the rate at which access decision making for high productivity is undertaken amongst jurisdictions.

• **Streamlines the access process** – the service levels are required to be seamlessly incorporated into the access decision making process.

On the basis of the material outlined in the preceding paragraphs of this section, several additional factors can be added, which will define the degree to which the framework is accepted by jurisdictions and the industry, as outlined below.

• **Alignment of service levels to familiar concepts** – the service level framework must align with concepts that are tangible and familiar to the transport industry, and those that they can easily understand.

• **Links service levels to tangible factors** – as far as practicable, the service levels must link directly to tangible factors such as road characteristics that are familiar to users at all levels within the transport industry. This will also keep the system as simple as possible, and should help to encourage user engagement and adoption of the system.

• **Accommodates the variable nature of the road network** – the ability of the system to cope with the high variability of the road network is crucial, and encompasses considerations including the effects of unforeseen or unpredictable events such as extreme weather and traffic crashes.

• **Links to asset owner objectives** – the service level framework should adopt aspects of service levels across each of the operational, tactical, and strategic levels, within the overall purpose of directly linking with and supporting the objectives of the asset owner.

• **Alignment with past, current and future practices** – the framework should align with existing systems, such as access arrangements and vehicle/road classification, and also accommodate future pricing structures.

### 3.6 Service Level Framework Development

At this point, a high-level concept for the service level framework is proposed, guided by relevant examples from the literature. NAMS (2011) provides a useful framework for developing levels of service for infrastructure (Figure 3.2).
Four distinct concepts within the service level framework are outlined, and examples of each are given for specific industries. The first, a service ‘attribute’, defines the aspect or characteristic of the service at a high-level grouping. The second concept is the actual level of service, which represents what an organisation intends to deliver, in the form of a specific statement. The final two concepts relate to performance measures, being those perceived by the customer, and that used by the organisation to measure their performance in a given service attribute.

This example can be adopted to define a service level framework to support the reforms to the heavy vehicle charging scheme. The service level framework is required to link vehicle classes, road classifications, and access arrangements into a framework where prices reflecting the cost of road use can be set for individual transport tasks, and also provide a clear indication to transport operators and their customers regarding the level of service they can expect, thus enabling the transition to a ‘user-focused’ heavy vehicle access market.

At the simplest level, the service level framework should comprise defined levels of service and performance indicators under varying groupings of service attributes in a similar manner to that outlined above, as under this arrangement the majority of key success factors can be achieved. An example of what the service level framework might look like at this level, including descriptions of the data included in each section is shown in Table 3.2.

### Table 3.2: Example level of service framework

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Performance indicator</th>
<th>Rating system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of the aspect or characteristic of the service at a high-level grouping, such as safety, accessibility, or amenity.</td>
<td>The method by which the performance of the network in the attribute is determined. As an example, for safety performance, an indicator of fatalities/injuries per unit of travel exposure could be used.</td>
<td>How the asset is rated according to the result of the performance indicator (e.g. one star for lowest performance, five stars for highest performance), and the corresponding ratings assigned to different performance levels.</td>
</tr>
</tbody>
</table>

However, there are several factors which prevent this approach from being adopted directly. Primarily, the degree of variation within the heavy vehicle industry, particularly in the areas of freight task, vehicle type and configuration, access arrangement and road classification, mean that...
one set of service levels is unlikely to fulfil the objectives of all, and views on which aspects of a service are important are unlikely to be shared uniformly across operators from all freight tasks.

An associated complication is the identified requirements for the framework to promote productivity, streamline the access process, and be aligned with existing systems, such as access arrangements and vehicle classification, and support the future pricing scheme. Preliminary work conducted by Marsden Jacobs and Associates (MJA 2013) indicates that the pricing scheme may be comprised of marginal and capacity cost elements (representing the cost of road wear caused directly by the vehicle, and the cost of providing the infrastructure for the vehicle, respectively).

Accounting for the marginal cost of heavy vehicles can be done by incorporating a vehicle road-wear specific parameter into the pricing structure, such as the equivalent standard axles (ESA) methodology. However, in order to account for the capital cost elements, a structure is required where different prices can be set in order to account for the different requirements of the road structure (in terms of design and construction) that longer and heavier vehicles require.

In order to ensure that these concerns are addressed, an additional level of classification for the service level framework is required, the nature and scope of which will need to be determined. The way in which this classification method will sit within the service level framework, itself comprising performance indicators, attributes, and service factors, is outlined in Figure 3.3.

![Figure 3.3: Outline of the relationship between service factors and components within the framework](image)

Within this, it is proposed that the framework itself comprise a table which links each specific service level to a particular classification, allowing a continuum of service levels to be set for a range of classifications, as outlined in Table 3.3. This incorporates the example framework shown in Table 3.2, at each classification level.
The concept proposed above shows five separate service levels, meaning that infrastructure could be assigned a service level ranging between very high, high, medium, low, and very low however the requirement on the number of service levels required will need to be investigated, and is expected to be substantially driven by data availability. As an example, there would be little value in designing a framework incorporating five or more service levels if it was later determined that data held by jurisdictions could only provide a basic differentiation between service levels.

A similar concept was initially presented to the working group in the report by Ritzinger & Karl (2013), and discussed during a teleconference on 22 February, where it received broad support, although those present noted several key points regarding the classification method and other aspects. All attempts have been made to include and address the comments received from the working group members both during the teleconference, and subsequently via e-mail, and are discussed throughout the remainder of the report as appropriate.

In order to further define the service level framework, the classification system needs to be developed, and is discussed in Section 4. The set of service attributes and performance indicators themselves need to be defined for each combination of service level and classification, which is discussed in Section 6.

### Table 3.3: Concept for the service level framework

<table>
<thead>
<tr>
<th>Classification</th>
<th>Service level 1</th>
<th>Service level 2</th>
<th>Service level 3</th>
<th>Service level 4</th>
<th>Service level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification 2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Classification 3</td>
<td></td>
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</tr>
</tbody>
</table>
4 OPTIONS FOR THE CLASSIFICATION METHOD

Defining the classification method is an important aspect of the service level framework, as the degree of variation within the heavy vehicle industry means that one set of service levels are unlikely to fulfil the objectives of all, and views on which aspects of a service are important are unlikely to be shared uniformly across operators within all freight tasks.

Additionally, the framework should promote productivity, streamline the access process, and be aligned with existing systems, such as access arrangements and vehicle classification, and support the future pricing scheme.

This section sets out the various classification options, and separately considers access arrangements, systems of vehicle classification, vehicle-based classification elements such as, number of axles, road classes, and vehicle performance, as illustrated in Figure 4.1.

While many other classifications are possible, such as by type of freight/commodity, freight classification by the nature of the transport task (Austroads 2008), classification by drivers and transport operators (Ko et al. 2009), these are not included here as it is considered likely that the classification options outlined below are more suitable. Consideration is given as to how a service level framework might be based on each of the options, discussing the advantages and disadvantages of each.

4.1 Classification by Access Arrangements

The project brief sets three general requirements for the development of the service levels. Primarily, the service levels are required to more easily facilitate applications for access and the associated charges. In order to achieve this, service levels should be defined from a vehicle access perspective, and seek to ‘package’ the current various access levels in order to best meet the needs of industry when seeking access for a heavy vehicle.

This approach, while being fundamentally sound and representative of good practice, poses a distinct problem in Australia as vehicle classes and access arrangements vary significantly across jurisdictions. As a result, a service level framework which is designed to facilitate access applications in one particular jurisdiction, or set of closely-aligned jurisdictions, would be poorly aligned with access arrangements in others.

As an example, Table 4.1 highlights the differences between the general and restricted access arrangements between Victoria and Queensland.
Table 4.1: Differences between general and restricted access arrangements of Victoria and Queensland

<table>
<thead>
<tr>
<th>Victoria</th>
<th>Queensland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Access (including local roads)</strong></td>
<td><strong>General Access (including local roads)</strong></td>
</tr>
<tr>
<td>42.5 t, 19 m, 4.3 m</td>
<td>Extended to 50 t PBS vehicles (not 50.5 t)</td>
</tr>
<tr>
<td>+ HML rigid</td>
<td></td>
</tr>
<tr>
<td>+ HML semi-trailers (tri-axle &lt;= 20 t)</td>
<td></td>
</tr>
<tr>
<td>+ Mini B-doubles &lt;= 50.0 t</td>
<td></td>
</tr>
<tr>
<td><strong>Restricted Access</strong></td>
<td><strong>Restricted Access</strong></td>
</tr>
<tr>
<td>HML semi-trailers (tri-axle at 22.5 t)</td>
<td>B-double (19 m, 23 m, 25 m, 26 m)</td>
</tr>
<tr>
<td>Mini B-doubles &gt; 50.0 t</td>
<td>Type 1 road trains</td>
</tr>
<tr>
<td>B-doubles at GML 62.5 t (25 m or 26 m)</td>
<td>Type 2 road trains</td>
</tr>
<tr>
<td>B-doubles at HML 68.0 t (25 m or 26 m)</td>
<td>MCV networks matched to PBS levels</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td><strong>Notes</strong></td>
</tr>
<tr>
<td>Use vehicle classes 1, 2 and 3</td>
<td>Do not use vehicle classes 1, 2 and 3</td>
</tr>
<tr>
<td>HML access is limited by critical bridges</td>
<td>HML network exists independently of RAV networks</td>
</tr>
<tr>
<td>Vehicle types considered first</td>
<td>Road train regions exist</td>
</tr>
<tr>
<td>6-axle truck and dogs in class 3</td>
<td>MCV terminology not RAV</td>
</tr>
<tr>
<td>B-triples are in class 2</td>
<td>CML at 6.25 t steer axle and at 4 levels</td>
</tr>
<tr>
<td>109 t Super B-doubles in class 2</td>
<td></td>
</tr>
</tbody>
</table>

The vehicle class system employed in the *Heavy Vehicle National Law Act 2012* (Qld), hereafter referred to as ‘HVNL’, provides a basis for national vehicle classes; namely Class 1, Class 2 and Class 3. The classes described by the HVNL however, have been adopted differently by each state. Regardless of the current usage of the HVNL classes, the classes are a requirement for managing heavy vehicles in accordance with the HVNL and therefore must feature as part of classification systems used by jurisdictions.

While it is anticipated that the National Heavy Vehicle Regulator (NHVR) will guide the reform of the heavy vehicle industry in some areas related to vehicle classification, route assessment, and the provision of access arrangements, the responsibility of permitting and providing access will ultimately remain with the asset owner. This means that each state, territory, and local government will continue to implement their own access arrangement systems. Thus, the service level framework must be designed specifically to accommodate them.

An approach where the service level framework could be designed specifically to accommodate a classification system by access arrangements would be to link into the access arrangement system at a high level, one which encompasses the various access arrangements in operation through all jurisdictions. The access arrangements and associated vehicle classes specified under the HVNL offers a possible approach.

The HVNL defines two levels of vehicles, based on existing access arrangements. The first, termed ‘general access’, covers the vehicles that comply with prescriptive requirements on overall mass and dimensions, and are given access to all parts of the road network, unless indicated by signage. The second, termed ‘restricted access’, sets out three specific classes of vehicles, which are generally longer, heavier, have more axles, or more individual units than general access vehicles, and usually operate under a notice or gazette, or on the basis of specific permits with
operating conditions that vary according to the nature of the operation. The three classes specified in the HVNL are:

- **Class 1** – special purpose vehicles such as mobile cranes and concrete pump trucks, agricultural vehicles, vehicles carrying or designed specifically to carry a large indivisible item
- **Class 2** – B-doubles, road trains, livestock vehicles, and buses that exceed the prescriptive mass and dimension limits for general access
- **Class 3** – all other restricted access vehicles, such as high-productivity (PBS) vehicles.

Due to the differentiation that occurs between jurisdictions past this level, it is expected to be too difficult to use a classification system that defines levels of access in further detail, as a system defined according to the arrangements of one jurisdiction would not suit others.

However, preliminary comments made by the working group indicated that these classes alone are too broad, and without examining the sub-types of vehicles within each class, a true representation of the costs of the impacts of each vehicle type would be difficult to obtain, due to the variation that exists in impacts of vehicles on road wear within the classes.

In recognition of this, the three HVNL classes could provide the basis for a classification scheme, if used as primary classes and supported by sub-classes with further detail to provide the resolution required. This may be possible by splitting the separate classes of restricted access by notice/gazette (Class 2) and by restricted access by special permit (Class 1). Some examples of vehicles which operate under various notice/gazette and permit arrangements are outlined in Table 4.2.

<table>
<thead>
<tr>
<th>Notice/gazette vehicles</th>
<th>Permit vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-doubles and trucks loaded to higher mass limits in Victoria</td>
<td>Oversize and overmass vehicles in most jurisdictions</td>
</tr>
<tr>
<td>Multi-combination vehicles (B-doubles, road trains, B-triples, and AB-triples) in Queensland</td>
<td>Special purpose vehicles (mobile crane, concrete pump, drilling rig, farming mobile plant etc.) in most jurisdictions</td>
</tr>
<tr>
<td>Higher mass limit buses, and ‘stinger’ car carriers in South Australia</td>
<td></td>
</tr>
</tbody>
</table>

This level of differentiation becomes particularly useful as the majority of permit-based vehicles will require some level of case-specific assessment by the relevant jurisdiction. It could be argued that roads are designed primarily for general access and restricted access (notice/gazette) operation, with permits being used only because the transport task cannot be completed by any other means, as in the case of very large indivisible loads. For such vehicles, that the road is not inherently designed for, a service level offering cannot be defined, as the only service offered is access.

The service level framework using access arrangements defined to this level as the classification system is outlined in Table 4.3.
Table 4.3: Concept for the service level framework using access arrangements as the classification system

<table>
<thead>
<tr>
<th>Classification</th>
<th>Sub-classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>General access</td>
<td>Rigid trucks and buses</td>
</tr>
<tr>
<td></td>
<td>Semi-trailers</td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
</tr>
<tr>
<td>Restricted access</td>
<td>Oversize and overmass vehicles</td>
</tr>
<tr>
<td>Class 1</td>
<td>Special purpose vehicles (mobile crane, concrete pump, drilling rig, farming mobile plant etc.)</td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
</tr>
<tr>
<td>Restricted access</td>
<td>Multi-combination vehicles (B-doubles, road trains, B-triples, and AB-triples)</td>
</tr>
<tr>
<td>Class 2 and 3</td>
<td>Higher mass limit vehicles</td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
</tr>
</tbody>
</table>

Using access arrangements as the classification system has the advantages of being largely transferrable across jurisdictions, and is relatively simple at the highest level, having only three classes for service levels to be defined, with permit vehicles not being offered a service level, as such. This approach may also effectively accommodate different road classes, as they are expected to roughly align with the service levels themselves (i.e. a high service level will be an urban highway, while a low service level may be a rural local road).

However, this approach does not successfully accommodate the existing various national schemes that are currently intended to increase productivity, being higher mass limits (HML), and concessional mass limits (CML). Vehicles participating in these schemes, which could fall into restricted access class 1 or 3, would need to be catered for.

This approach also has the disadvantage that some restricted access or permit vehicles from one jurisdiction may be treated as ‘general access’ vehicles in another, which creates difficulties as a national, uniform system with the same pricing structure cannot be created, and operators may be given incorrect price signals depending on their location.

One important point for consideration is the current work being commissioned by the NHVR which seeks to develop a nationally consistent framework for the assessment and classification of heavy vehicles and routes, and is presently being completed by ARRB. The objective of the NHVR project is to develop processes and procedures to ensure that jurisdictional heavy vehicle access decisions are made in a consistent manner, and meet the regulator’s obligations under the legislation. The methodology employed by ARRB to undertake this project is based on extensive stakeholder consultation and a literature review encompassing many regulatory and policy documents (e.g. HVNL, National Transport Commission 2007, Transport and Main Roads 2007). The intention is to provide a framework that will allow access decisions to be made based on consistent methods of classifying heavy vehicles, and consistent methods of assessing routes.
ARRB’s research for the NHVR has highlighted that some types of vehicles prove difficult to classify consistently. Approximately thirty-five of these have been identified, and include garbage trucks and road sweepers with left hand drive from Northern Territory.

Whilst the project is on-going, draft results have highlighted substantial disconnects between access arrangement procedures across Australian jurisdictions, and the eventual level to which the NHVR framework will harmonise access decision making is yet to be determined. Presently, ARRB’s work focuses on distilling access arrangements into five groups: exemption notice, access by permit, access by period permit, single trip permit, and special assessment, as outlined below.

- **General access (GA):** vehicles that comply with the limits outlined in the regulations have an ‘as of right’ access to the whole network. Some examples of general access vehicles include passenger vehicles, certain buses and heavy vehicles complying with specific dimension and mass limits.

- **Exemption notice (N):** in general, exemption notices are used for commonly used vehicles that do not comply with the mass or dimension limits outlined in the regulations. These vehicles do not need to individually apply for a permit provided they meet the specifications in the notice however they are generally able to travel only on a restricted road network. These notices can also be referred to as gazettes.

- **Access by permit (P):** some vehicles require permits to be able to travel on the road network. Vehicles travelling under permits generally do not meet the requirements to travel under general access or notice (e.g. oversize vehicle permits). Period permits are permits which are for a limited time (often between one and three years).

- **Single trip permits (STP):** single permits are issued for one-off travel for a particular vehicle.

- **Special assessment (SA):** special assessments are required for vehicles which cannot be issued single trip permits.

This vehicle access hierarchy categorises vehicle access arrangements by ease of access and increasing scrutiny, and is shown in Figure 4.2.

![Figure 4.2: Proposed vehicle access hierarchy](source)

Depending on the subsequent acceptance and eventual level of adoption of this approach by the NHVR, it could potentially serve as a useful primarily classification method, for similar reasons as discussed above in relation to the adoption of the HVNL access classes.
4.2 Classification by Vehicle Type

There are several existing methods of vehicle classification by type of vehicle which could be employed as the classification system, as jurisdictions all presently have different approaches to how they define each vehicle class. This topic is also currently being investigated by ARRB for the NHVR, which will review and summarise of vehicle classifications at the jurisdictional level. The report is presently in draft form, but has produced several preliminary useful results which are relevant here. Table 4.4 shows a summary of the vehicle classification schemes and standards which are presently in place at the national level and across each jurisdiction (Germanchev et al. 2013).

At the national level, the Austroads classes categorise vehicles from 5.5 m to 36.5 m in length, by the number of trailers and axles in the combination, and form a total of ten individual classes. The NTC charging model incorporates 22 classes, and arranges vehicles based on type and gross mass. These are examples of systems that define distinct vehicle groups on the basis of vehicle characteristics, such as length, mass, number of trailers, and number of axles. At the jurisdiction level, the content and scope of the individual classification schemes have similar elements, but nonetheless differ across jurisdictions. As an example, the various classifications for B-doubles cover vehicles ranging from 55 to 68.5 tonnes gross combination mass (GCM), and overall length from 25 to 30 metres.

Table 4.4: Summary of vehicle classifications schemes/standards currently in place

<table>
<thead>
<tr>
<th>National</th>
<th>ACT</th>
<th>NSW</th>
<th>NT</th>
<th>QLD</th>
<th>SA</th>
<th>TAS</th>
<th>VIC</th>
<th>WA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Vehicle National Law Amendment Bill 2012 classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austroads classification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Transport Commission registration charges divisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Based Standards levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Design Rules classification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oversize and overmass vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Germanchev et al. (2013).
Again, the substantial differences in vehicle classification across jurisdictions poses difficulties, as a classification system defined according to the schemes of one jurisdiction would not suit others, and a neatly defined separation of vehicle classes and access arrangements does not presently exist. As a result, a classification system based on vehicle type which would suit all jurisdictions would have to be restricted to a high level of detail, capturing broad vehicle groups but no further definition of mass or length.

On this basis, an example service level framework (not intended to be representative of the full system, shown only for example purposes) which groups vehicles based on vehicle type (configuration) is shown in Table 4.5. It should be noted that this is similar to the Austroads vehicle classes.

Table 4.5: Concept for the service level framework using vehicle group as the classification system

<table>
<thead>
<tr>
<th>Vehicle group</th>
<th>Typical vehicle</th>
<th>Service level 1</th>
<th>Service level 2</th>
<th>Service level 3</th>
<th>Service level 4</th>
<th>Service level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single unit rigid</td>
<td><img src="image1" alt="Diagram" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double unit articulated</td>
<td><img src="image2" alt="Diagram" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rigid + articulated</td>
<td><img src="image3" alt="Diagram" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple unit articulated</td>
<td><img src="image4" alt="Diagram" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad unit articulated</td>
<td><img src="image5" alt="Diagram" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As such a system would be based on existing vehicle classification schemes, it would be expected to fulfil the requirements of aligning with existing systems well by default. Again, as per the previous approach involving vehicle access classes, this approach may also effectively accommodate different road classes, as they are expected to roughly align with the service levels themselves (i.e. a high service level will be an urban highway, while a low service level may be a rural local road).

A key challenge of the system would be the level to which the defined vehicle classes successfully collate the breadth and width of vehicles in operation throughout Australia. While the system should be kept as simple as possible, defining a manageable set (between 10 and 15) of vehicle classifications may not be sufficient to provide enough differentiation to support the pricing structure.

Additionally, this classification system does not support a pricing structure defined by road wear calculations such as the equivalent standard axle (ESA) method, as road wear figures can vary widely across vehicle groups such as rigid articulated, with some vehicles being far more damaging to the road network than others, even for vehicles with a similar overall mass. To account for this, an axle-mass level of differentiation would need to be added to each vehicle group.
4.3 Classification by Road Classes

Road classification systems in operation throughout Australia exist at many levels, and vary across jurisdictions, each with differing terminology. MacNamara (2003) highlights that jurisdictions have at least one road classification system in operation, and sometimes operate two or more in parallel. This fact alone means that road classes are unlikely to be a feasible method of classification for the service level framework, as the definitions used in the classification may not be accepted or used by each jurisdiction.

Broadly, classification systems exist on two levels, functional classifications, which group roads on the basis of their intended purpose, and administrative classifications, which are used to provide a legal or administrative differentiation which allows allocation of funds between federal, state, and local levels. Some examples of each are provided below.

The National Association of Australian State Road Authorities (NAASRA) provided a functional classification of roads with nine categories (Local Government and Municipal Knowledge Base 2013), outlined in Table 4.6. Although NAASRA no longer exists, and the functions it originally performed are now undertaken by Austroads, the original NAASRA road classifications are still in use throughout Australia.

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural areas</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>Those roads which form the principal avenue for communication between major regions of the Commonwealth, including direct connections between capital cities.</td>
</tr>
</tbody>
</table>
| Class 2 | Those roads, not being Class 1, whose main function is to form the principal avenue of communication for movements:  
- between a capital city and adjoining States and their capital cities  
- between a capital city and key towns  
- between key towns. |
| Class 3 | Those roads, not being Class 1 or 2, whose main function is to form an avenue of communication for movements:  
- between important centres and the Class 1 and Class 2 roads and/or key towns  
- between important centres  
- of an arterial nature within a town in a rural area. |
| Class 4 | Those roads, not being Class 1, 2 or 3, whose main function is to provide access to abutting property (including property within a town in a rural area). |
| Class 5 | Those roads which provide almost exclusively for one activity or function and which cannot be assigned to Classes 1, 2, 3 or 4. |
| Urban areas |
| Class 6 | Those roads whose main function is to form the principal avenue of communication for massive traffic movements. |
| Class 7 | Those roads, not being Class 6, whose main function is to supplement the Class 6 roads in providing for traffic movements or which distribute traffic to local street systems. |
| Class 8 | Those roads, not being Class 6 or 7, whose main function is to provide access to abutting property. |
| Class 9 | Those roads which provide almost exclusively for one activity or function and which cannot be assigned to Classes 6, 7 and 8. |

This road classification system is used by MRWA to assign jurisdictional responsibility for public roads. Under this arrangement, MRWA is responsible for Classes 1, 2, 3 and 6, while local
governments in WA are responsible for roads in the other classes. MRWA also uses a hierarchy for road types and associated criteria, which classified roads according to primary distributor, district distributor A and B, regional distributor, local distributor, and access road.

A classification system similar to the original NAASRA system is adopted by Austroads (Austroads 2006a) which appears to be largely based on the NAASRA classifications, but provides additional differentiation for roads at the urban level, as outlined in Figure 4.3.

<table>
<thead>
<tr>
<th>ARTERIAL ROADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 – Those roads, which form the principal avenues for communications</td>
</tr>
<tr>
<td>between major regions, including direct connections between capital cities.</td>
</tr>
<tr>
<td>Class 2 – Those roads, not being Class 1, whose main function is to form the</td>
</tr>
<tr>
<td>principal avenue of communication for movements between:</td>
</tr>
<tr>
<td>- a capital city and adjoining states and their capital cities; or</td>
</tr>
<tr>
<td>- a capital city and key towns; or</td>
</tr>
<tr>
<td>- key towns.</td>
</tr>
<tr>
<td>Class 3 – Those roads, not being Class 1 or 2, whose main function is to</td>
</tr>
<tr>
<td>form an avenue of communication for movements:</td>
</tr>
<tr>
<td>- between important centres and the Class 1 and Class 2 roads and/or key</td>
</tr>
<tr>
<td>towns; or</td>
</tr>
<tr>
<td>- between important centres; or</td>
</tr>
<tr>
<td>- of an arterial nature within a town in a rural area.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCAL ROADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 4 – Those roads, not being Class 1, 2 or 3, whose main function is to</td>
</tr>
<tr>
<td>provide access to abutting property (including property within a town in a</td>
</tr>
<tr>
<td>rural area).</td>
</tr>
<tr>
<td>Class 5 – Those roads, which provide almost exclusively for one activity or</td>
</tr>
<tr>
<td>function, which cannot be assigned to Classes 1 to 4.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Road</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled access highways (motorways or freeways)</td>
<td>Motorways and freeways have an exclusive function to carry traffic within cities and to ensure the continuity of the national or regional primary road system. As they are designed to accommodate through traffic, they do not offer pedestrian or frontage access.</td>
</tr>
<tr>
<td>Urban arterial roads</td>
<td>Urban arterial roads have a predominant function to carry traffic but also serve other functions. They form the primary road network and link main districts of the urban area. Arterial roads that perform a secondary function are sometimes referred to as sub-arterial roads.</td>
</tr>
<tr>
<td>Urban collector/distributor roads</td>
<td>These are local streets that have a greater role than others in connecting contained urban areas (e.g. residential areas, activity areas) to the arterial road system. Generally, consideration of environment and local life predominate and improved amenity is encouraged over the use of vehicles on these roads.</td>
</tr>
<tr>
<td>Urban local roads</td>
<td>These are roads intended exclusively for access with no through traffic function.</td>
</tr>
</tbody>
</table>

Source: Austroads (2006a).

Figure 4.3: Austroads road classification system, rural (top), and urban (bottom)

Many of the functional classification schemes adopted by jurisdictions contain elements or definitions from the NAASRA and Austroads classifications, with some modifications to account for local conditions or terminology. In contrast to the functional classifications are the administrative classifications used by jurisdictions. The VicRoads administrative classifications (VicRoads 2013) are outlined in Table 4.7.
Table 4.7: VicRoads administrative road classifications

<table>
<thead>
<tr>
<th>Road type, description, and total chainage</th>
<th>Responsible authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeways (approximately 800 km, not including tollways)</td>
<td>VicRoads</td>
</tr>
<tr>
<td>Tolled freeways (approximately 61 km)</td>
<td>Transurban (Citylink) and ConnectEast (Eastlink)</td>
</tr>
</tbody>
</table>
| Arterial roads (urban areas) | Operational responsibility, including inspection, maintenance and repair of road infrastructure:  
  ▪ Through traffic lanes - VicRoads  
  ▪ Other (including service roads, pathways and roadside areas) - municipal councils  
  Coordination responsibility, including consents for road and infrastructure works and road closures – VicRoads |
| Arterial roads (non-urban areas) | Operational responsibility (not including pathways) – VicRoads  
Coordination responsibility – VicRoads |
| Municipal roads (approximately 129,000 km) | Municipal councils (for municipal roads) |
| Municipal roads (approximately 50,000 km of non-arterial state roads and minor roads and tracks) | Department of Sustainability & Environment and others, including Parks Victoria, for non-arterial State roads and minor roads and tracks |

Transport and Main Roads Queensland (TMR) also has multiple road classification methods, each developed for independent purposes, and outlined below:

- **Funding and administration** – National Land Transport Network, State Controlled Network, Local Roads of Regional Significance
- **Investment** – Priority road network, State Strategic Road Network
- **Freight** – Key Freight Network, Higher Mass Limit Network, Road Train Network.

If road classes were to be chosen as the basis for the classification system, it would be prudent to align the classifications with those in place at the national level, such as the Austroads or original NAASRA classes. For simplicity, these classes could be combined into a set of two rural road classes (rural local, and rural arterial), three urban road classes (urban local, urban collector/distributor, urban arterial) and a highway class, applicable to highways in rural and urban areas. The service level framework using access arrangement as the classification system is outlined in Table 4.8.
Table 4.8: Concept for the service level framework using road type as the classification system

<table>
<thead>
<tr>
<th>Classification</th>
<th>Service level 1</th>
<th>Service level 2</th>
<th>Service level 3</th>
<th>Service level 4</th>
<th>Service level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural local</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural arterial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban local</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban collector/distributor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban arterial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This system has the advantage of avoiding the issues discussed earlier in relation to classification systems based on vehicles or access arrangements, and can effectively permit a pricing structure to be set on the basis of differing classes of roads and road types, which may be particularly beneficial if the economic analysis requires a price differentiation at that level. It is also expected to align well with existing systems of road classification within jurisdictions, however this will depend on the specific definitions of roads used.

Despite this, the system has the disadvantage that unless different prices are specifically set for different vehicle classes within the service levels, operators may not be given clear or accurate price signals regarding the relative infrastructure cost of a particular heavy vehicle combination. There is the additional challenge that high service levels may not be provided for certain road classes, which would mean that there would be gaps in the framework.

Feedback received from members of the working group indicated that previous attempts have been made at the national level to redefine road classifications and impose these classifications onto structures that were unable to fulfil the task assigned to them without significant modification. Furthermore, it was noted that any new road classification system should involve assessing the capacity of roads, rather than imposing a desired capacity on them.

4.4 Classification by Vehicle Performance Level

While any method of assessing vehicle performance could be used as the classification system for the service level framework, the method used by the pricing structure would be the most suitable, as it would reflect clear price signals to operators.

Preliminary work conducted by Marsden Jacobs and Associates (MJA 2013) indicates that the pricing scheme may be comprised of marginal and capacity cost elements (representing the cost of road wear caused directly by the vehicle, and the cost of providing the infrastructure for the vehicle, respectively). The report indicates that calculations such as the equivalent standard axle (ESA) or standard axle repetition (SAR) methods for assessing road wear performance, and a passenger-vehicle based equivalency factor (PCU) have emerged as potential candidates for metrics upon which to base the marginal and capacity cost elements of the charging system.
If such factors were to be used as a classification system, they would have to be translated into ‘bands’, comprising a range of possible values the metric could take, bounded by the lower and upper levels of vehicle performance. If a combination of ESA/SAR and PCU was used to define vehicle performance, the service level framework shown in Table 4.9 would result.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Service level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Service level 1</td>
</tr>
<tr>
<td>Low ESA/SAR/PCU</td>
<td></td>
</tr>
<tr>
<td>Medium ESA/SAR/PCU</td>
<td></td>
</tr>
<tr>
<td>High ESA/SAR/PCU</td>
<td></td>
</tr>
</tbody>
</table>

The distinct benefit of this system is that it does not rely on an existing classification of vehicles, access arrangements, or roads, and therefore avoids the difficulties of having to align with such systems. However, a considerable disadvantage is that the concepts of ESA/SAR and PCU, and many others of a similar technical nature, are not readily understood by the majority of operators, and as a result they would be unlikely to engage with a system based on performance factors.

An alternative approach would be to align the classification level with vehicle performance as defined by the NHVR’s Performance Based Standards (PBS) scheme, which is a regulatory tool designed to improve heavy vehicle productivity. The regulatory controls under the PBS scheme focus on investigating how well the vehicle performs, rather than specifying maximum dimensions or characteristics (e.g. length, width and height), through a set of sixteen safety-related and four infrastructure protection standards, which focus on quantifying vehicle performance in many key areas (NTC 2008). PBS vehicles must meet stricter safety standards, and demonstrate better performance than existing equivalent vehicles.

Although PBS is intended to focus on vehicle performance, due to the lack of an accepted test method and performance criteria for some performance measures (overtaking provision and pavement vertical loading), prescriptive measures are included by default for vehicle overall length and mass. The application of these prescriptive measures to the four PBS access levels has created seven vehicle classes, as outlined in Table 4.10.

<table>
<thead>
<tr>
<th>Level</th>
<th>Typical vehicle</th>
<th>Network access by vehicle length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Class ‘A’</td>
</tr>
<tr>
<td>Level 1</td>
<td>Single articulated</td>
<td>L ≤ 20 (general access)</td>
</tr>
<tr>
<td>Level 2</td>
<td>B-double</td>
<td>L ≤ 26</td>
</tr>
<tr>
<td>Level 3</td>
<td>A-double</td>
<td>L ≤ 36.5</td>
</tr>
<tr>
<td>Level 4</td>
<td>A-triple</td>
<td>L ≤ 53.5</td>
</tr>
</tbody>
</table>
There is also a corresponding PBS network for each of the four access levels within Australia, although only a portion of the national network has been classified through the PBS guidelines, and generally only at the Class ‘A’ level. This means that the networks for Class ‘B’ vehicles have not yet been defined, and many local roads are not included in the current PBS network, and will not be included until they are classified by their owners, a task which requires considerable resources.

While the PBS classes could be used as a means of classification, doing so would present several challenges. Primarily, the PBS levels do not align well with the pricing structure, as there is no consideration of ESA/SAR or PCU within the PBS performance levels. As an example, typical Level 2 vehicles are B-doubles and truck and dog combinations. While having a similar overall mass, the ESA results for the two vehicle types can vary substantially. This means that a price set across a PBS level would be unlikely to represent the true marginal cost of typical vehicles within that vehicle class.

An additional difficulty is that the PBS scheme, while it has been in operation since October 2007, has not achieved widespread success within the industry, with vehicle approval numbers remaining relatively low (Ritzinger et al. 2012), and the majority of the road network in Australia is yet to be assessed using the PBS classifications.

While several initiatives are presently underway to address this, including the development of a PBS Route Assessment Tool (RAT) for local government, it is not considered that the service level framework (intended to be a national scheme) should be designed around an access and classification scheme which has relatively low industry and jurisdictional adoption.

4.5 Discussion and Preferred Option

While several possible options have emerged by which the classification of a service level framework could be set, each has distinct advantages and disadvantages, as summarised in Table 4.11.

While many other classifications are possible, such as by type of freight/commodity, freight classification by the nature of the transport task (Austroads 2008), classification by drivers and transport operators (Ko et al. 2009), these are not included here as it is considered that the classification options outlined in Table 4.11 are more suitable.
Table 4.11: Summary of possible classification options

<table>
<thead>
<tr>
<th>Classification option</th>
<th>Details</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Possible modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>Classification by existing access arrangements, such as the HVNL ‘general’ and ‘restricted’ access classes</td>
<td>Aligns well with existing national schemes by default, is relatively simple, and accommodates various road classes</td>
<td>Cross-over between access arrangements in different jurisdictions not effectively dealt with</td>
<td>Add detail to access classes to cater for HML and CML</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>May not accommodate all vehicle classes, nor support other various national schemes such as HML and CML</td>
<td>Add detail to ensure that all vehicle classes are accommodated</td>
</tr>
<tr>
<td>Vehicle classes</td>
<td>Classification by existing national systems such as the Austroads’ classes</td>
<td>Aligns well with existing national schemes by default, is relatively simple, and accommodates various road classes</td>
<td>The ability of the system to effectively capture all vehicles and refine them into a manageable set is doubtful</td>
<td>Add detail to the vehicle groups to define each class</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Does not support a pricing structure defined by road wear</td>
<td></td>
</tr>
<tr>
<td>Road classes</td>
<td>Classification by existing national systems such as the NAASRA classes</td>
<td>Aligns well with existing national schemes by default, and is relatively simple, and avoids issues related to classification by access or vehicle group</td>
<td>Requires further differentiation within each service level to set prices for different vehicles, and does not provide operators with clear pricing signals</td>
<td>Further development to provide a pricing structure for different vehicle types within each service level</td>
</tr>
<tr>
<td>Performance level</td>
<td>Classification by the metrics used to set the pricing structure, or via the levels set within the PBS scheme</td>
<td>Avoids issues related to classification by access or vehicle group</td>
<td>Potentially difficult for the industry to understand</td>
<td>Relate bands of low ESA/SAR/PCU to example vehicles</td>
</tr>
</tbody>
</table>

On the basis of the above analysis, some of the options appear to have more potential than others, due to the nature of the advantages and disadvantages of each, which will be discussed here.

Classification by vehicle characteristics

The ‘vehicle classes’ classification option is simple, as it would define vehicle groups according to their configuration, which are easily recognisable and understandable. It would also align well with existing vehicle classification schemes, such as the Austroads or NTC vehicle classes. However, the disadvantage of this option is that in order to be used across all jurisdictions, vehicle groups could only be defined at a high-level, with no detail on vehicle mass or length. Additionally, this scheme would not support a pricing structure defined by road wear calculations such as ESA, as road wear figures can vary widely within individual vehicle groups, even for vehicles with a similar overall mass. For these reasons, the ‘vehicle classes’ classification option is not recommended.

Classification by vehicle performance

The ‘performance level’ option, if set on the basis of vehicle road wear calculation methods such as ESA or SAR, has the advantage of not relying on existing classification of vehicles, access arrangements, or roads, and therefore avoids the difficulties of having to align with such systems. However, a considerable disadvantage is that the concepts of ESA/SAR, and many others of a similar technical nature, are not readily understood by operators, and as a result they would be unlikely to engage with a system based on performance factors.
A classification level set using the PBS vehicle classes would not align well with a pricing structure based on the ESA/SAR or PCU, due to substantial differences in these metrics across the PBS levels, which would result in prices not representative of the true marginal cost of typical vehicles within that vehicle class. Additionally, it is not considered that the service level framework (intended to be a national scheme) should be designed around an access and classification scheme which has relatively low industry and jurisdictional adoption.

On this basis, the ‘performance level’ options investigated are not recommended as suitable classification methods.

**Classification by road classes**

The ‘road classes’ option has the advantage of allowing a pricing structure to be set on the basis of differing classes of roads and road types, which may be particularly beneficial if the economic analysis indicates that a price differentiation at that level is required. It is also expected to align well with existing systems of road classification within jurisdictions; however this will depend on the specific definitions of roads used. Despite this, the system has the disadvantage that unless different prices are specifically set for different vehicle classes within the service levels, operators may not be given clear or accurate price signals regarding the relative infrastructure cost of a particular heavy vehicle combination. There is the additional challenge that high service levels may not be provided for certain road classes, which would mean that there would be gaps in the framework. For these reasons, the ‘road classes’ classification option is not recommended.

**Classification by access arrangement**

In contrast, the ‘access’ classification option appears relatively sound. If defined using the Heavy Vehicle National Law (HVNL 2012) approach (which comprises general access, and three classes of restricted access), it would be expected to be largely transferrable across jurisdictions. It also fulfils the requirements set out in the project brief of more easily facilitating applications for access, as it is defined from a vehicle access perspective, and therefore seeks to ‘package’ the current various access levels in order to best meet the needs of industry when seeking access for a heavy vehicle.

However, further work is required to ensure that the classification system can successfully cater for all types of vehicles, supports the pricing framework, and does not conflict with existing national access schemes such as higher mass limits (HML) and concessional mass limits (CML).

Depending on the subsequent acceptance and eventual level of adoption of the approach reported by Germanchev et al. (forthcoming) for the NHVR, it could potentially serve as a useful primarily classification method, for similar reasons as discussed above in relation to the adoption of the HVNL access classes.
5 INDUSTRY AND JURISDICTION CONSIDERATIONS

This section outlines the process undertaken and provides the results of the consultations with the industry and the jurisdictions as part of the task of defining the service levels.

As the service levels are required to represent the aspects of the transport task that the transport operators consider important, and simultaneously integrate with the existing systems and ideas for the service levels scheme used by the asset owners, consultation was conducted at both the jurisdictional and transport operator levels. Consultation at the transport operator level also provided insights into the considerations of their customers, being the freight/goods owners.

To supplement the findings of the consultations, a literature review was also undertaken in order to investigate and inform on three broad areas: if service levels for transport operations had been previously researched, the use of service levels in contemporary asset management approaches, and the performance indicators both currently used and recently proposed for transport systems. Documents reviewed comprised those identified in the inception report (Ritzinger & Karl 2013), as outlined in Appendix A, and other relevant publications uncovered throughout the project.

This section discusses considerations of the transport operator and the asset owner in turn, using information from the consultations, and the literature review where appropriate. The technical factors relevant to the service level components including access, safety and traffic conditions, are discussed, and possible performance indicators for each component are proposed. Finally, this section discusses the feasibility of each approach, in terms of measurability and potential data collection requirements.

5.1 Considerations of the Transport Operator and Freight Owner

In order to understand the interests of the freight transporter, industry sectors and groups were consulted, and a targeted literature review of several key documents was undertaken, with the objective of uncovering material related to the following:

- aspects of the service provision that users consider important
- how can the service level be improved
- options for performance indicators.

Relevant material provided by the groups consulted and obtained via the literature review is outlined in the following sections.

5.1.1 Published Material Related to Transport Operator Considerations

While relatively few documents were found which dealt specifically with this topic, those that were uncovered yielded some important insights or the perceptions of heavy vehicle drivers on service quality related to transport operations. The review uncovered the key documents:

- *Travel Time Reliability and Truck Level of Service on the Strategic Intermodal System* (Washburn & Ko 2007).

A summary of the main findings of the literature is provided below.
Multimodal Quality of Service Part 1: Truck Level of Service (Washburn 2002)

In the United States, Washburn (2002) explored the development of a level of service methodology specific to heavy vehicles, and developed a preliminary methodology for assessing truck level of service for basic freeway segments. The methodology was based on a ‘relative manoeuvrability’ concept, which is a function of the ratio of the percentage of free-flow speed of trucks to the percentage of free-flow speed of passenger cars.

The foundation of this concept was that heavy vehicles are less able to take advantage of available gaps in the traffic stream than smaller vehicles, due to their larger size and reduced acceleration and braking performance. As a result, with increasing traffic density, heavy vehicles will have fewer options available for lane changing and overtaking, and may not be able to maintain their desired speed. The study concluded that while the approach appeared to show merit, further research was required before it could be operationally adopted.

Travel time Reliability and Truck Level of Service on the Strategic Intermodal System (Washburn & Ko 2007)

Washburn and Ko (2007) identified the determinants of level of service perceived by truck drivers, and measured their relative importance. The traffic, roadway, and control factors important to truck trip quality were identified through focus group studies and the relative importance of each factor was determined from a follow-on survey study. The study found that the quality of the trip, as considered by heavy vehicle drivers, depended on travel safety, travel time, and physical and psychological driving comfort.

Best practice on Improving Level of Service for Freight Vehicles, On-Road Public Transport, HOV and Emergency Vehicles (Austroads 2008)

Austroads (2008) provides a summary report on best practice for improving the level of service for specific road users, including freight vehicles. The report notes that there are many potential areas for improvement, as outlined below.

- **Land use regulations** – insufficient attention given to freight activities in urban areas and new developments has led to sub-optimal outcomes for freight efficiency. It is noted that defined land use strategies, such as zoning, access and infrastructure, relocation, ad urban renewal have the potential to address these issues.
- **Intermodal freight logistics** – physical infrastructure located within cities and ports lacks the capacity and capability required to effectively facilitate intermodal freight. Recent advances in information and communication technologies (ICT) are noted as having potential to address this problem.
- **Road-based freight measures** – the report identifies a range of short-term measures for the improvement of freight efficiency, including improved truck routes and access management, night-time operation, parking and loading control, operational conditions (e.g. lane use restrictions) and ITS measures.

Performance Measures for Truck Level of Service (Ko et al. 2009)

Ko et al. (2009) analysed the most relevant issues for level of service improvements from the perspective of the needs of the trucking community. The study identified which roadway, traffic, and control issues should become the focus, in order to better serve the needs of the freight industry. The research method surveyed drivers and company managers to quantitatively measure the relative importance, satisfaction, and improvement priority of truck level of service determinants, and to examine which aspects of a truck trip should be analysed to estimate truck level of service on each roadway type.
The findings were specified by road type. Speed variance and pavement quality were identified as the service measures on freeways, while the percentage of time being followed, the percentage of time spent following, and travel lane and shoulder width and the pavement quality were identified for two-lane highways. Trip quality on urban arterials depends on factors such as ease of turning manoeuvres, speed variance, traffic density, and pavement quality. Major common contributors to the level of service regardless of roadway type were other drivers’ behaviour, pavement condition, level of congestion, and frequency and timing of construction activities.

5.1.2 Feedback from Industry

The project team and the HVCI jointly developed a list of organisations to be approached for invitation to take part in the consultation process, as outlined in Table 5.1.

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>General freight</td>
<td>Toll, DHL, Linxox, Chalmers Industries, Deliver Australia, Glen Cameron Group, K&amp;S Freighters, Murphy Transport Solutions, Secon Freight, Fletcher Group of Companies, Ron Finemore Transport, Simon Carriers, Johnstons Transport, McGrath Regional Logistics Group (Newcastle)</td>
</tr>
<tr>
<td>Mining</td>
<td>Brambles Industrial Services, Kalari, Chemtrans, Orica, Queensland Resources Council</td>
</tr>
<tr>
<td>Construction</td>
<td>Holcim/Cemex, Boral, Cement, Concrete and Aggregates (CCA), Newbold Bulk Haulage</td>
</tr>
<tr>
<td>Oil and gas</td>
<td>IES, Scotts, FBT Transwest, Australian Bulk Tankers Association</td>
</tr>
<tr>
<td>Livestock and produce</td>
<td>Riordan Grain Services, Australian Livestock and Rural Transporters Association, National Farmers Federation, ABB Grain, Livestock and Rural Transport Association of WA</td>
</tr>
<tr>
<td>Forestry</td>
<td>Tasmanian Forest Contractors Association</td>
</tr>
<tr>
<td>Remote area and heavy freight</td>
<td>HHA Group (QLD), HeviHaul (WA), Hi-Haul Transport (VIC)</td>
</tr>
<tr>
<td>General associations</td>
<td>NSW Trucking Association, Australian Logistics Council, Australian Trucking Association, National Road Train Operators Association (NATROAD), NT Trucking Association, National Road Freighters Association, Owner Drivers Association of SA, Motor Trade Association of WA, WA Road Transport Association, WA Owner Drivers Association</td>
</tr>
</tbody>
</table>

The organisations shown in Table 5.1 are considered to represent a meaningful cross-section of the freight transport industry, as most industry sectors are represented, and there are examples of small and large companies within each sector, from different geographical regions in Australia.

During the consultation process, industry representatives from the organisations listed were interviewed and asked about their opinions regarding many aspects of the service levels. Examples of the material used in the consultation period are shown in Appendix B. It should be noted that not all groups/companies contacted during the consultation phase provided a response, with responses received from approximately one-third of those contacted.

Feedback was specifically sought on which areas (factors and characteristics) the transport operators considered critical to their task of transporting freight, with the intention being to obtain an understanding of those factors which would be an important step in the development of the service levels.
service levels. Feedback from industry indicated very strongly that they considered key aspects of the service provision to be in the following areas:

- **access conditions** – being able to access parts of the road network with the desired vehicle combinations, in order to improve productivity and deliver on customer (freight owner) expectations
- **ride smoothness** – to reduce vehicle operating costs (e.g. fuel, tyres and suspension) and reduce driver discomfort and prevent fatigue
- **traffic conditions** – reduced congestion, ability to achieve and maintain desired speed and complete trips and deliveries according to schedule
- **traveller information** – information on provision of rest areas, and also traffic conditions and possible detour options, in order to select the most optimal place to rest, and achieve the requirements of the schedule
- **provision of amenities (rest areas)** – quality and frequency of rest areas, in order to meet driving hours legislation and reduce driver fatigue
- **road safety** – general road safety improvements in order to provide a safer environment for all road users.

In addition to these key points, the industry consultations conducted to date yielded important insights which are summarised below, and attributed to respondents from each organisation, where appropriate.

1. **Access is potentially the most crucial issue for freight transporters**
   Several respondents identified that a service level scheme, while recognised as having benefits, is a lower-level concern for them than access decision making at jurisdictional level, and how it influences their business (Toll, Linfox, K&S).

2. **Willingness to pay where a benefit or outcome is provided**
   It was a fairly unanimous viewpoint that the operators will readily accept charges for access, as long as they have some certainty that the funds they pay are returned to the road industry via maintenance or investment.

3. **Consistency, transparency, and accountability are important concerns**
   Again, it was a fairly unanimous viewpoint that consistency in relation to access decision making and specific operating conditions applied across jurisdictions, transparency in terms of how decisions for access are made, and accountability in terms of the desire for a mechanism which allows jurisdictional decisions to be analysed and assessed for appropriateness are required.

4. **Time, driver safety, and operating costs are critical issues for the transport industry and drive decisions on many levels**
   Vehicle travel time, and the effects that this has on the overall productivity of a freight operation drive decisions on many levels within the industry, and measures relating to travel time and reliability of travel time for roads should be included within the service level framework (Toll, Linfox, and others).
Some respondents noted that certain road characteristics such as wide, paved shoulders (allowing vehicles to safely move off the road if stopped) are paramount, for reasons of road safety. Similarly, routes with frequent rest areas of consistently high quality are required (Johnstons Transport).

Factors that impact on vehicle operating costs and driver safety, such as the quality of the road surface, are also important considerations and should be included in the service levels.

5. **Road and asset factors considered important for the service levels**

When surveyed on road engineering characteristics, operators noted road roughness, presence of grades, number of lanes, any height/width restrictions, ride quality, lane width, roadside facilities, and overtaking lanes to be important considerations in route choice. Shoulder condition, number of roundabouts, road safety, and bridge limitations were also noted, but less often.

When asked about road asset characteristics, travel time, congestion, ease of passing through signalised intersections, ability to maintain desired speed, possibility of encounters with slow moving traffic, and reliability were noted as being important considerations in route choice. Ease of passing through unsignalised intersections, frequency and length of road works, and time-of-use restrictions were also noted, but less often.

These findings were noted to be in agreement with the broad predictions of operational and asset-based factors that were identified by the project team in early stages of the project.

6. **Interest in co-operative intelligent transport systems**

Operators noted that roads with co-operative intelligent transport systems would be particularly beneficial, comprising variable message signage (VMS) that gives information on parking availability in up-coming truck rest areas, information on road conditions such as traffic or congestion, or warning of nearby railway crossings (Johnstons, McGrath).

7. **Transporters in different freight sectors hold varying views on service level factors**

There was a difference in factors which were considered important by different sectors. As an example, livestock transporters, being primarily concerned with animal welfare, noted that ride quality and presence of overhanging trees were important. Carriers of different types of freight predominantly considered reliability in travel time to be the most important characteristic (LTAV).

8. **Freight owners may potentially influence the service level chosen for a freight task**

One respondent indicated that freight owners will drive the choices that are made within the service levels, not the freight transporters. The transporters might have a preference as to which level of service is chosen, but they may not be willing to pick and pay for a higher level of service than the customer is willing to pay for (Toll).

5.1.3 **Summary of Freight Transporter Considerations**

The findings from the literature and consultations with of the transport operators are summarised in Table 5.2.
### Table 5.2: Summary of findings from the literature review and considerations with transport operators

<table>
<thead>
<tr>
<th>Research area</th>
<th>General factors defining level of service</th>
<th>Road-type specific factors defining level of service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Freeways</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two-lane arterials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urban arterials</td>
</tr>
<tr>
<td>Literature</td>
<td>Travel safety</td>
<td>Percentage of time spent following</td>
</tr>
<tr>
<td></td>
<td>Travel time</td>
<td>Percentage of time spent being followed</td>
</tr>
<tr>
<td></td>
<td>Physical and psychological comfort</td>
<td>Travel lane width</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shoulder width</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ease of turning manoeuvres</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed variance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic density</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pavement quality</td>
</tr>
<tr>
<td>Consultations</td>
<td>Access conditions, ride smoothness,</td>
<td>Percentage of time spent following</td>
</tr>
<tr>
<td></td>
<td>traffic conditions (congestion, speed</td>
<td>Percentage of time spent being followed</td>
</tr>
<tr>
<td></td>
<td>and travel time), traveller information,</td>
<td>Travel lane width</td>
</tr>
<tr>
<td></td>
<td>provision of amenities, overall level of</td>
<td>Shoulder width</td>
</tr>
<tr>
<td></td>
<td>road safety</td>
<td></td>
</tr>
</tbody>
</table>

It is considered important to note that of the range of factors identified from the literature as being important to transport operators, the majority could be defined as ‘operational’ factors, meaning that they related primarily to operational aspects of the road asset, such as speed variance, time spent being followed/following, traffic density, and ease of turning manoeuvres. The remainder could be defined as ‘asset’ factors, meaning that they relate to specific qualities of the asset itself, such as pavement quality and shoulder width.

It is again important to note that while the industry placed several asset based factors as important, primarily road roughness and provision of rest areas, their primary concerns focussed more on operational based factors, such as access, traffic conditions (including travel time), and road safety.

### 5.2 Considerations of the Asset Owners

In order to understand the interests of the asset owner, jurisdictions were consulted and a literature review was undertaken, with the objective of uncovering material related to the following:

- high-level asset owner considerations of asset management
- the areas of interest for asset owners related to the service of the asset
- how performance levels are typically set and monitored (performance indicators)
- options available for future performance indicators.

Relevant material provided by the jurisdictions and the literature review is outlined in the following sections.

#### 5.2.1 Published Material

A literature review was conducted which aimed to understand the high-level asset owner considerations related to asset management, the areas of interest for asset owners related to the service of the asset they provide, how performance levels are typically set and monitored using performance indicators, and potential options for future performance indicators.

The literature review uncovered several useful documents relating to high-level asset management approaches (ATC 2006, and Austroads 2009c, 2009d, 2009e, and 2009f), encompassing service
levels and performance standards for infrastructure, and various network performance indicators both proposed and presently in use (Austroads 2004, 2007a, and 2011b). The key documents uncovered by the literature review are listed below:

- Austroads Guide to Asset Management (Austroads 2009c, 2009d, 2009e, 2009f)
- Network Performance Indicators (Austroads 2011a)
- National Performance Indicators for Network Operations (Austroads 2007a)

Relevant information from each document is summarised in the following sections.

**National Guidelines for Transport System Management in Australia**

These Guidelines provide a national standard for transport planning and development, focusing on road, rail and inter-modal transport. They provide a detailed framework for strategic-level transport planning and analytical approaches to project appraisal. Volume 2 of the Guidelines cover strategic transport planning and development and promote a ‘transport system management framework’, which includes the requirements to set transport system objectives, and performance indicators and targets for the objectives as the first step.

The scope of the document is high-level, and does not provide granular detail on the transport system objectives and performance indicators that should be set, further than the few examples outlined in the list below:

- minimum whole-of-life costs, and maximum whole-of-life asset performance
- efficient and effective transport to support industry competitiveness and export growth
- environmental management to support conservation
- transport system and critical infrastructure security.

The Guidelines advise that performance targets and indicators should be set in order to ‘operationalise’ each of the set objectives. It is noted that performance indicators should be expressed in quantitative terms, cover attributes that are important to transport users (e.g. travel time, safety), reflect a broader stakeholder perspective (e.g. noise or other pollution), not be biased towards a particular transport mode, and be based on analysis to ensure targets are realistic.

**Austroads Guides to Asset Management**

Part 1 of the Guide to Asset Management indicated that generally, the key aim of asset management is the reduction of whole-of-life cycle costs, meaning the costs that are incurred by the asset owner and the road user, with the ideal outcome for the community occurring when the sum of road agency costs and user costs are minimised. The Guide indicates that the scope of interest of the asset owner typically covers the following areas:

- network operations – transport planning and traffic modelling, and traffic engineering
- infrastructure provision, protection, and maintenance
- pavements, materials and bridge technology
- road design and road safety
- project evaluation and implementation.
Section 2.3 of part one of the Guide provides information for defining levels of service as objectives to be met in the context of asset strategies, in order to provide the basis for addressing planning needs, assessing risks, and gauging the quality of service delivery. The Guide recommends that levels of service be established covering all asset classes, including structures such as bridges or culverts, and environmental and social impacts.

It is advocated that traffic volumes should be taken into account when determining levels of service, as higher trafficked roads warrant a higher minimum level of service standard, and vice versa for lower trafficked roads, however the guide acknowledges that minimum levels of service are required to ensure basic levels of safety, accessibility, and mitigate the risk of asset loss.

The choice for asset owners is to set levels of service which achieve the asset owners’ aims and are economically efficient. In order to achieve this, it is recommended that a ‘stepped minimum standard’ approach is adopted, which raises the standard of the infrastructure alongside increasing traffic volume or demand, and the cost of meeting this demand (Frontier Economics, 2012). Figure 5.1 illustrates this, showing how the different minimum standards can be set based on demand for infrastructure usage, and how this approach can deliver equitable and economically efficient standards.

![Figure 5.1: The 'stepped minimum approach' to achieving equitable service levels](image)

Further information on asset performance, including performance monitoring and assessment against set objectives, is provided in *Part 5 of the Guide to Asset Management* (Austroads 2009d), Part 6 (Austroads 2009e) and Part 7 (Austroads 2009f), which cover pavements, bridges, and other road-related assets, respectively. The performance areas that each Part covers are listed in Table 5.3 below.
Table 5.3: Asset performance areas covered in the Austroads Guide to Asset Management

<table>
<thead>
<tr>
<th>Part 5: Pavement performance</th>
<th>Part 6: Bridge performance</th>
<th>Part 7: Road-related assets performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various aspects of pavement performance, including:</td>
<td>Various aspects of bridge performance, including:</td>
<td>Roadside vegetation</td>
</tr>
<tr>
<td>Roughness</td>
<td>Load capacity</td>
<td>Geotechnical areas</td>
</tr>
<tr>
<td>Rutting</td>
<td>Safety</td>
<td>Roadside facilities</td>
</tr>
<tr>
<td>Strength</td>
<td>Reliability</td>
<td>Transit interchanges</td>
</tr>
<tr>
<td>Cracking</td>
<td>Clearances</td>
<td>Drainage</td>
</tr>
<tr>
<td>Skid resistance</td>
<td>Bridge/element condition</td>
<td>Environmental treatments</td>
</tr>
<tr>
<td>Texture</td>
<td></td>
<td>Signage, delineation and signals</td>
</tr>
</tbody>
</table>

Pavement performance is generally characterised using measures related to its physical condition, via the following means, which are either directly measured or derived from measurements:

- measured parameters (e.g. roughness, rutting, cracking)
- index values (e.g. normalised physical (measured) parameters)
- composite index values (e.g. Pavement Condition Index).

Measured parameters typically describe physical properties that can be directly obtained. These parameters may be the results of automated and/or visual data collection. However these are not the only performance measures that can be used. Performance can also be measured using other parameters such as traffic density, compliance with design, or environmental and safety standards, with the choice of measure used ultimately depending on the function of the pavement relative to the expectations of the user.

Bridge performance can be measured and expressed in a number of ways. Typically, jurisdictions (e.g. VicRoads, RMS NSW) report on bridge condition either by a condition descriptor (e.g. ‘poor’ or ‘fair’), or via the assignment of a numerical value based on the mathematical combination of a number representing the state or condition of a particular bridge element. These methods provide an indication of the relative condition of each bridge, and are generally used as management tool for the purpose of comparing the relative maintenance or repair needs of individual bridges. It is noted that some of the numerical indices assigned to aspects of bridge condition are controversial, as an absolute method of measurement is difficult to achieve.

Road-related assets performance and measures of service levels are extensively detailed in Appendix A of Austroads (2009f). Consultations with transport operators, described in that report, outlined that provision of roadside facilities (rest areas), signage, delineation and signals, and electronic communication were of particular importance, and the performance objectives and service levels related to these are summarised in Table 5.4.
Table 5.4: Performance objectives and service levels for road-related assets considered important by transport operators

<table>
<thead>
<tr>
<th>Road-related asset</th>
<th>Performance objective or outcome sought</th>
<th>Measure of service level or asset performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadside rest areas – toilets, furniture, shelters,</td>
<td>To support road safety and amenity for road users by provision of facilities for rest and recovery, Visual amenity,</td>
<td>Community acceptability – number of complaints, Level of use, Continuity of services</td>
</tr>
<tr>
<td>parking areas</td>
<td>Vegetation conservation and biodiversity</td>
<td></td>
</tr>
<tr>
<td>Roadside signs – regulatory, warning, information,</td>
<td>To inform, guide, and regulate traffic, To support road safety, legal compliance and user amenity by adequate driver</td>
<td>Visibility (day and night), Retroreflectivity and legibility, Customer acceptability – number of complaints,</td>
</tr>
<tr>
<td>parking</td>
<td>information</td>
<td>Extent of compliance, particularly with regulatory signs and warning signs</td>
</tr>
<tr>
<td>Electronic communications – electronic signs</td>
<td>Road user safety and transport efficiency through integrated and coordinated network traffic management, Real-time driver</td>
<td>Continuity of services (downtime), Reliability of service, Accuracy of information</td>
</tr>
<tr>
<td></td>
<td>information and incident management response, Road user safety</td>
<td></td>
</tr>
</tbody>
</table>

Network Performance Indicators (Austroads 2011a)

In 1993, Austroads established a program to develop a set of national performance indicators for roads, representing the economic, social, safety and environmental performance of the road system. The current edition, published in 2011, is the 17th National Performance Indicators publication, and covers the indicators outlined in Table 5.5.

Table 5.5: Austroads Network Performance Indicators for safety and asset management

<table>
<thead>
<tr>
<th>Area</th>
<th>Performance indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road safety</td>
<td>Serious casualty crashes (population basis)</td>
</tr>
<tr>
<td></td>
<td>Serious casualty crashes (veh-km travelled basis)</td>
</tr>
<tr>
<td></td>
<td>Road fatalities (population basis)</td>
</tr>
<tr>
<td></td>
<td>Road fatalities (veh-km travelled basis)</td>
</tr>
<tr>
<td></td>
<td>Persons hospitalised (population basis)</td>
</tr>
<tr>
<td></td>
<td>Persons hospitalised (veh-km travelled basis)</td>
</tr>
<tr>
<td></td>
<td>Social cost of serious casualty accidents (population basis)</td>
</tr>
<tr>
<td></td>
<td>Social cost of serious casualty accidents (veh-km travelled basis)</td>
</tr>
<tr>
<td>Asset management</td>
<td>Smooth travel exposure for urban, rural and all roads, calculated using a limit of 4.2 IRI</td>
</tr>
<tr>
<td></td>
<td>Smooth travel exposure for urban, rural and all roads, calculated using a limit of 4.2 IRI, for roads within the Nation</td>
</tr>
<tr>
<td></td>
<td>Building National Network</td>
</tr>
<tr>
<td>Program/Project assessment</td>
<td>Smooth travel exposure for urban, rural and all roads, calculated using a limit of 5.33 IRI</td>
</tr>
<tr>
<td></td>
<td>Smooth travel exposure for urban, rural and all roads, calculated using a limit of 5.33 IRI, for roads within the Nation</td>
</tr>
<tr>
<td></td>
<td>Building National Network</td>
</tr>
<tr>
<td></td>
<td>Return on construction expenditure, on a state and territory basis</td>
</tr>
</tbody>
</table>
While extensive detailed methodology for the calculation of each performance indicator is given in Austroads (2011a), a short outline of the key points of each is provided here.

The road safety performance indicators are relatively straightforward, and are calculated using a combination of data sources, including crash statistics, census and population data, and vehicle usage data. The asset management indicator, ‘smooth travel exposure’, uses the widely accepted International Roughness Index (IRI) for road roughness, combined with data for vehicle usage to calculate the relative exposure of road users to roads with a roughness values having an upper limit of either 4.2 or 5.33.

The International Roughness Index (IRI) is an internationally accepted and tested standard measure of road roughness, and is widely used by asset owners on a national level. It includes relevant aspects such as roughness, cracking, and surface texture, and is endorsed by Austroads as the reporting unit for road roughness in Australasia (Austroads 2007b). It is understood that the required data to calculate IRI is regularly collected by jurisdictions for the vast majority of Australia’s major road network (Austroads 2007b, Austroads 2011b).

Local IRI values range from about 0.5 to 5.5 (Austroads 2007b). Some typical IRI values for Australian roads are shown in Table 5.6, which could be used as the basis for setting the service level values.

<table>
<thead>
<tr>
<th>Road function</th>
<th>Typical maximum desirable roughness (IRI m/km) for new construction or rehabilitation (length 500 m)</th>
<th>Indicative investigation levels for roughness, IRI\textsubscript{max} (IRI m/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeways and other high-class facilities</td>
<td>1.6</td>
<td>4.2</td>
</tr>
<tr>
<td>Highways and main roads (100 km/h)</td>
<td>1.9</td>
<td>5.3</td>
</tr>
<tr>
<td>Highways and main roads (&lt; 80 km/h)</td>
<td>1.9</td>
<td>6.1</td>
</tr>
<tr>
<td>Other local sealed roads</td>
<td>No limits defined**</td>
<td>No limits defined**</td>
</tr>
</tbody>
</table>

* Lower values may be appropriate where local traffic or heavy vehicle volumes are high.
** Roughness levels depend on local conditions and traffic calming measures.

Source: Austroads (2007b).
The program/project assessment indicator is a comparison of the benefit cost ratio (BCR) of various projects within a jurisdiction. The BCR used is the initial value that was attributed to the project when the decision to fund it was made. By comparing the BCR values of a range of projects within a jurisdiction, a qualitative assessment of return on expenditure can be made.

The travel speed indicator uses data from travel time surveys to calculate average actual travel speed for a representative sample of arterial roads and freeways, in order to monitor the impact of the arterial road system on the level of service to road users. Similar data is used in the congestion indicator, which provides the difference between the actual travel time experienced by the user, and the nominal travel time. Travel time variability is calculated using the standard deviation and mean of travel times on a particular route, to calculate variability as a percentage.

The lane occupancy rate is based on the number of persons per traffic lane per hour, and the car occupancy rate is based on the number of persons per vehicle. The congestion indicators for efficiency and productivity are complex, but essentially rely on a comparison of the posted speed and the actual travel speed for a particular route, and the overall traffic volume and number of lanes.

**National Performance Indicators (Austroads 2007a)**

This report highlights that the Austroads national performance indicators predominantly use survey cars as the measurement method, and recently some jurisdictions noted that the limited amount of data which could be collected via this method could potentially mean that survey and performance indicator results might not accurately represent on-road traffic conditions (Austroads 2007a). To address this, some jurisdictions have begun to use real-time traffic performance measurement, relying on data collected from freeway management systems and traffic control signals.

Recognising this shift, Austroads (2007a) investigated the re-development of traffic performance indicators in order to utilise real-time data from automated traffic data collection systems. The performance indicators developed are as follows:

- **Traveller efficiency (travel speed)** – this indicator monitors congestion in terms of speeds. It is derived from spot speeds on freeways measured directly using point sensors such as a pair of loops. On arterial roads, it can be derived from the inverse of travel times estimated from an ATC system.

- **Traveller efficiency (variation from posted speeds)** – this indicator monitors the proportions of a road network at various levels of deviation from posted speed limits on freeway or arterial road links.

- **Traveller efficiency (arterial intersection performance)** – this indicator monitors the proportion of an arterial road network at various levels of congestion.

- **Reliability (travel speed)** – this indicator measures the variability of speeds by calculating the coefficient of variation. It is displayed as the proportions of a road network at different levels of variability in a measurement time period.

- **Productivity (speed and flow)** – this indicator is based on the product of speed and flow. A high productivity is achieved if both speed and flow are maintained near maximum values, i.e. near free-flow speed and capacity flow. It is displayed as the proportions of a network at various levels of productivity in a measurement period.

Each of these performance indicators use data measured on-line via the use of freeway monitoring systems, such as detector loops and arterial monitoring systems including SCATS detector loops. Progress made within the jurisdictions on the use of these indicators was summarised in Austroads
Defining Service Levels for a User-focused Access Market: Final Report

(2009a), which noted successful outcomes following the slight modifications in the way some data was collected, and the results reported.

**Network Performance Indicators – Next Generation (Austroads 2011b)**

This report defines a consolidated set of asset management Network Performance Indicators (NPIs), building on earlier research which recommended that the smooth travel exposure (STE) indicators be retained as the primary Austroads NPIs relating to road maintenance (Austroads 2004). The report discussed five new asset-related NPIs:

- **Pavement condition index** – this indicator uses both individual and combined performance indicators relating to various aspects of pavement characteristics, including functional characteristics (roughness, cracking and texture), and structural characteristics (rutting and deflection).

- **Drainage condition index** – while an NPI for drainage was considered sound, practical constraints regarding the level of resources required to undertake the assessments prevented it from being proposed.

- **Environmental index** – an environmental performance indicator was developed to cover air quality, fuel consumption, and noise emissions, however it was not considered suitable for use beyond the network level on a national scale. It was also noted that environmental indices being developed by RMS in NSW, and the Global Reporting Initiative (GRI) could have further merit.

- **Safety index** – a network level safety index based on the NetRisk methodology was proposed, but noted to be resource intensive, and lacking an effective means for taking crash history of a road segment into account. Methodology similar to the pavement condition index, comprising individual and combined performance indicators relating to safety factors such as skid resistance, road width, and roadside hazards was noted as potentially having merit, but would require further research.

- **Efficiency index** – an efficiency index based on the former Road Maintenance Efficiency (RME) indicator was proposed, which could consider the quality of service delivered to road users and associated changes in externalities. This indicator could demonstrate the overall efficiency of asset owner activities in terms of activities per unit measure of road use at the network level.

The report finds that while the indicators have merit, further work is required in order for asset owners to reach agreement regarding the acceptable limits for each characteristic for the various road types comprising the network before the indexes can be finalised. Additional further work is also required to develop and refine the environmental and efficiency indices that meet the broad reporting needs of the asset owners.

### 5.2.2 Feedback from Jurisdictions

During the consultation process, the members of the working group representing the state-level jurisdictions were asked to provide input to understand their considerations in relation to how performance levels are typically set and monitored. Examples of the material used in the consultation period are shown in Appendix C.

Timing requirements on the delivery of this report meant that jurisdictions could only be allowed a time-frame of two weeks in order to provide their submissions. As a result of these constraints, only three responses were received from jurisdictions. A summary of the responses from jurisdictions relating to network performance indicators and road quality measures is discussed here.
The Department of Transport and Main Roads Queensland (TMR) use three measures at the corporate level, smooth travel exposure, road system seal age, and road system condition. For internal reporting purposes, which form part of the annual ‘State of the Asset’ report. The following performance indicators are used:

- road structural condition (currently represented by pavement age, however new test methods will allow more technical reporting of structural condition)
- pavement risk
- ride quality (derived from road roughness and traffic condition)
- pavement rutting and cracking
- road surfacing condition (seal age)
- seal width
- bridge condition and bridge risk
- major culvert condition and risk.

Road pavement condition indicators are determined from annual network-level pavement test results, and are recorded in ARMIS, the asset management database, and reported annually.

Main Roads Western Australia (MRWA) uses various performance indicators to assess and report on the performance of the state-owned road network (i.e. excluding local roads). Primarily, MRWA delivers an annual report which covers many asset-based performance indicators, as outlined in Table 5.7, and the data which is used to calculate them, and their calculation frequency.

<table>
<thead>
<tr>
<th>Indicators from the Main Roads Annual Report</th>
<th>Data requirements / frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Spot location indicator</td>
<td>Crash data is collected throughout the year. Data is audited and released one year behind.</td>
</tr>
<tr>
<td>% road network permitted for use by heavy vehicles</td>
<td>B-double ≤ 27.5 m</td>
</tr>
<tr>
<td></td>
<td>Double road train ≤ 27.5 m</td>
</tr>
<tr>
<td></td>
<td>Double road Train 27.5 m – 36.5 m</td>
</tr>
<tr>
<td></td>
<td>Triple Road Train 36.5 m – 53.5 m</td>
</tr>
<tr>
<td>% travel on roads meeting investigatory criteria</td>
<td>Roads</td>
</tr>
<tr>
<td></td>
<td>Bridge strength</td>
</tr>
<tr>
<td></td>
<td>Bridge width</td>
</tr>
<tr>
<td>% Smooth travel exposure</td>
<td>This indicator uses IRI. Data is collected every 2 years and is available from IRIS*.</td>
</tr>
<tr>
<td>% Preventative maintenance indicator</td>
<td>Deviation of seal age from target seal age. Data is available from IRIS* as required but calculated annually.</td>
</tr>
</tbody>
</table>

*IRIS refers to the ‘Integrated Road Information System’ asset management database operated by MRWA

Various Austroads NPIs are used, relying on either road roughness data, or travel time survey data collected by the floating car method, as outlined in Table 5.8.
Table 5.8: Austroads National Performance Indicators used by MRWA

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Data Requirements / Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth travel exposure for state roads and National Land Transport routes by urban, rural and total</td>
<td>These indicators use IRI. Data is collected every 2 years and is available from IRIS.</td>
</tr>
<tr>
<td>Actual travel speed (urban)</td>
<td>These indicators use travel time data collected using the floating car method. Two surveys are carried out each financial year on the 8 sampled routes. These indicators are reported annually.</td>
</tr>
<tr>
<td>Nominal travel speed (urban)</td>
<td></td>
</tr>
<tr>
<td>Congestion (urban)</td>
<td></td>
</tr>
<tr>
<td>Variability of travel time (urban)</td>
<td></td>
</tr>
</tbody>
</table>

The ride quality of the National Land Transport Network is also calculated based on roughness as a function of traffic volume and speed, as part of the Nation Building Program, at a frequency of once every two years. Additionally, various engineering measures of road quality are used and reported on in the ‘link investigatory profiles’, and include seal width, carriageway width, curve rating, bridge width, bridge strength, rutting, pavement strength, seal age, overtaking opportunities, rest areas, safety, and grade separation. These profiles are produced annually from IRIS data, and are used for planning and investment purposes.

Roads and Maritime Services in NSW (RMS) has set a range of pavement performance measures, and pavement key performance indicators. An outline of each of the pavement performance measures, and their purpose and scope is provided in Table 5.9.

Table 5.9: Pavement performance measures and key performance indicators used by RMS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Purpose</th>
<th>Key performance indicator</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of road re-building</td>
<td>To monitor the extent that the pavement structure is rebuilt each year, and compare with long-term targets</td>
<td>The proportion (%) of the State Road Network rebuilt in each financial year</td>
<td>State roads, and projects that re-build or replace existing pavements from the asset maintenance program, and the growth and improvement program</td>
</tr>
<tr>
<td>Intensity of road re-surfacing</td>
<td>To monitor the extent that the road surface is renewed each year, and compare with long-term targets</td>
<td>The proportion (%) of the State Road Network surface (sprayed seal and asphalt) renewed under the maintenance program in each financial year</td>
<td>Bituminous surfaced state roads, and road resurfacing activities including sprayed sealing and asphalt inlay or overlay</td>
</tr>
<tr>
<td>Distribution of road construction period</td>
<td>To analyse long-term trends in the rate of creation of new and rebuilt road pavements</td>
<td>The proportion (%) of the State Road Network built or rebuilt in each decade</td>
<td>State roads only</td>
</tr>
<tr>
<td>Preventative pavement maintenance indicator</td>
<td>To provide an indication of the extent of preventative (proactive) maintenance</td>
<td>Complex – detailed in jurisdiction policy documents</td>
<td>National Highway Network only</td>
</tr>
<tr>
<td>Pavement Health Index (PHI)</td>
<td>To monitor the overall condition of the pavement</td>
<td>Complex – detailed in jurisdiction policy documents</td>
<td>Bituminous surfaced state roads only</td>
</tr>
<tr>
<td>Smooth Travel Exposure (STE)</td>
<td>To monitor whether roads are providing acceptable travel conditions</td>
<td>Proportion of travel undertaken each year on urban roads with a roughness level condition of less than 4.2 IRI</td>
<td>State roads only</td>
</tr>
<tr>
<td>Ride Quality Index (RQI)</td>
<td>To report road user comfort, by</td>
<td>Complex – detailed in jurisdiction</td>
<td>National Highway Network only</td>
</tr>
</tbody>
</table>
Road surface roughness | Monitor the evenness or irregularity of the pavement surface | Complex – detailed in jurisdiction policy documents | Sealed state roads only
--- | --- | --- | ---
Rural road width | To identify the extent of rural state roads with sealed shoulders | Road width for single carriageway roads excluding urban roads | Sealed state roads and ‘Class A’ carriageways
Road surface cracking | To indicate the ability of the wearing surface to protect the pavement structure during wet weather | Complex – detailed in jurisdiction policy documents | Flexible pavements on State roads only
Road surface rutting | To monitor the pavement maintenance program and its effects on reducing the extent of permanent deformation | Complex – detailed in jurisdiction policy documents | Flexible pavements on state roads only
Road surface texture (macrotecture) | To indicate texture depth of the pavement surface wearing course | Under development | Sealed state roads only
Skid resistance (microtexture) | To monitor skid resistance of road pavements and ensure optimisation of resources | Under development | Sealed state roads only
Pavement structural remaining life | To monitor the structural capacity of road pavements | Complex – detailed in jurisdiction policy documents | Flexible state roads only

While the methodology of calculation for the majority of performance indicators is too complex to outline here, it is useful to note that ‘reporting bands’ are provided for each indicator, which assign a colour score depending on the severity range of the indicator. Examples for smooth travel exposure, rural road width and road surface rutting are provided in Table 5.10.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Red</th>
<th>Amber</th>
<th>Green</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Travel Exposure</td>
<td>IRIqc ≥ 5.33</td>
<td>5.33 &gt; IRIqc ≥ 4.2</td>
<td>4.2 &gt; IRIqc ≥ 3.05</td>
<td>IRIqc &lt; 3.05</td>
</tr>
<tr>
<td>Rural road width</td>
<td>width &lt; 7 m</td>
<td>7 m ≥ width &lt; 7.8 m</td>
<td>7.8 m ≥ width &lt; 9 m</td>
<td>width ≥ 9 m</td>
</tr>
<tr>
<td>Road surface rutting</td>
<td>ruts &gt; 15 mm</td>
<td>15 mm ≤ ruts &gt; 9.4 mm</td>
<td>9.4 mm ≤ ruts &gt; 5 mm</td>
<td>ruts ≤ 5 mm</td>
</tr>
</tbody>
</table>

5.2.3 Summary of Asset Owner Considerations

High-level transport planning and management guidelines exist which outline the need for transport system objectives, and performance indicators and targets (ATC 2006, Austroads 2009c, 2009d, 2009e, 2009f). Specifically, the Austroads Guide to Asset Management outlines the importance of service levels and consideration of a risk management approach based on traffic volumes in the setting of minimum service standards, and also provides guidance on various aspects of pavement, bridge, and road-related assets performance which can be assessed using performance objectives, and graded against a minimum standard.

The Austroads Network Performance Indicators (Austroads 2011a) outline a range of performance indicators aimed at assessing the economic, social, safety and environmental performance of the road system, and provide a detailed methodology for each. Recent research work (Austroads...
2007a, 2011b), has provided an updated set of network performance indicators, however further research is required in some areas in order to fully develop the proposed measures for use.

Based on the material received from jurisdictions, it is clear that various combinations of asset and network based factors derived from the Austroads indicators (Austroads 2011a) are being used in annual reports and subsequent analysis. In relation to assets, jurisdictions are measuring and quantifying aspects including pavement condition (rutting, cracking, roughness), and asset standard (seal width, shoulder width). In relation to networks, performance indicators include travel speed, congestion, exposure to roughness, safety, and access levels provided.

It is important to note, however, that while the performance indicators chosen by jurisdictions may appear similar, the scope and nature of reporting programs appear to vary. It is broadly evident, however, that jurisdictions tend to place an increased focus on asset-based performance measures, and these feature more prominently in their reporting programs than operational-based measures.

This is illustrated in Table 5.11 which provides an overview of the asset and operational based performance measures found in the literature, and compares this with the ones used by the jurisdictions. It is evident that while the literature shows a range of asset and operational based performance measures, those in use by jurisdictions tend to be more closely aligned with the asset-based performance measures.

<table>
<thead>
<tr>
<th>Area</th>
<th>Literature</th>
<th>In use by jurisdictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset-based</td>
<td>▪ Pavement performance measures (rutting, strength, cracking, skid resistance, texture)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Smooth travel exposure</td>
<td>▪ Pavement performance measures (roughness, cracking, rutting, texture, structural life)</td>
</tr>
<tr>
<td></td>
<td>▪ Pavement condition index</td>
<td>▪ Pavement health index</td>
</tr>
<tr>
<td></td>
<td>▪ Drainage condition index</td>
<td>▪ Smooth Travel Exposure</td>
</tr>
<tr>
<td></td>
<td>▪ Bridge performance measures (load capacity, safety, reliability, clearance, condition)</td>
<td>▪ Ride Quality Index</td>
</tr>
<tr>
<td></td>
<td>▪ Road-related assets performance measures (many areas – refer to Table 5.2)</td>
<td>▪ Bridge strength and width</td>
</tr>
<tr>
<td></td>
<td>▪ Expenditure (return on investment)</td>
<td>▪ Maintenance – Preventative maintenance indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Reconstruction (intensity of road re-building, re-surfacing, distribution of road construction period)</td>
</tr>
<tr>
<td>Operational-based</td>
<td>▪ Safety measures (serious casualty and road fatality crashes, hospitalisations, social costs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Safety index</td>
<td>▪ Safety (black spot location indicator)</td>
</tr>
<tr>
<td></td>
<td>▪ Efficiency index</td>
<td>▪ Access (% of road network for heavy vehicles)</td>
</tr>
<tr>
<td></td>
<td>▪ Environmental index</td>
<td>▪ Travel speed and congestion (actual and nominal travel speed)</td>
</tr>
<tr>
<td></td>
<td>▪ Travel speed and congestion measures (actual travel speed, variability and reliability of travel speed)</td>
<td>▪ Traveller efficiency measures (lane occupancy rates, car occupancy rates, variability and reliability)</td>
</tr>
</tbody>
</table>

It should be noted however that this finding may be skewed by the limited number of responses that were received from jurisdictions throughout the consultation period, and as a result may not be representative of the range of performance indicators used by jurisdictions on a national scale.
5.3 **Comparison of Industry and Jurisdiction Considerations**

The separate summaries of the considerations of industry and the jurisdictions shows that there are broad differences which exist between the two. As highlighted in Table 5.2, transport operators tend to focus on operational-based factors, such as access, traffic conditions (including travel time, speed variance, traffic density, and ease of turning manoeuvres), comfort, and road safety, with asset-based factors, such as road roughness, provision of information, and lane width featuring slightly less prominently.

This is in contrast with the considerations of asset owners, who tend to place an increased focus on asset-based performance measures, and these feature more prominently in their reporting programs than operational-based measures, even though there is a roughly even split between asset and operational based factors in the literature.

The challenge for the service level framework is to select service attributes that strike a balance between asset and operational-based factors. In the project inception phase, it was recognised that a key element to the success of the service level framework in facilitating the change to a user-focused access market, is the degree to which the service levels are aligned with the requirements and needs of the user. However, the framework also needs to align with the existing systems of performance monitoring and assessment in use throughout the jurisdictions. This is discussed in further detail in Section 6.

5.4 **Current and Future Work Programs of Relevance**

There are several work programs either in progress or planned which may provide new material relevant to levels of service. A short summary of these documents is provided below.

5.4.1 **AT1732 – LOS Requirements for Freight on Rural Roads**

This project, currently being undertaken by ARRB within the Austroads 2012/13 project cycle, seeks to determine the level of service needs for freight on rural arterials, including last-mile issues relevant to local roads, in order to provide a relevant level of service guideline for asset managers, a better understanding of freight customer requirements, and better management of funds. The research method is based around the use of a survey of transport operators.

5.4.2 **National Guidelines for Transport System Management (Update)**

Since the publication of the current guidelines (ATC 2006) there has been a range of additional tools developed that have implications for transport planning and project evaluation. The update of the guidelines is intended to capture these developments, and align the various sources of information into a comprehensive publication. The first stage of the update will commence in 2013-14.

5.4.3 **AT1920 – Developing the information to support the Heavy Vehicle Cost and Investment (HVCI) reform**

This multi-year project, currently being undertaken by ARRB within the Austroads 2013/14 project cycle, is a new project for the Assets task force which broadly seeks to support the HVCI reform by developing a common categorization of roads, generating an infrastructure inventory, developing parameters defining LOS, and identifying the processes that need further development.
6 DEFINING THE SERVICE LEVELS

This section uses the findings from the previous section, to provide an example service level framework in-line with the concept as originally outlined in Table 3.2, reproduced for convenience here as Table 6.1.

### Table 6.1: Concept for the service level framework

<table>
<thead>
<tr>
<th>Classification</th>
<th>Service level 1</th>
<th>Service level 2</th>
<th>Service level 3</th>
<th>Service level 4</th>
<th>Service level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification 2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Classification 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This section defines the attributes and performance indicators, and provides an example of the rating system which could be implemented to assign service levels to infrastructure.

6.1 Selecting the Service Level Attributes

The comparison of the asset and operational based performance identified in the literature, and those used by jurisdictions, as outlined in Table 5.11 has found a wide range of potential areas which could be used to define service levels. These include measures of pavement and bridge performance, safety, travel time and efficiency, access, expenditure and construction and repair.

While the task of designing the final service level framework for regulatory and policy purposes fitting the requirements of the HVCI reform objectives is beyond the scope of this project, and would require stakeholder consultation at a much deeper level than the constraints of this project allow, a set of attributes and performance indicators can be chosen by which to illustrate the function of the service level framework, and serve as a useful starting point to allow further development of the concept as the reform options are investigated.

To this end, the following list of service level attributes was selected by the project team, as it closely mirrors the feedback received from industry, and incorporates aspects of the existing performance measures currently used by jurisdictions.

- access provisions
- ride smoothness
- traffic conditions
- traveller information
- provision of amenities (rest areas)
- road safety.
It was recognised that within each of these service level attributes, the various interests of the three key stakeholder groups, being the asset owner, the transport operator, and the goods and freight owner could be identified, as outlined in Table 6.2.

Table 6.2: Outline of relationships between service component and stakeholder interest

<table>
<thead>
<tr>
<th>Service level attributes</th>
<th>Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Road owner</td>
</tr>
<tr>
<td></td>
<td>Transport operator</td>
</tr>
<tr>
<td></td>
<td>Goods and freight owners</td>
</tr>
<tr>
<td>Access provisions</td>
<td>Trade-off between accessible road network, prevent damage to roads and road safety</td>
</tr>
<tr>
<td></td>
<td>Damage to goods penalty/detour to avoid damage</td>
</tr>
<tr>
<td></td>
<td>VOC (wear, fuel, etc.)</td>
</tr>
<tr>
<td></td>
<td>Travel speed and driver fatigue</td>
</tr>
<tr>
<td>Ride smoothness</td>
<td>Cost-efficient road maintenance, environment (pollution, noise), speed, comfort</td>
</tr>
<tr>
<td>Traffic conditions</td>
<td>Congestion (structural)</td>
</tr>
<tr>
<td>Traveller information</td>
<td>Informed road users</td>
</tr>
<tr>
<td>Amenities</td>
<td>Safe roads</td>
</tr>
<tr>
<td>Safety</td>
<td>Road safety, traffic efficiency</td>
</tr>
</tbody>
</table>

An outline of why each of these attributes is important in relation to stakeholder requirements is provided in the following sections.

6.1.1 Access Provisions

Based on industry feedback, provision of access is perhaps one of the most crucial factors for transport operators, as it controls their operations at the highest level. Transport operators strongly desire to use the most productive vehicle, as it reduces their costs and offers the best service to their customers, however such vehicles are often subject to stringent access restrictions, due to their increased size and length. Operators are also hampered by time-of-day restrictions, and route restrictions imposed by 'weak links' in the transport network, such as bridges and rail crossings.

Industry feedback also indicated that to a certain extent, freight owners had little understanding of the impact that access restrictions have on freight operations, which can make it difficult for transporters to pass on the costs of transport operations which are strictly access controlled. For these reasons, provision of access is regarded as an important factor in defining the service levels.
However, unlike other factors such as road roughness, which can be defined using a scale, access for a particular vehicle is either granted or prohibited, and this decision is made by the asset owner. This creates difficulties in assigning service levels, as the service level methodology is better suited to factors which can be measured on a scale.

### 6.1.2 Ride Smoothness

Feedback from industry strongly indicated that ride smoothness is a particular concern, for several reasons. Primarily, a rough road is noted to increase vehicle operating costs (VOC), by increasing fuel consumption, wear of components such as tyres, suspension, and brakes, and requiring increased vehicle maintenance and servicing. This is supported by the literature which indicates, based on statistical evidence, that VOC is directly related to road roughness.

Tan et al. (2012) consolidated local and international research on the International Roughness Index (IRI) of a particular road and VOC, and it was found that roughness affected VOC components, namely, fuel consumption, repairs and maintenance costs, tyre wear and lubricating oil costs. The review also found that the Australian findings differ from overseas experience in terms of the magnitude of change of roughness on the VOC components.

Anecdotal evidence indicates that high road roughness can lead to increased damage of goods, which can lead operators to reduce travel speed, and hence incur a greater trip cost because of the longer time taken. Perhaps most critically of all, however, is the link between ride smoothness and driver fatigue.

High levels of road roughness may also result in increased vehicle noise emissions, and increased vibrations experienced by residents living nearby major roads; however, such issues are not generally the concern of the freight operator, and as a result are not discussed here.

### 6.1.3 Traffic Conditions

In relation to traffic conditions, the interest for the transport operator is the ability to maintain the desired speed, which in most cases closely aligns with the maximum posted speed limit. The consultation sessions provided a very strong indication that travel time is a critical concern, and delays in travel time have the potential to cause problems in many areas of freight transport.

As an example, operators transporting fast-moving consumer goods are generally required to deliver between 6:00am and 10:00am, in order to enable vendors to process the goods and present them for sale. Some operators indicated that they are required to deliver goods within much shorter time-frames, due to strict scheduling or site access conditions. Operators undertaking long-haul or interstate operations may be faced with a potential breach in driving hours as a result of travel time delays.

Delays due to unforeseen events such as inclement weather (e.g. floods) or traffic crashes undoubtedly have a strong impact on traffic conditions, and can result in high, localised congestion and cause considerable time delays. However, the extreme unreliability of such events, and the difficulty in accounting for this in the performance indicators, mean that they are not considered here.

### 6.1.4 Traveller Information

In relation to traveller information, transport operators desire to be provided with information on travel time, potential delays due to roadworks, crashes or other events, detour options, and the provision of parking facilities at the rest areas they are approaching.
Generally, feedback from transport operators indicated that the provision of this information via roadside variable message signage (roadside signs that change their message based on real-time, updated information) would be the most appropriate, although in-vehicle information, such as that provided via ‘break-in’ radio announcements was also noted as a possible option.

6.1.5 Amenities (Rest Areas)

Feedback from industry strongly indicates a reliance on quality roadside amenities and facilities, such as roadside truck stops, incorporating rest areas and service stations. It is important for operators to have frequent access to rest areas of consistently high quality, with sufficient space to accommodate their vehicle and its trailers.

The underlying reasons for these requirements are two-fold; efficient trip planning and scheduling, in order to ensure that operators can plan a trip to meet their compliance obligations, and as a contingency in the case of vehicle breakdowns or delays due to traffic or inclement weather.

These considerations are also supported by the literature. Austroads (2009b) highlighted that the opportunity for a heavy vehicle driver to park in an off-road location and rest, as well as attend to any mechanical or load-related issue is an important factor for overall road safety, and provided a summary of previous research supporting the benefits to road safety that rest areas provide.

6.1.6 Safety

Transport operators constantly seek to mitigate the risk of heavy vehicle operation, in order to provide a high level of safety for the driver, other road users, and the wider community. Feedback from the industry has indicated that certain road features, such as wide sealed shoulders, appropriate lane width, high levels of sight distance, high road pavement quality, and overtaking/passing opportunities all contribute to road safety.

6.2 Selecting the Performance Indicators

The next stage in defining the service levels is to select appropriate performance indicators for each of the service level attributes. Generally, the preference of the project team for selecting each performance indicator was to focus on an indicator which represents the most important aspects of the service attribute, is able to be measured via a thoroughly validated industry standard, is supported by scientific studies, and can be assessed using data that is either already held within jurisdictions, or is expected to be easily obtained.

The feasibility of any indicator will in some cases depend on the nature of the classification used, which is expected to be further defined following feedback from the project working group. As a result, the indicators shown here should be considered as preliminary, and may be further refined on the basis of feedback from the jurisdictions regarding the availability of data required for the calculation.

Austroads (2009c) notes that there could be considerable variation within the ability of road authorities to monitor, analyse, and predict the service life of road-related assets, including a lack of inventory, asset condition, and maintenance history data, or if the cost of collecting and maintaining asset data is greater than the potential savings in preventative maintenance, or if there is a lack of suitably-trained field officers available to undertake the task of data collection. Each of these aspects could limit the feasibility of any proposed performance indicator.

An outline of the performance indicators and possible data requirements for each attribute is provided in the following sections.
6.2.1 Access Provisions

One method of measuring access is based on the percentage of total kilometres of the road network that is open to a particular vehicle class, as demonstrated in Table 5.7. This is the performance indicator for access used by MRWA to capture the percentage of the road network which is open to B-doubles, two separate classes of double road trains (based on overall length), and triple road trains.

Under this definition, a network with low or limited access for a particular vehicle type would correspond to a low service level, and vice versa. On a smaller scale, an individual route or link segment permitting access for a vehicle type would correspond to a high service level. This concept allows asset owners to define a service level score based on access to an entire network, a geographical region, or an individual road/link segment. Figure 6.1 shows how the differing levels of service across the state-based network, local government network, and individual route/link might be assessed.

The motive for proposing this indicator is that it accurately conveys the general principle of the industry that more access provisions allow for better and more efficient use of the most productive vehicle. While it appears sound, it does have some limitations, particularly regarding the practicality of the access arrangements provided.
As an example, consider a network, 90% of which is open to B-doubles. Under the proposed performance indicator, the network would receive a high score for accessibility which would contribute to its overall service level. In practice however, it may be found that access is not allowed for a specific, crucial link, thereby requiring some operators to make a large detour in order to reach their destination.

An indicator that accounts for this would be more complex, and require substantially more data. The indicator would have to be defined as a function of the distance between the origin and the destination of the freight. An example would be a comparison of the distance between the freight origin and destination along the shortest route, and the actual distance over the route that would be travelled. Such an indicator would reflect any detours imposed for restricted access vehicles compared to general access vehicles. However, it would most likely require data about freight flows (how much freight is transported from which origin to which destination), as well as which vehicle types have access to which routes between these origins and destinations (as opposed to which road sections certain vehicle types have access to). This information may not be easily available, so therefore a simpler indicator has been proposed.

An additional limitation is that the performance indicator does not account for time-of-day access restrictions, while the literature and industry consultations suggest that this is an important issue. Austroads (2008) suggests night-time truck operations in urban areas can increase productivity. On this basis, the performance indicator should be modified to include consideration of any time-of-day restrictions imposed.

Additionally, the performance indicator does not account for temporary access restrictions, such as those which may be imposed by weather conditions. However, due to the extreme unreliability of such events, a performance indicator could not be effectively designed to take such considerations into account.

The suitability of using access provision as a service attributed has been questioned, as it is considered that access is either provided, or it is not, and if it is not, there is no service level offering. While this is correct, the imposition of operating conditions such as time-of-day restrictions, load limits, or speed limits could be used to quantify the quality of the access offered. It is anticipated that the industry would prefer to have fewer and less onerous operating conditions, so access with fewer conditions would represent a higher service level.

Assessment of access using the proposed performance indicator will require asset owners to quantify access levels for a given network, region, or specific link. It is anticipated that while this data does exist and is available, as indicated by the published access maps (NHVR 2013), and the fact that at least one jurisdiction already uses it, it might need to be translated depending upon the classification method used for the service level framework, as the access definitions vary slightly across jurisdictions.

As an example, an asset owner might know the percentage of its network that is restricted access, but not the specific percentage that is B-double access. Whether the existing access maps for vehicles requiring the higher-level vehicle access arrangements can be provided depends on how the vehicle categories will be defined in the service level framework.

One important point for consideration is the current work being undertaken by the NHVR in developing a nationally consistent framework for the assessment and classification of heavy vehicles and routes, presently being completed by ARRB. While the project is on-going, draft results have highlighted differences between route assessment procedures across Australian
jurisdictions, and the level to which the NHVR framework will harmonise access decision making is yet to be determined.

The proposed performance indicator for access provision is the percentage of total kilometres of the road network that is open to a particular vehicle class and is considered to have strong merit in that it accurately reflects industry wishes, supports more productive vehicles, is simple, and is expected to be able to be easily calculated by asset owners based on existing data. However, further refinement is required to ensure that the performance indicator can account for any time-of-day restrictions. While a more detailed indicator could be developed, its data requirements and complexity are expected to render it too onerous.

6.2.2 Ride Smoothness

Several options exist for a performance indicator that provides an indication of ride smoothness, with varying levels of acceptance within the industry, and each with advantages and disadvantages. Roughness is considered to be the primary criteria for users to judge pavement performance and is perceived as the key indicator of the condition of a highway system (Bennett et al. 2007). The roughness indicators described here are:

- International Roughness Index (IRI)
- Truck Ride Index (TRI)
- Heavy Articulated Truck Index (HATI)
- Heavy Vehicle Roughness Band Index (HVRBI)
- Austroads Network Performance Indicator on Pavement Conditions.

The IRI metric, despite having widespread use throughout Australia, has some potential issues when used as a metric for indicating truck ride smoothness. Austroads (2012b) highlighted that because IRI is based on the relative driver comfort for a standard passenger car, it may give misleading results if used to indicate the ride quality experienced by a heavy vehicle and its driver.

Two alternative measures, the Truck Ride Index (TRI) and the Heavy Articulated Truck Index (HATI), both similar in scope and methodology to the IRI, were noted (Austroads 2012b) to represent an improved methodology of measuring the ride quality of heavy vehicles, by considering the longer wheelbase of a heavy vehicle, and the differences in vehicle response that are the result of axe group, suspension type, and trailer configuration. However, they were still considered to be deficient for various reasons.

To address this, Austroads (2012b) developed the Heavy Vehicle Roughness Band Index (HVRBI), a ride quality index for heavy vehicles based on the measured road profile, which considers vehicle speed, wheel base length, amplitudes of the road profile undulations and lateral vibrations due to wheel path profile differences. The HVRBI is intended for use by road asset managers as a trigger to initiate pavement intervention works targeted at maintaining ride quality, freight productivity, safety and driver comfort for heavy vehicles. While appearing to represent a sound approach, it should be noted that the HVRBI has only recently been published, and is not yet commonly used and accepted.

Recent Austroads work (Austroads 2011b) which developed a methodology for a pavement condition performance indicator as discussed in Section 5.2.1 could potentially have merit, however further work should be undertaken in finalising a combined performance indicator for pavement condition based on the individual performance indicators for functional measures (roughness, cracking, texture) and structural measures (deflection, rutting). Agreement between
jurisdictions regarding the acceptable limits for each characteristic for the various road types comprising the network is required before this index can be finalised (Austroads 2011b).

Each of the performance indicators proposed in the previous sections will require the frequent and widespread collection of road condition data through field surveys. Austroads (2011b) indicates that road condition surveys are performed regularly by jurisdictions to collect the required data for IRI calculation. This is supported by the responses from jurisdictions, which indicate that regular data collection activates are undertaken, albeit for a limited set of the road network, which is generally limited to state roads and national highways. Austroads (2007b) defines the frequency and test specification for roughness surveys. The frequency varies between once every five years depending on the traffic volumes and the deterioration rate. This provides a strong indication that data required to calculate roughness is held by asset owners, updated on a regular basis, and is readily available for portions of the network

While several potential methods for assessing ride smoothness are available, the method chosen for inclusion in the service level methodology should be robust, validated, and widely accepted amongst jurisdictions. Additionally, the data required to collect it should be readily available, and the relationship with VOC should be clearly defined.

On this basis, neither the Austroads Pavement Condition Performance Indicator, nor the HVRBI are suitable, as they are not of sufficient maturity to be recommended for use in the service level framework.

Of the remainder, the IRI appears to have the widest level of adoption and acceptance within jurisdictions. However both the TRI or HATI would be expected to provide results that are more closely aligned with heavy vehicles and could be more suitable, but there is no demonstrated link between them and VOC, which is a key concern for vehicle operators. On this basis, IRI is recommended as the performance indicator for ride smoothness, incorporating the smooth travel exposure performance indicator recommended by Austroads (2011b), and presently used by some jurisdictions.

### 6.2.3 Traffic Conditions

The literature review highlighted that there are many available performance indicators to inform on traffic conditions, with most focussing on measures of travel speed and congestion, as outlined in Table 6.3 (Austroads, 2011b).

<table>
<thead>
<tr>
<th>Area</th>
<th>Performance indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel speed</td>
<td>Actual travel speed (urban) for AM, PM, off-peak, and all day</td>
</tr>
<tr>
<td></td>
<td>Congestion indicator (urban) AM, PM, off-peak, and all day</td>
</tr>
<tr>
<td></td>
<td>Variability of travel time for AM, PM, off-peak, and all day</td>
</tr>
<tr>
<td></td>
<td>Nominal travel speed (urban)</td>
</tr>
<tr>
<td>Lane occupancy rate</td>
<td>Lane occupancy rate (persons) for AM, PM, off-peak, and all day</td>
</tr>
<tr>
<td></td>
<td>Car occupancy rate, for AM, PM, off-peak, and all day</td>
</tr>
<tr>
<td>Congestion – traveller efficiency</td>
<td>Traveller efficiency (average travel time per 10 km)</td>
</tr>
<tr>
<td></td>
<td>Variation from posted speed</td>
</tr>
<tr>
<td></td>
<td>Reliability (variability of travel time for a typical trip)</td>
</tr>
<tr>
<td>Congestion – productivity</td>
<td>Speed and flow</td>
</tr>
</tbody>
</table>
While the methods proposed by Washburn (2002) relating truck level of service to the ‘relative manoeuvrability’ concept appear logical and robust, further research in some areas (particularly investigating the applicability of that approach to Australian conditions), is required, and for these reasons are not recommended here.

While any of the Austroads indicators could be used, it is expected that the ones relating specifically to travel time, including travel time variability and reliability most strongly align with the concerns of the transport operator, and therefore appear to have the most merit, and are inherently easily understandable. Data could be obtained from either floating car surveys, in-vehicle telematics units, or road monitoring equipment.

There are presently approximately 7–10 companies within Australia that provide floating car survey services, and several jurisdictions have collected real-time data for the calculation of traffic performance on an annual basis. However, the degree to which such data is available could be limited, due to the infrastructure required and associated expense.

Similarly, the current proliferation of surveys and volume of survey data would need to be investigated. As an example, Austroads (2007a) notes that VicRoads’ travel time data collection using the floating car method typically occurs in March and October on urban roads. Traffic volumes are also collected on each road link or segment selected for performance monitoring. On rural roads, the travel times are collected in one survey between February and April on a single weekday. The sample size is about 15% of representative freeways, divided arterials, undivided arterials with and without trams in urban areas, and also about 15% of rural routes.

If limited data is available, one possibility is to use data collected from the on-board telematics devices fitted to trucks. Industry consultations have indicated that potentially large numbers of trucks are fitted with telematics devices, data from which could be used to assess network performance, depending on the indicator chosen. An additional complication is that permission to use the data would need to be obtained.

In calculating this performance indicator, care should be taken to ensure that the data is collected and averaged over a period of sufficient length to ensure that temporal effects such as peak-hour traffic do not skew the results.

### 6.2.4 Traveller Information

Austroads (2007c) provides a detailed and useful summary of the application and utility of variable message signs (VMS), noting the variations in different types of VMS offered, their effectiveness based on previous research findings, local proliferation and examples, and specific requirements for the provision of information. It was noted, based on previous research, that road users require information that falls into three categories:

- simple data about incidents
- situational analysis of the incident
- the degree of impact on the road user.

The study also notes that considerable recent research has gone into improving the clarity and consistency of the content of VMS, in order to improve user comprehension of the messages. It should be noted that the majority of state-level jurisdictions currently have policies controlling the design and implementation of VMS (MRWA 2010, VicRoads 2001). Two example of VMS used in Australia are shown in Figure 6.2.
Due to the complexity and variation of such documents, and the ongoing state of research evaluating the effectiveness of VMS or other methods of relaying information to road users, it would be difficult to define a performance indicator based on a qualitative assessment of the information provided. If a performance indicator were developed, it would most likely have to be revised on the basis of new research findings.

To avoid this issue, a more useful performance indicator could be a simple measurement of the percentage of the network for which a minimum level of real-time travel information is available. The minimum level of information should comprise factors that industry has indicated are of importance, including:

- Incident/local hazard/roadworks/parking information
- Real-time/predicted traffic speed or travel time.

Examples of quality standards for this information are available in the literature (AutomotiveNL et al. 2012, EasyWay 2012, Karl & Béchervaise 2004), covering ranges of requirements for the timeliness of information, update frequency, information quality assurance, accuracy, and length of forecast. While consideration of these factors is important, it is recommended that the published jurisdictional guidelines for traveller information and VMS be followed in the first instance, such as the VicRoads and MRWA specifications (MRWA 2010, Vicroads 2001), unless specific deficiencies are noted.

Traffic speed and travel time information can be obtained from different data sources, such as detection loops, Bluetooth sensors and floating car surveys. It is anticipated that incident and local hazard information can be obtained from road owners’ current data collection systems (loops, field operators) and from floating car survey service providers. Roadworks information is expected to be available from road owners’ roadwork planning systems.

While this information may be available, the scope of its availability, relating to the amount of the road network where information is available, needs to be confirmed.

It is recommended that the percentage of the network for which a minimum level of real-time travel information is available be used as the performance indicator, pending feedback from jurisdictions regarding the availability of data.
6.2.5 Amenities

While there are a wide variety of characteristics which could potentially be used to assess the quality of rest area provisions, feedback from industry indicates that key concerns are the frequency of rest areas, and the quality of the rest areas themselves. Guidelines produced by the National Transport Commission (NTC 2005) outline the ‘satisfactory’ provision of rest areas according to truck volumes, but indicate that the following general indicators are applicable:

- Major rest areas should be located at maximum intervals of 100 km.
- Minor rest areas should be located at maximum intervals of 50 km.
- Truck parking bays should be located at maximum intervals of 30 km.

It is recognised that the spacing requirements for heavy vehicle rest areas will vary considerably across freight routes throughout Australia (Austroads 2012a). Requirements in more heavily trafficked and relatively shorter freight routes such as those found in Victoria are very different from the less heavily trafficked, longer and extremely remote freight routes in areas like outback Western Australia.

To accommodate these differences, the methodology guides selection of appropriate spacing based on a number of methods which range from the NTC Guidelines (NTC 2005) to the philosophy that heavy vehicle rest areas should be spaced to ensure drivers can plan their travel to meet heavy vehicle fatigue legislation. Intermediate spacing based on these two approaches may often be appropriate. Figure 6.3 and Figure 6.4 show different classes of rest areas suitable for different combinations of road type and heavy vehicle volume, and provide an outline of the heavy vehicle rest area classes by the characteristics of the rest area itself (Austroads 2012a).

![Figure 6.3: Heavy vehicle rest area classes A, B, C and D by heavy vehicle volume vs. road environment](source: Austroads (2012a).)
In order to assess the provision and quality of amenities, data on the location and type of each facility is required. It is understood that maps showing the location and type of rest area facilities are currently held by the jurisdictions. As an example, Figure 6.5 shows an extract of the public rest area maps provided by Roads and Maritime Services (RMS) of NSW.
Data such as this does not provide an indication of the quality of rest area facilities, which would need to be determined if required by the performance indicator, and may be held by jurisdictions. Additionally, if the performance indicator requires the assessment of rest areas for given volumes of heavy vehicles, traffic volume data (in terms of AADT) would also be required.

While the research indicates that a detailed performance indicator could be developed on the basis of the quality of rest areas, taking into account considerations such as those outlined above and in conjunction with NTC or Austroads recommendations, for simplicity it is recommended that the performance indicator be the percentage of the road network for which a satisfactory level of rest areas is available, relying on the minimum requirements set out in Austroads (2012a) for the definition of satisfactory.

6.2.6 Safety

In recent years, considerable research has been conducted into the assessment of safety on the network level. The key methodologies presently adopted in Australia – NetRisk and AusRAP, and a new model, ANRAM, completed by Austroads in 2012, are discussed here.

Traditionally, road safety risk assessment or some form of safety index has been based on the review of previous crash locations. A new approach proposed by Roper and Turner (2008), was based on the existing road itself and roadside features, and the expected or anticipated contribution of these to crash volumes.

In line with this methodology, NetRisk involves a process that enables jurisdictions to examine and identify sections of road with high crash risk. The process involves data collection (video recording or a driving survey of each road length), while observing a specified set of safety parameters including lane width, curve radius and roadside hazard conditions. When any of these parameters fall below a certain threshold, relevant risk scores are calculated based on the roadside conditions indicated and assigned to the affected part of the road (Affum & Goudens 2008).

NetRisk was developed for the Department of Transport and Main Roads, Queensland, and it has also been used by Main Roads Western Australia. NetRisk provided the basis for the development of AusRAP – the Australian Road Assessment Program (Metcalfe & Smith 2005). AusRAP focuses on two assessment methods, ‘risk mapping’ and ‘star rating’, which are briefly explained here.

Risk mapping is based on a road's crash history and traffic flow, and provides a measure of the safety performance of a road. Risk maps have been produced for the National Highway Network (formerly AusLink National Network), and are shown alongside the risk bands in Figure 6.6.
Star rating uses an automated data collection system (such as a network survey vehicle) to collect road profile and video data for individual roads, and assess the degree to which the engineering features of the road impact on the likelihood of crashes occurring, and their severity. The assessment provides a simple and objective measure of the relative level of risk associated with road infrastructure for an individual road user. Five-star (green) roads are the safest, while one-star (black) roads are the least safe.

The current status of the AusRAP program is that following the completion of a pilot study into the use of a Network Road Safety Score (NRSS), further work on the NRSS is planned, and the

---

**Table 1: Colours and Thresholds Used in Risk Maps**

<table>
<thead>
<tr>
<th>Risk rating</th>
<th>Collective risk (average annual casualty crashes per km)</th>
<th>Individual risk (average annual casualty crashes per 100M veh-km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt; 0.03</td>
<td>&lt; 6.85</td>
</tr>
<tr>
<td>Low-medium</td>
<td>0.03 – 0.10</td>
<td>6.85 – 9.56</td>
</tr>
<tr>
<td>Medium</td>
<td>0.10 – 0.17</td>
<td>9.56 – 12.34</td>
</tr>
<tr>
<td>Medium-high</td>
<td>0.17 – 0.29</td>
<td>12.34 – 16.44</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 0.29</td>
<td>&gt; 16.44</td>
</tr>
</tbody>
</table>

Source: AusRAP (2011).

**Figure 6.6: Risk mapping of Australia’s network based on 2005–2009 data**
extension of the AusRAP research has been identified as a priority action in the National Road Safety Action Plan.

Relevant data required for safety measures are generally only available to a limited extent. There are two types of data, being crash statistics and road characteristics. Crash statistics are generally easily available for frequently travelled roads and sparse for less travelled roads. Data on road characteristics are generally collected during surveys and are known to be relatively expensive to collect. The process of collecting data for the purposes of AusRAP or NetRisk-style assessments would be considerable, and may not be able to be undertaken for the majority of the road network without considerable cost to jurisdictions.

The ANRAM model provides road authorities with the opportunity to assess the road network for risk in accordance with Safe System philosophies (Bekavac et al. 2012). It is a system that provides a viable alternative to address the gaps that currently exist in the determination and assessment of risk-based road investment. This system was developed in response to a need for a nationally consistent approach to determining levels of casualty crash risk on sections of the national, state controlled and major local government road networks.

ANRAM utilises scores derived from iRAP as a core input into the model. Historically, coding road networks to determine a road assessment score has been a labour intensive process, requiring trained staff to view road segments and make a determination of over 30 attributes every 100 m. Road authorities in Australia have a significant amount of data on the road network, much of which can be directly imported into the iRAP processing tool, thus reducing duplication of data collection and processing.

To date, several jurisdictions including DPTI and MRWA have trialled the ANRAM tool, with positive results. It is anticipated that Austroads will formally endorse the first version of ANRAM in mid-late 2013. The tool currently utilises a spreadsheet interface, however there are plans to eventually incorporate it into the AusRAP web-based interface. ARRB is working closely with road safety partners to ensure future development of ANRAM.

The proposed indicator for safety could be based on the AusRAP (Metcalfe & Smith 2005) or ANRAM methodologies, pending feedback from jurisdictions regarding the availability of data. These methods are proposed because they represent national standards (AusRAP 2011, Austroads 2006b). AusRAP has produced Star Ratings for the National Highway Network and significant lengths of the state highway network in Victoria, Queensland, Western Australia and South Australia, and it is expected that the ANRAM results will be further expanded.

6.3 Example Service Level Framework

In order to apply the service level framework in a practical sense, appropriate weighting factors and a rating scale are required for each service attribute.

Weighting factors are required to account for the difference in importance of some service attributes when compared to others, which may also change for different classifications. As an example, using access arrangements as the classification method, vehicles in the ‘Class 2’ group may place a higher importance on ride smoothness or provision of amenities than vehicles in the ‘Class 3’ group. While the appropriate weighting factors to be assigned for each service attribute are beyond the scope of this project, example weighting factors are shown in Table 6.4 for illustrative purposes.

A rating scale, similar to the ‘reporting bands’ used by RMS NSW for their asset performance measures (refer to Table 5.10), are also required for each performance indicator. These rating
scales will take the upper and lower extents of the performance band, calculated using the performance indicator. Again, while the definition of the appropriate rating scale for each attribute is beyond the scope of this project, some typical/possible descriptive rating scales are shown in Table 6.4.

Using this arrangement, a service level framework could be set to cover the entire spectrum of vehicle classifications, if it is determined that a single relative weighting and rating scale could be set for each performance indicator, which is applicable to all classifications. This would result in the simplest framework, as both weighting and rating would be consistent.

Individual service level frameworks could also be set for specific vehicle classifications, or classes of vehicles, if it is determined that either (or both) of the weighting and rating scales need to vary across the spectrum of classifications in order to account for the differences between vehicle classes, and the effects this has on the expectations of the users in relation to service levels. If required, this would increase the level of complexity of the framework, as a series of separate frameworks would be required for each of the classifications.

### Table 6.4: Example service level framework

<table>
<thead>
<tr>
<th>Service attribute</th>
<th>Performance indicator</th>
<th>Relative weighting</th>
<th>Rating scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access conditions</td>
<td>% of network that can be accessed for different types of vehicles.</td>
<td>25%</td>
<td>Between 80% and 100% network access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Between 50% and 80% network access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Between 20% and 50% network access</td>
</tr>
<tr>
<td>Ride smoothness</td>
<td>International Roughness Index (IRI), potentially incorporating smooth travel exposure (STE)</td>
<td>15%</td>
<td>IRI ≤ 3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.0 ≥ IRI &gt; 3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IRI &gt; 4.0</td>
</tr>
<tr>
<td>Traffic conditions</td>
<td>Travel speed variability and reliability</td>
<td>15%</td>
<td>Low travel speed variability and high reliability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Medium travel speed variability and medium reliability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High travel speed variability and low reliability</td>
</tr>
<tr>
<td>Traveller information</td>
<td>% of network for which minimum level of real-time travel information is available</td>
<td>10%</td>
<td>Between 25% and 50% of network</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Between 10% and 25% network</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Less than 10% network</td>
</tr>
<tr>
<td>Amenities</td>
<td>% of network for which satisfactory level of rest areas is available</td>
<td>15%</td>
<td>Between 50% and 75% of network</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Between 25% and 50% network</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Less than 25% network</td>
</tr>
<tr>
<td>Safety</td>
<td>AusRAP or ANRAM methodology</td>
<td>20%</td>
<td>5 star rated roads</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 and 3 star rated roads</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 and 1 star rated roads</td>
</tr>
</tbody>
</table>
A depiction of how the example service level framework fits in with the classification method is shown in Table 6.5. It should be noted that the figure depicts a framework set for the ‘general access class’.
### Table 6.5: Concept for the service level framework using access arrangement as the classification system

<table>
<thead>
<tr>
<th>Classification</th>
<th>Sub-classification</th>
<th>Service level</th>
<th>Service attribute</th>
<th>Performance indicator</th>
<th>Relative weighting</th>
<th>Rating scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General access</strong></td>
<td>Rigid trucks and buses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semi-trailers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access</strong></td>
<td>Oversize and overmass vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Special purpose vehicles (mobile crane, concrete pump, drilling rig, farming mobile plant etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access Class 1</strong></td>
<td>Higher mass limit vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access Classes 2 and 3</strong></td>
<td>Multi-combination vehicles (B-doubles, road trains, B-triples, and AB-triples)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher mass limit vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Sub-classification</th>
<th>Service level</th>
<th>Service attribute</th>
<th>Performance indicator</th>
<th>Relative weighting</th>
<th>Rating scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General access</strong></td>
<td>Rigid trucks and buses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Semi-trailers</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Special purpose vehicles (mobile crane, concrete pump, drilling rig, farming mobile plant etc.)</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access Class 1</strong></td>
<td>Higher mass limit vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Restricted access Classes 2 and 3</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher mass limit vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Other classes as required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7 FEEDBACK RECEIVED FROM THE WORKING GROUP

A simplified version of the example framework was presented to the working group in the report by Ritzinger & Karl (2013), and discussed during a teleconference on 22 February, where it received broad support, although those present noted several key points regarding the classification method and other aspects of the framework.

Feedback was also sought from the jurisdictions during the consultation process, in the areas outlined in Table 7.1, areas which broadly covered issues related to the implementation of the service level framework, covering application in practice, options for encouraging the adoption of the framework, issues related to planning and pricing, and governance elements of the new system.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Input/feedback/questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of service levels in practice</td>
<td>- How is heavy vehicle access currently incorporated into planning processes? Is it considered on a strategic level?</td>
</tr>
<tr>
<td></td>
<td>- How difficult do you think it would be to incorporate the service level framework into current processes and systems, such as planning for heavy vehicle access?</td>
</tr>
<tr>
<td></td>
<td>- The service level framework differs from current approaches to heavy vehicle access in that it represents a ‘user-focussed’ system. Would a shift in culture at the asset owner level be required to accommodate it? If so, how could this be achieved?</td>
</tr>
<tr>
<td></td>
<td>- It is understood that vehicles requiring permits, such as oversize or overmass vehicles, often require detailed investigation. How could such vehicles be accommodated within the service level framework?</td>
</tr>
<tr>
<td>Encouraging the adoption of the service level framework</td>
<td>- How readily do you think the service level framework will be adopted by asset owners?</td>
</tr>
<tr>
<td></td>
<td>- What are some ways in which asset owners could be incentivised in order to encourage adoption of the new system?</td>
</tr>
<tr>
<td>Planning and pricing</td>
<td>- What are the factors critical to pricing and charging of heavy vehicles which you consider should be included in access decision making processes?</td>
</tr>
<tr>
<td></td>
<td>- How do decisions regarding heavy vehicle access currently drive project funding?</td>
</tr>
<tr>
<td>Governance elements</td>
<td>- Asset owners will be responsible for setting the service levels, and will receive funds to either deliver or maintain the network to the requirements of the specified service level. What is a reasonable means of providing assurance that service levels are met or maintained? Could current methods for monitoring road network performance be used?</td>
</tr>
<tr>
<td></td>
<td>- How could jurisdictions address industry concerns regarding transparency and accountability of the access decision making process?</td>
</tr>
<tr>
<td></td>
<td>- How could jurisdictions ensure that funding requests for new infrastructure or upgrades to accommodate increased levels of access were reasonable and justifiable?</td>
</tr>
<tr>
<td></td>
<td>- How could jurisdictions effectively capture future access requests from industry?</td>
</tr>
</tbody>
</table>

Timing requirements on the delivery of this report meant that jurisdictions could only be allowed a time-frame of two weeks in order to provide their submissions. As a result of these constraints, only three responses were received from jurisdictions. However, all attempts have been made to
include and address the comments received from the working group members both during the original teleconference, and the subsequent consultation period.

An outline of the comments received is provided in the following sections, alongside comments from the project team addressing the issues raised, where appropriate. A separate investigative report into the future strategy for road supply and charging in Australia (PwC, 2013) provided alternatives for the classification scheme, and is also discussed here. On the basis of this discussion, unresolved issues, or areas where further work is required are summarised in Section 7.7.

7.1 The Service Level Framework

Several issues surrounding the service level framework, particularly the classification systems and the performance measures were highlighted by the working group, and are discussed below.

7.1.1 Alternative Approach to Defining Service Levels

Feedback received outlined an alternative approach to examining services, which involves consideration of services within the full social context of infrastructure provision, as per Figure 7.1 below.

![Figure 7.1: Alternative approaches to estimating the road user cost base](source: GHD Meyrick (2010))

It was noted that in the same manner that significant steps are provided in the infrastructure provision costs for various users, there should be differentiation of infrastructure ‘services’. Thus, ‘service levels’ could be defined by the additional costs internalised by road providers in order to allow heavy vehicle access and reduce heavy vehicle operating costs. The costs internalised by road providers will depend on the user base, over which the additional costs can be spread according to the user’s willingness to pay.
On this basis, it was proposed that the service levels should be linked to the willingness of the user to pay based on the heavy vehicle demand for infrastructure, rather than being tied to specific asset performance measures, as this is considered a simpler, more objective and more user-focussed approach. A refined concept for the service level framework was provided, and is outlined in Table 7.2.

Table 7.2: Refined concept for the service level framework

<table>
<thead>
<tr>
<th>Classification</th>
<th>Service level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital city</td>
</tr>
<tr>
<td>General access</td>
<td></td>
</tr>
<tr>
<td>Restricted access</td>
<td>Decreasing heavy vehicle traffic, and decreasing ability of the road</td>
</tr>
<tr>
<td>class 1</td>
<td>provider to recover internalised social cost</td>
</tr>
<tr>
<td>Restricted access</td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td></td>
</tr>
<tr>
<td>Restricted access</td>
<td></td>
</tr>
<tr>
<td>Class 3</td>
<td></td>
</tr>
</tbody>
</table>

The definition of the service levels using this approach represents a sizeable shift in the approach that has been adopted throughout the majority of the project. While it could have merit, it would need to be discussed further with the working group and also tested against the reform objectives before any recommendation could be made regarding its adoption.

7.1.2 Concerns Regarding Class 1 Vehicles

It was noted that Class 1 vehicles, comprising oversize and overmass vehicles, mobile cranes, and concrete pumping trucks, may not fit well within the service level and pricing scheme. Although they generally travel low kilometres, their potential to damage pavements and structures is high as a result of their increased mass, and their access is generally determined using different criteria. As a result, they may not fit well within the service level framework, nor the proposed pricing structure.

In recognition of this, it could be argued that roads are designed primarily for general access and restricted access (notice/gazette) operation, with permits being used only because the transport task cannot be completed by any other means, as in the case of very large indivisible loads. For such vehicles, that the road is not inherently designed for, a service level offering cannot be defined, as the only service offered is access.

For these reasons, a service level framework is not proposed to be offered for Class 1 vehicles, as outlined in Section 4.1 however the level of success by which they can be accommodated by the pricing structure would need to be investigated further.

One respondent indicated that they did not consider Class 1 vehicles to be covered under the reform, however this is not the understanding of the project team, as the service level framework is intended to capture all types of heavy vehicles currently comprising the Australian fleet.
7.1.3 Use of PBS as a Classification Method

The use of PBS as a classification method was put forward by a member of the working group on the basis that it is an existing national regulatory tool, has effectively defined a set of seven vehicle classes, and has a corresponding National access network. A discussion of the relative merits of this approach was provided in Section 4.4, and is repeated here for convenience.

While the PBS classes could be used as a means of classification, doing so would present several challenges. Primarily, the PBS levels do not align well with the pricing structure, as there is no consideration of ESA/SAR or PCU within the PBS performance levels. As an example, typical Level 2 vehicles are B-doubles and truck and dog combinations. While having a similar overall mass, the ESA results for the two vehicles can vary substantially. This means that a price set across a PBS level would be unlikely to represent the true marginal cost of all typical vehicles within that vehicle class.

An additional difficulty is that the PBS scheme, while it has been in operation since October 2007, has not achieved widespread success within the industry, with vehicle approval numbers remaining relatively low (Ritzinger et al. 2012), and the majority of the road network in Australia is yet to be assessed using the PBS classifications. While several initiatives are presently underway to address this, including the development of a PBS Route Assessment Tool (RAT) for local government, it is not considered that the service level framework (intended to be a national scheme) should be designed around an access and classification scheme which has relatively low industry and jurisdictional adoption.

7.1.4 Comments on Performance Indicators, and Recommendations for Additions

While the service attributes and performance indicators proposed received broad support from the working group, and feedback received from the jurisdictions indicated that in most cases the performance indicators were aligned with current practice, and could be supported by existing data collection activities, responses indicated a strong preference for the inclusion of further measures in the framework related to infrastructure capacity.

Specifically, it was recommended that performance measures such as pavement strength, structural capacity, and road formation (restrictions due to slope stability issues) be included in the service level framework, as crucial freight routes can comprise ageing pavements with poor subgrade conditions which are severely impacted by heavy rainfall. It is advocated that these areas need strengthening in order to reduce the high maintenance costs that result from emergency patching works.

In this case, the project team consider infrastructure capacity to be relatively poorly aligned with the intent of the service level framework, as it is not an interest of the transport industry, and is therefore a poor fit in terms of the level of service provided to the users. This does not indicate that the concerns raised are not acknowledged and regarded as important issues, rather that the service level framework may not be the correct mechanism for delivering road infrastructure capacity upgrades. This issue needs to be discussed further with the working group in order to be resolved.

7.2 Application of the Framework in Practice

Several issues which can be broadly grouped together as high-level ‘implementation’ issues were noted by the working group, and are discussed below.
7.2.1 The Potential Impacts of Offering Different Levels of Road Quality

It was noted that the ability of road authorities to offer different levels of service ‘quality’ for the same level of access needs to be considered within the context of the following points, in order to understand the practicality of offering different levels of service, rather than simply setting minimum service ‘standards’:

- being able to sensibly demonstrate different costs
- industry willingness to be able to purchase higher levels of quality
- community and government standards.

While the framework is designed specifically to provide a service level definition which is based on the quality of the service offered, the linkages to the pricing structure are not presently well defined, and would need to be further investigated in order to ensure that the costs for different levels of service can be sensibly demonstrated.

Associated concerns are the willingness of industry to be able to purchase higher levels of quality, and the effects of a lack of choice regarding quality levels (i.e. if only a few operators value higher quality roads, do the others have to pay as well?), and the existing minimum community and government standards, such as road safety requirements.

On the basis of the above, one member considered that it may not be practical to offer different levels of quality and, as such, the scope of the project may eventually evolve into one which focuses on investigating the process for defining and setting minimum service standards. This requires further discussion amongst the working group.

7.2.2 Concerns Regarding Productivity

It was noted that the framework does not readily demonstrate how productivity is improved, particularly as high productivity vehicles are often operated on roads of a low standard in rural or remote areas, and the highest standard of roads, such as urban freeways, are only used by general access vehicles, and some B-doubles.

This concern can be addressed by providing more information regarding the intention of the reform in these particular areas. By providing a framework which links service levels and vehicle classes through access arrangements, asset owners can demonstrate and justify the additional costs required to provide heavy vehicle access at all service levels, and can receive funds accordingly. In this way, productivity can be improved, as an asset owner will have the means by which to reliably claim the additional costs of providing improved access.

However, operators need to be given the correct price signals regarding the cost of operation of heavy vehicles on the infrastructure, which will require further investigation.

7.2.3 Linking the Costs and the Performance of Roads

It was noted that the service level framework concept places a focus on the performance and quality of the roads, where existing systems used by jurisdictions focus on engineering aspects of the roads through a focus on costs and risks, an aspect which was also uncovered via the literature review and material provided by the jurisdictions.

The key point of concern is that the service level framework does not provide an effective link between the costs of providing a given level of service, and the level of service provided by the roads. This is a valid point, as preliminary work conducted by Marsden Jacobs and Associates (MJA 2013) indicates that the pricing scheme may be comprised of marginal and capacity cost
elements (representing the cost of road wear caused directly by the vehicle, and the cost of providing the infrastructure for the vehicle, respectively), which does not link well with the service level structure. This requires further investigation and discussion amongst the working group.

7.2.4 Risk Assessment Approach

It was noted that traffic volumes are a key factor in the design of roads, and the service levels proposed do not appear to take into account that a lower standard of road may be suitable for a road with a low traffic volume. This is a valid point, and it is also understood that access arrangements are also tied to traffic volumes, and considerations regarding heavy vehicle access for routes includes a risk management approach based on traffic volume (both of other road users, and the heavy vehicles).

It is expected that an aspect of the task of implementing the service level framework will be a risk assessment (though this is not explicitly stated) in a similar manner as is currently undertaken by jurisdictions when setting design standards and determining access arrangements.

7.2.5 Integration with Existing and Future Planned Service Level Schemes

Feedback from jurisdictions noted that there are existing service standards for asset maintenance, which generally cover intervention standards and response times. One jurisdiction uses a six-level sub-network categorisation method for setting performance targets, triggers and unit costs, which is driven by the correlation between the sub-network and the economic importance of the road.

Additionally, some internal asset management processes define 5-year milestones and 20-year performance targets for road assets, which are modest and aspirational in nature, and lack an effective link between the forecast level of service and the funding required to provide it.

One jurisdiction is presently undertaking a project to define a level of service for freight requirements, encompassing freight and journey reliability, road and structures condition, environment, and road safety, with the goal of identifying sustainable levels of service for assets in terms of provided funding. The same jurisdiction noted that the implementation of the service level framework would require similar frameworks to be simultaneously developed for other road user needs, in order to be a balanced approach.

The service level scheme proposed here would need to be developed in conjunction with existing asset management standards/levels, any current efforts to develop service levels, and may require additional service level frameworks to be developed for other modes, all of which adds additional complexity and needs to be investigated further.

7.2.6 Recommendations for Further Consultation

It was noted that further consultation with AustRoads reference groups and task forces needs to be undertaken, specifically with the Assets Task Force, the Network Task Force, the Traffic Management Task Force, the Road Design Review Panel, the Pavement Technology Review Panel, and the Bridge Technology Review Panel.

7.3 Encouraging Adoption of the Framework

Feedback was sought in relation to some of the potential options available for encouraging the adoption of the service level framework amongst asset owners. Some limited feedback was received from the working group and jurisdictions with regard to options for encouraging adoption of the service level framework, however the issues raised are discussed below.
It was generally recognised that the framework needs to present a clear, practical and applicable standard that can be applied at the vehicle type level in order to encourage adoption. One jurisdiction noted that asset owners will be more likely to adopt a framework which is more closely aligned with the critical performance measures in their areas of concern.

This potentially creates a conflict, as the over-arching requirement of the service level framework is that it represents a user-focussed system, and it has been shown that while some overlap exists, the areas of concern of asset owners are not consistently aligned with the areas of concern of the transport operators. The level to which a framework aligned with the requirements of the transport operator will limit its adoption amongst asset owners needs further investigation.

7.4 Planning and Pricing Considerations

Feedback was sought in relation to current methods of planning for heavy vehicle access, and other factors that asset owners considered important in relation to pricing. Again, limited feedback was received from the working group and jurisdictions however the issues raised are discussed below.

Responses indicated that decisions regarding heavy vehicle access are taken into account at a strategic level, and currently drive project funding to a large extent. One jurisdiction noted that industry demand for access is the primary input for decisions made regarding improvement works for heavy vehicle access. If this is consistent across jurisdictions, it could be interpreted as a positive indication for the adoption of the service level framework, as it is intended to provide a stronger link between vehicle access and funding arrangements.

However, one jurisdiction noted that factors such as the damage caused by heavy vehicles, and the cost to bridge a road to the standard required for access are important pricing considerations. It was noted that strength and structural capacity are the most critical drivers for funding in order to provide for access. Pavement conditions and remaining life are also major drivers of costs and must be considered in any fair cost recovery framework.

While it is considered that the proposed pricing structure (comprising elements of the marginal and capacity cost of heavy vehicles) will capture the costs of road wear/damage, and to a certain extent the capital cost, the service level framework may not be the correct mechanism for delivering road infrastructure capacity upgrades, and this issue needs to be discussed further with the working group in order to be resolved.

One possible method of dealing with this proposed by one jurisdiction is the separation of funding sources for ‘maintenance of service levels’, and ‘improvement of service levels’, as improving access arrangements is dependent on capital improvement, and cannot be achieved through a maintenance program. The feasibility of this approach should be discussed further with the project team.

Other issues related to changing that were noted are:

- including a mechanism for charging for the required bridge structural assessments and on-going maintenance and monitoring
- network restrictions due to the condition of the asset (e.g. lane closures and load restrictions on bridges)
- alternative charges for oversize and overmass vehicles, based on a ‘per kilogram per kilometer’ fee.
7.5 Governance Elements

Feedback was sought in relation to the expected governance elements required to support the service level framework, primarily surrounding the need for access decisions to be made on a transparent and justifiable basis, the monitoring of agreed service levels, and also justification in funding requests. Again, limited feedback was received from the working group and jurisdictions however the issues raised are discussed below.

It was generally accepted that all aspects of decisions regarding access and funding must be transparent, accountable, justifiable, and reasonable. While it is expected that the involvement of the NHVR, specifically in managing access requests on a national scale, may largely deliver on these areas, jurisdictions indicated that current systems for monitoring access approvals and recording operational performance could help to deliver the required levels of accountability.

One jurisdiction noted that access is granted within transport policy limits and in consideration of community, environmental and amenity issues. If the factors support the access, then the cost benefit ratio calculated as part of the assessment would ensure that the project is justified. Relying on published policies and economic assessments such as BCR appears sound, and it is anticipated that this could be effectively used to demonstrate transparency and provide the required levels of justification.

One jurisdiction commented that any assessment should consider all freight-related benefits are captured during the financial analysis part, and not just simply rely on AADT measures. However, an independent and external review of access decision making is generally supported, subject to the condition that services are only provided when the funding is allocated, and that jurisdictions cannot be held accountable for failure to deliver an output when funding was not given.

7.6 Alternative Approaches to the Classification Framework

A separate investigative report into the future strategy for road supply and charging in Australia (PwC, 2013) provided alternatives for the classification scheme. The report advocates the adoption of a three-tiered approach to road classification based on access, as a direct means of supporting a service level framework. The three tiers are:

- **Tier 1 – the primary land freight transport corridors**, representing the highest level of access, building on Infrastructure Australia’s (IA) National Land Freight Network
- **Tier 2 – significant ‘last mile’ higher mass limit connections**, possibly aligning with Tier 1 mass limits to ensure end-to-end connectivity
- **Tier 3 – the remaining freight network**, comprising a minimum level of access in-line with current general access requirements.

The simplicity of this approach is appealing, however further investigation similar to that provided in Section 4 for the four classification options is required in order to understand its advantages and shortcomings.

One possible issue is that there is presently no agreement on IA’s proposal for the national freight network, and if agreed to, such a network would take time to develop, and appropriate policy settings would need to be put in place in the interim for transition.

Additionally, it is presently unclear how effectively the three-tiered approach would accommodate the breadth and depth of road standards, vehicle types and transport operations. This is the key challenge for any classification framework, and such a simplified approach may not be feasible.
### 7.7 Areas Requiring Further Investigation

Some of the comments and issues raised by the working group have been outlined and addressed in the previous sections, however due to the breadth and depth of the issues raised, some remain unresolved. Areas where further work is required are summarised in Table 7.3.

<table>
<thead>
<tr>
<th>Item</th>
<th>Area</th>
<th>Explanatory notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An alternative approach to defining service levels</td>
<td>An alternative approach to defining the service levels on the basis of consideration of services within the full social context of infrastructure provision was promoted by one jurisdiction. This approach represents a sizeable shift from the approach that has been adopted by the project team. While it could have merit, it needs to be discussed further with the working group and also tested against the reform objectives before any recommendation could be made regarding its adoption.</td>
</tr>
<tr>
<td>2</td>
<td>Concerns regarding class 1 vehicles</td>
<td>Class 1 vehicles, comprising oversize and overmass vehicles, mobile cranes, and concrete pumping trucks, may not fit well within the service level and pricing scheme. The level of success by which they can be accommodated by the pricing structure would need to be investigated further.</td>
</tr>
<tr>
<td>3</td>
<td>Additional performance indicators focussing on assets</td>
<td>It was recommended that performance measures such as pavement strength, structural capacity, and road formation (restrictions due to slope stability issues) be included in the service level framework. While the project team consider infrastructure capacity to be relatively poorly aligned with the intent of the service level framework, this issue needs to be discussed further with the working group in order to be resolved.</td>
</tr>
<tr>
<td>4</td>
<td>The potential impacts of offering different levels of road quality</td>
<td>It was noted that the ability of road authorities to offer different levels of service ‘quality’ for the same level of access needs to be considered in the context of demonstrating different costs, and industry willingness to pay. One member considered that it may not be practical to offer different levels of quality and, as such, the scope of the project may eventually evolve into one which focuses on investigating the process for defining and setting minimum service standards. This requires further discussion amongst the working group.</td>
</tr>
<tr>
<td>5</td>
<td>Demonstration of productivity improvements</td>
<td>The framework does not readily demonstrate how productivity is improved, particularly as high productivity vehicles are often operated on roads of a low standard in rural or remote areas, and the highest standard of roads, such as urban freeways, are only used by general access vehicles, and some B-doubles. Operators need to be given the correct price signals regarding the cost of operation of heavy vehicles on the infrastructure, which will require further investigation.</td>
</tr>
<tr>
<td>6</td>
<td>Linking the costs and performance levels</td>
<td>The service level framework does not provide an effective link between the costs of providing a given level of service, and the level of service provided by the roads. This requires further investigation and discussion amongst the working group.</td>
</tr>
<tr>
<td>7</td>
<td>Integration with existing and future planned service level schemes</td>
<td>There are existing service standards for asset maintenance, which generally cover intervention standards and response times. The service level scheme proposed here would need to be developed in conjunction with existing asset management standards/levels, any current efforts to develop service levels, and may require additional service level frameworks to be developed for other modes, all of which adds additional complexity and needs to be investigated further.</td>
</tr>
<tr>
<td>8</td>
<td>Different options for the classification framework</td>
<td>A separate report into the future strategy for road supply and changing has proposed an alternative classification framework be based on a three-tiered approach to road classification.</td>
</tr>
</tbody>
</table>
8 INTEGRATING THE FINDINGS INTO THE REFORM

Material from a draft of this report (submitted to the HVCI in April) was used to develop an access and service level discussion paper, which was circulated to members with the intention of being discussed at a targeted workshop held on 17th June in Brisbane. Key outcomes and recommendations from the workshop relevant to the further development of the access and service level framework are summarised below:

- the need to refine and simplify the key service attributes included in the framework
- identifying quantifiable performance indicators for the revised set of key attributes to support the long term framework,
- consideration of a simplified service level framework which is aligned to access provision by road type, as a preliminary approach
- consideration of a more sophisticated service level framework as a potential long term approach, building on the initial framework, which introduces key service quality attributes and a rating system
- testing the practicalities of applying each of the attributes in both urban, rural and remote areas of the long term framework.

Relevant to the first and second of the points raised above, a revised and simplified table of service level attributes and performance indicators was jointly developed by the HVCI and ARRB subsequent to the workshop, and is shown in Table 8.1.

<table>
<thead>
<tr>
<th>Original attribute</th>
<th>New service attribute</th>
<th>Proposed performance indicator</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>Operating conditions</td>
<td>‘quality of access’ offered, on the basis of the operating conditions imposed (e.g. speed restrictions, mass limits, IAP, curfews).</td>
<td>Test proposal with working group (feasibility of developing a rating system for operating conditions)</td>
</tr>
<tr>
<td>Ride smoothness</td>
<td>Road condition</td>
<td>a range of different measures for different roads types (sealed/unsealed), and an alternative method for assessing roads with no IRI data.</td>
<td>Discuss with working group (how to rate unsealed roads, how to rate roads with no IRI data)</td>
</tr>
<tr>
<td>Amenity</td>
<td>Amenity</td>
<td>Route compliance with NTC or jurisdictional guidelines</td>
<td>Understand how rest area requirements are treated within jurisdictions, remove from the framework if found to be a critical aspect of the access determination</td>
</tr>
<tr>
<td>Safety</td>
<td>Safety</td>
<td>Netrisk/AusRAP/ANRAM, possibly investigate alternative assessment methods for unrated roads, or less ‘data intensive’ methods for roads owned by local government</td>
<td>Discuss with working group (possibly investigate alternative assessment methods for unrated roads, or less ‘data intensive’ methods for roads owned by local government)</td>
</tr>
<tr>
<td>Traffic conditions</td>
<td>-</td>
<td>-</td>
<td>Inclusion of traffic as a service level attribute effectively links congestion with pricing, which is outside the scope of the reform.</td>
</tr>
<tr>
<td>Traveller information</td>
<td>-</td>
<td>-</td>
<td>Application as a service attribute limited by lack of guidelines or minimum requirements for traveller info.</td>
</tr>
</tbody>
</table>
It is currently intended that the further development and testing of this refined framework will continue as part of the HVCI's on-going work program.

Relevant to the remainder of the points raised above, an internal review within the HVCI determined that the development of a simplified service level framework should be considered as a preliminary or initial solution to ensure that a framework can be applied and implemented in practice in the short term. Once the initial approach is established, sophistication could be built up over time to introduce key set of service quality attributes and performance measures.

A draft implementation path on the basis of the above was determined, and is outlined as follows:

- **Step 1 – Preliminary/Initial framework**
  - implementation of a simplified service level framework which aligns vehicle access to particular road types
  - a preliminary list of road type categories (broadly aligned to charging framework) to be established through the current Austroads project ‘AT1920’, presently being undertaken by ARRB

- **Step 2 – Potential long term approach**
  - evolution to a more sophisticated service level framework (long term)
  - introduces key service quality attributes and a performance rating system to be applied to each road.

It is proposed that initially, service levels will be based primarily on the provision of access, achieved via the development of a framework which correlates road classes to access classes. This arrangement will focus on the level of productivity supported rather than an assessment of detailed service attributes.

As an example, asset owners make decisions on access based on their own route assessment guidelines or other policy documents. This decision links a vehicle class to a road classification. The level of service provided can then be quantified by an assessment of how the road asset meets the requirements of the route assessment guidelines in key areas (e.g. road geometry, provision of amenity, etc.)

Road classifications (broadly aligned to charging categories) will need to be established. Broadly, road classification systems presently exist on two levels; functional classifications, which group roads on the basis of their intended purpose, and administrative classifications, which are used to provide a legal or administrative differentiation which allows allocation of funds between federal, state, and local levels.

Example classifications which combine functional and administrative classifications, listed from highest level of service to lowest level of service, include; highway, urban arterial, urban collector/distributor, urban local, rural arterial, and rural local. The establishment of appropriate classifications for the basis of access and service levels will be the investigated under the Austroads project AT1920. Appropriate access classes will also need to be set for each road classification, however it is anticipated that this task will be straightforward, as the functional classification of a road includes a defined access class.

Again, it is currently intended that this approach will continue to be refined and developed as part of the HVCI’s on-going work program.
9 CONCLUSION AND RECOMMENDATIONS

The project brief required three main goals to be addressed, as follows:

- identify methods of access decision making within jurisdictions, including road and access level classification and the identification of proposed changes to access regimes by bodies such as the NHVR, NTC or jurisdictions
- define service levels to be applied by asset owners to the road network, underpinning investment proposals, and providing clarity to industry about the type and extent of vehicle access that can be purchased
- identify any changes that may be necessary to existing access arrangements under any or all of the three reform options outlined by the RIS, to meet the objectives of the reform and to create a more customer-oriented culture within the access regime.

The primary objective of the project was to investigate and deliver a service level framework, linking vehicle classes and levels of road access into a system where services provided in terms of road access for heavy vehicle operators can be quantified, and supporting a pricing structure being developed concurrently under a separate project.

The various stages of work conducted have delivered outcomes relevant to each of these goals, and a service level framework has been provided on the basis of input from the transport industry and jurisdictions (via the project working group), and material uncovered via the literature review.

The sole exception to this is the discussion of the implementation of the service level framework within the context of the three reform options, which was not included in this report due to on-going refinement the reform objectives. Work on this project is completed and further refinement will be undertaken in future studies.

While the service level framework proposed was broadly supported by the working group, feedback from the working group and jurisdictions indicates that there are several areas in which further work is required. ARRB’s recommendations for addressing these areas are listed below:

- conduct further preliminary investigation into the defining service levels according to the full social cost of infrastructure provision (refer to Item 1, Table 7.3)
- investigate the level to which the all vehicle classes can be accommodated within the classification framework, and investigate possible alternative classification schemes (refer to Items 2 and 8, Table 7.3)
- investigate the need to revise the service level attributes, and possible inclusion of additional performance indicators (Item 3, Table 7.3)
- investigate the ability of road owners to offer different levels of service ‘quality’ for the same level of access (Item 4, Table 7.3)
- demonstrate how the framework will deliver productivity improvements, and link the costs for providing a service level to the performance of a road (Items 5 and 6, Table 7.3)
- investigate the possible links with existing and planned service level schemes (Item 7, Table 7.3).

It is also recommended that further consultation with Austroads reference groups and task forces be undertaken, specifically with the Assets Task Force, the Network Task Force, the Traffic Management Task Force, the Road Design Review Panel, the Pavement Technology Review Panel, and the Bridge Technology Review Panel.
Material from a draft of this report (submitted to the HVCI in April) was used to develop an access
and service level discussion paper, which was circulated to members with the intention of being
discussed at a targeted workshop held on 17th June in Brisbane.

Key outcomes and recommendations from the workshop included a revised and simplified table of
service level attributes and performance indicators, which was jointly developed by the HVCI and
ARRB subsequent to the workshop.

Subsequent to the workshop, an internal review within the HVCI determined that the development
of a simplified service level framework should be considered as a preliminary or initial solution to
ensure that a framework can be applied and implemented in practice in the short term. Once the
initial approach is established, sophistication could be built up over time to introduce key set of
service quality attributes and performance measures.

It is currently intended that this approach will continue to be refined and developed as part of the
HVCI’s on-going work program.
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APPENDIX A

USE OF DOCUMENTS IDENTIFIED IN THE INCEPTION REPORT

The following list of documents were identified in the inception report as potentially containing information relevant to the current project. Each of these documents has been reviewed and a comment provided.

<table>
<thead>
<tr>
<th>Publication</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considering the heavy vehicle access and charging function (Vanderkooi Consulting 2012)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>CRRP feasibility study (GHD Meyrick 2010)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>NTC feasibility study and determination of charges (various publications)</td>
<td>No material directly relevant to this project</td>
</tr>
<tr>
<td>Heavy vehicle charging and funding reform options (NERA Economic Consulting 2012)</td>
<td>Useful as background information, but not directly referenced</td>
</tr>
<tr>
<td>Identifying issues with the proposed road fund and regulatory reforms (Frontier Economics 2012)</td>
<td>Useful as background information, but not directly referenced</td>
</tr>
<tr>
<td>Heavy vehicle investment process options (Frontier Economics 2012)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Scope and role of planning in road capital budgeting (GHD 2012)</td>
<td>Useful as background information, but not directly referenced</td>
</tr>
<tr>
<td>Improving access for higher productivity vehicles (GHD 2012)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Investigating the development of a bridge assessment tool for determining access for high productivity freight vehicles (Austroads 2012)</td>
<td>No material directly relevant to this project</td>
</tr>
<tr>
<td>Development of marginal costs for heavy vehicle bridge usage (Austroads 2012)</td>
<td>No material directly relevant to this project</td>
</tr>
<tr>
<td>National Performance Indicators for Network Operations (Austroads 2007)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Network Performance Indicators – Next Generation (Austroads 2011b)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Economic Reform of Australia's Road Sector (Juturna Consulting 2012)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Worth Feeding: Case Study of Rural Local Road Efficiency and Reform of Australia's Road Pricing and Investment System (Juturna Consulting 2012b)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Preliminary Methodology for Estimating Cost Implications of Incremental Loads on Road Pavements (Austroads 2012a)</td>
<td>No material directly relevant to this project</td>
</tr>
<tr>
<td>PBS network classification guidelines (NTC 2007),</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Guidelines for Assessing Heavy Vehicle Access to Local Roads (Austroads 2009)</td>
<td>No material directly relevant to this project</td>
</tr>
<tr>
<td>Route assessment guidelines for multi-combination vehicles in Queensland (TMR 2007)</td>
<td>Referenced in this report</td>
</tr>
<tr>
<td>Guidelines for assessing the suitability of routes for restricted access vehicles (MRWA 2009)</td>
<td>No material directly relevant to this project</td>
</tr>
</tbody>
</table>
APPENDIX B  MATERIAL USED DURING INDUSTRY CONSULTATION PERIOD

THE PROJECT

The project seeks to broadly propose the methods by which heavy vehicle access may be transitioned into more of a ‘market’ – with clear, customer oriented ‘service level offerings’ for industry to assess and make rational purchasing decisions based on the location of the journey, their heavy vehicle fleet profile and the freight task involved.

One aspect of the project is the development of the service levels themselves. The service levels need to be based on the factors and characteristics that road users (the transport industry) consider to be important. Different stakeholders will consider a different set of factors to be important, and this project needs to understand these factors, and establish the importance and order of consideration of such factors in terms of road/route selection.

The history, context, objectives and functions of the overall HVCI reform proposal can be found on the HVCI website: www.roadreform.gov.au.

DEFINITION OF SERVICE LEVELS

In order to understand the concept of service levels, the road network must be thought of as a ‘product’ that asset owners market and sell to customers, which are the freight industry. To provide an example, an asset owner might construct or upgrade a road for the purposes of allowing B-double access.

The new road is the ‘product’, and B-double access is the ‘service’ that is sold to customers. Thus, the ‘service levels’ define the characteristics of the product relevant to its customers. A high level of service represents a product that fulfils customer needs and expectations, while a low level of service represents a product that does not meet customer needs and falls short of expectations.

“The ‘service levels’ define the characteristics of the product relevant to its customers. A high level of service represents a product that fulfils customer needs and expectations, and vice-versa for low levels of service”.

The concept of service levels is already applied throughout other, similar industries. In relation to the rail industry, a high level of service network is characterised by the quantity of freight that can be transported per hour, as this is a key factor for operators and their customers.

INPUT SOUGHT FROM INDUSTRY

The service levels need to be based on the factors and characteristics that the users (the transport industry) and their customers consider to be important. These will vary for different sectors of the
industry, and need to be understood. Input is sought in the following areas related to road and operational factors which industry considers important in defining the service levels:

- In which areas do your customers demand high performance from you? What are the criteria by which they judge your performance?
- In which areas do you expect high performance from the road network?
- What value would you place on the different levels of service? If a transport operation could be undertaken using two different but similar routes, would you choose the highest level of service, or the cheapest one?
- How important is it for you that service levels are consistent across states? Would it be an issue if high levels of service were not available in some states?
- What are your expectations in terms of accountability? Would you expect asset owners to be able to justify decisions regarding levels of service and pricing?
- Would you expect the price system to be transparent and easily understandable? How important is it for you that it is?

PROVIDING FEEDBACK OR REQUESTING FURTHER INFORMATION

The HVCI project manager is Mr John Gordon, Senior Policy Advisor within the HVCI team, who will be primarily responsible for the completion of all work under the Access and Service Levels workstream. John can be contacted on 0410 539 539, or via e-mail at john.gordon@transport.vic.gov.au

The ARRB project manager is Mr Adam Ritzinger, Engineer within ARRB’s Freight and Heavy Vehicles team, who is managing the industry consultation process, and collating industry responses. Adam can be reached on (03) 9881 1529, or via e-mail at adam.ritzinger@arrb.com.au.
Participants’ response sheet

1. **How do road ‘engineering’ characteristics influence your decisions regarding route choice?**

<table>
<thead>
<tr>
<th>Roughness</th>
<th>Number of lanes</th>
<th>Rest areas</th>
<th>Overtaking lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutting</td>
<td>Shoulder condition</td>
<td>Roadside facilities</td>
<td>Travel information</td>
</tr>
<tr>
<td>Ride quality</td>
<td>Centre medians</td>
<td>Signage quality</td>
<td>Height/width restrictions</td>
</tr>
<tr>
<td>Lane width</td>
<td>Drainage</td>
<td>Weighbridges</td>
<td>Tunnels</td>
</tr>
<tr>
<td>Steep grades</td>
<td>Number of roundabouts</td>
<td>Number of intersections</td>
<td></td>
</tr>
</tbody>
</table>

2. **How do road ‘operational’ characteristics influence your decisions regarding route choice?**

<table>
<thead>
<tr>
<th>Travel time</th>
<th>Ability to maintain desired speed</th>
<th>Congestion</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent following others</td>
<td>Time spent being followed by others</td>
<td>Availability of desired lane</td>
<td>Frequency and length of roadworks</td>
</tr>
<tr>
<td>Ease of passing through signalized intersections</td>
<td>Ease of passing through un-signalized intersections</td>
<td>Possibility of encounters with slow-moving traffic</td>
<td></td>
</tr>
</tbody>
</table>

3. **Best** road – please describe and why

4. **Worst** road – please describe and why
5. Factors that make your job easier or harder

<table>
<thead>
<tr>
<th>Easier</th>
<th>Harder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Answering from a different perspective

7. How would you value levels of service?

8. How important is consistency for service levels?

9. How important is consistency for pricing?

10. What factors are important in determining the service levels?

11. Accountability – justifying the access and pricing decisions

12. Transparency and simplicity – how important?

13. Further industry consultations – what are your expectations, and how can they be met?

14. Do you believe that heavy vehicle access is used to allocate funds for infrastructure projects in Australia?
APPENDIX C  MATERIAL USED DURING JURISDICTION CONSULTATION PERIOD

INTRODUCTION
The Heavy Vehicle Charging and Investment Reform Office (HVCI) is reviewing the national heavy vehicle access and charging systems, with a view to implementing regulatory reforms which encourage more efficient road infrastructure investments. ARRB Group Ltd (ARRB) has been engaged by the HVCI to develop a service level framework which will link vehicles and roads, in order to enable prices to be set for individual transport tasks, and provide an indication to transport operators and their customers regarding the quality of service they can expect from the road network.

ARRB’s project has progressed through Stage 1, which resulted in the development of a draft service level framework. The draft was summarised in a report submitted to the working group on the 18th of February, and discussed during the working group teleconference on the 22nd of February. A detailed description of the framework is provided in the attached ARRB report.

The project team received feedback from the working group on the draft, and is still seeking further feedback. However, in order to meet project milestones, ARRB must begin Stage 2, which is about ‘testing’ the draft framework with jurisdictions, identifying the potential implications, and investigating the changes that may be required to accommodate it. This document is intended to brief jurisdictions on the specific information which ARRB is now seeking in order to progress with Stage 2.

INPUT SOUGHT FROM JURISDICTIONS
Input from jurisdictions is sought in the following areas, and specific questions are posed to guide discussion and debate.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Input/feedback/questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network performance indicators and road quality measures</td>
<td>What are the network performance indicators that are currently used within your jurisdiction? What are the data requirements for the indicators, and how often is performance assessed? What are the engineering measures of the road quality that are currently used within your jurisdiction? What is the nature of the assessments conducted, what are the data requirements, and how often is it collected? Are your performance indicators and road quality measures similar to the ones proposed in the draft service level framework? Would you support the use of the proposed performance indicators detailed in the ARRB report? Why/why not?</td>
</tr>
<tr>
<td>Road network hierarchy and functionality</td>
<td>What road classification framework is currently used within your jurisdiction? Are networks considered in terms of their functional class, or the differing level of productivity that they provide?</td>
</tr>
</tbody>
</table>
Application of service levels in practice

- How is heavy vehicle access currently incorporated into planning processes? Is it considered on a strategic level?
- How difficult do you think it would be to incorporate the service level framework into current processes and systems, such as planning for heavy vehicle access?
- The service level framework differs from current approaches to heavy vehicle access in that it represents a ‘user-focussed’ system. Would a shift in culture at the asset owner level be required to accommodate it? If so, how could this be achieved?
- It is understood that vehicles requiring permits, such as oversize or overmass vehicles, often require detailed investigation. How could such vehicles be accommodated within the service level framework?

Encouraging the adoption of the service level framework

- How readily do you think the service level framework will be adopted by asset owners?
- What are some ways in which asset owners could be incentivised in order to encourage adoption of the new system?

Planning and pricing

- What are the factors critical to pricing and charging of heavy vehicles which you consider should be included in access decision making processes?
- How do decisions regarding heavy vehicle access currently drive project funding?

Governance elements

- Asset owners will be responsible for setting the service levels, and will receive funds to either deliver or maintain the network to the requirements of the specified service level. What is a reasonable means of providing assurance that service levels are met or maintained? Could current methods for monitoring road network performance be used?
- How could jurisdictions address industry concerns regarding transparency and accountability of access decision making process?
- How could jurisdictions ensure that funding requests for new infrastructure or upgrades to accommodate increased levels of access were reasonable and justifiable?
- How could jurisdictions effectively capture future access requests from industry?

PROVIDING FEEDBACK OR REQUESTING FURTHER INFORMATION

ARRB are seeking responses from jurisdictions in the areas outlined above by 15th March. The project working group will have the opportunity to discuss this directly during the next working group teleconference, which will be held on 13th March. However, ARRB are also seeking preliminary responses prior to the teleconference. To assist, a response sheet is attached which you can use to enter your responses directly.

The HVCI project manager is Mr John Gordon, Senior Policy Advisor within the HVCI team, who will be primarily responsible for the completion of all work under the Access and Service Levels workstream. John can be contacted on 0410 539 539, or via e-mail at john.gordon@transport.vic.gov.au

The ARRB project manager is Mr Adam Ritzinger, Engineer within ARRB’s Freight and Heavy Vehicles team, who is managing the jurisdiction consultation process, and collating jurisdiction responses. Adam can be reached on (03) 9881 1529, or via e-mail at adam.ritzinger@arrb.com.au.
## RESPONSE SHEET

<table>
<thead>
<tr>
<th>Topic</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network performance indicators and road quality measures</td>
<td></td>
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<tr>
<td>Road network hierarchy and functionality</td>
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