

IMPROVING REGULATION OF HEAVY VEHICLES: PERFORMANCE-BASED STANDARDS

Fiona Calvert

National Transport Commission

Level 15, 628 Bourke Street, Melbourne, Victoria, 3000, Australia. Tel: +61 (0)3 9236 5036.

E-mail: calvertf@nrtc.gov.au

ABSTRACT

Prescriptive rules for the size, mass and configuration of heavy vehicles only roughly control their safety and infrastructure impacts. They also limit flexibility about how to achieve the desired safety and infrastructure outcomes and the level of responsibility vehicle operators have to take in ensuring these outcomes are achieved.

Australia has been working to develop a performance-based regulatory approach to controlling heavy vehicle impacts.

This new regulatory system comprises standards to control:

- safety risks associated with the ability of vehicles to start, stop, turn and fit on roads;
- pavement, surfacing and bridge impacts; and
- environmental and amenity impacts.

Alongside these standards, a system is being developed of administering the performance standards and ensuring they are achieved once vehicles are using the road system. The Performance-Based Standards (PBS) approach will rely on performance assessments that consider the risks involved, and identify appropriate operating conditions and compliance verification requirements that will ensure the standards are met. Vehicles and operators will need to be separately certified to show they can meet the requirements of a PBS approval, with multiple vehicles and operators able to operate under the one approval. A number of checks and balances have been included in the regulatory framework to clarify the role of governments and ensure their accountabilities are adequately addressed.

Community acceptance is vital to the success of PBS. This is why much attention has been directed to ensuring a results-oriented approach to compliance is incorporated. It is also why a higher level of environmental and amenity outcomes have been built into the requirements.

The PBS approach is expected to result in improved safety, infrastructure protection, environmental and amenity outcomes, while also providing potential for innovation and productivity improvements.

INTRODUCTION

This paper provides an overview of the Australian initiatives to develop a performance-based approach to regulating heavy vehicle use. This approach is being developed as an alternative to prescriptive limits on mass, dimension and vehicle configuration. It was initiated jointly by the Australian National Transport Commission (formerly the National Road Transport Commission) and Austroads, the collegiate association of Australian and New Zealand road agencies.

A performance-based approach to regulation is seen as the way forward in Australia, in response to:

- continuing pressures for marginal relaxation of prescriptive rules, often in 'special' circumstances;
- a proliferation of localised and more widely available exemptions, and requests for exemptions, from general rules;
- limits in the 'spare' capacity remaining in some parts of the road network;

- the need for more flexible regulations that take account of innovations and technological changes without the need for continuing specific reviews and revisions;
- recognition of the significance of transport activity to Australian society and economic well-being; and
- responding to the rapid growth in the freight task, as illustrated in Figure 1.

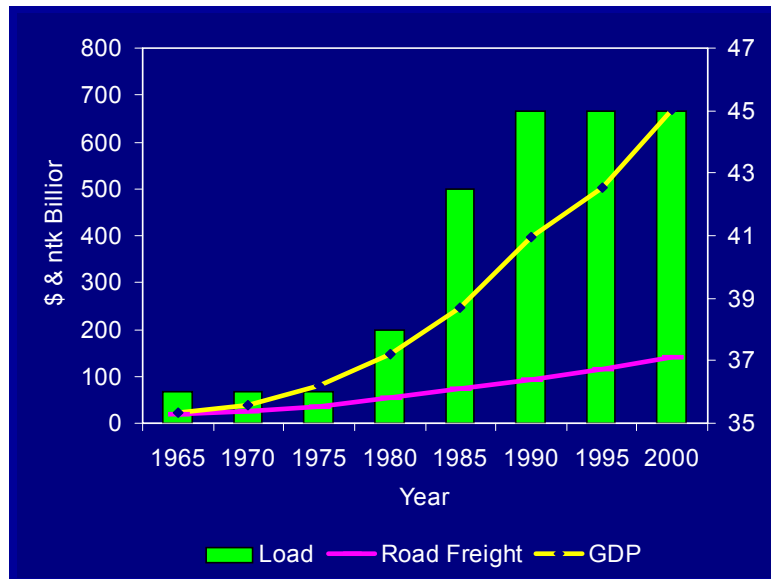


Figure 1. Growth in the Australian domestic freight task.

LIMITS OF PRESCRIPTIVE REGULATIONS

There is considerable evidence from both Australia and work in other countries that prescriptive rules on mass, dimension and configuration do not guarantee that vehicles will perform in a sufficiently safe manner or that road and bridge infrastructure will be adequately protected. This is because prescriptive rules are only rough proxies for the outcomes desired. They specify vehicle characteristics that will generally produce adequate performance, but may not always do so.

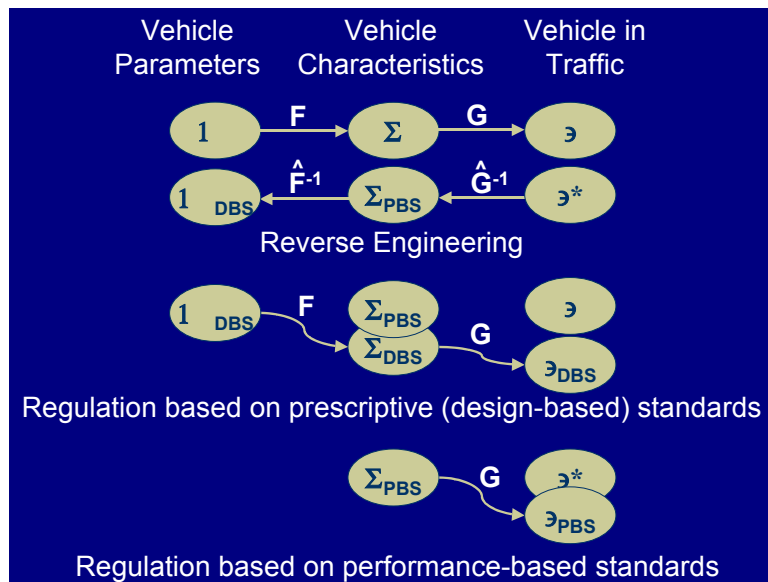
For example, it is generally agreed that it is important that vehicles be able to make a low speed turn in the available space. If they are not able to do this, they pose a safety risk to other road users, and to people and infrastructure on the roadside. Length limits on motor vehicles, on trailers and on combinations of motor vehicles and trailers are imposed under the prescriptive rules in order to attempt to ensure that vehicles are able negotiate turns.

However, a number of factors, not just length of the units and combination, affect the amount of space taken up by a vehicle in a turn. Wheelbases, the presence and features of steerable axles, the position of king pins and other factors all have an influence on this aspect of a vehicle's performance. Consequently, there is not a one-to-one match between prescriptive rules centred on vehicle design and the performance the vehicle should be able to achieve.

Kulakowski¹ described this mathematically in his presentation to the International Seminar on Performance-Based Standards in Melbourne 2003², as shown in Figure 2. He suggested that under prescriptive rules there are two sets of transformations that must be made to match the standards and what is required, providing a large potential for error. Under performance-based standards, only one set of transformations is required, and a closer match between actual and required outcomes is more likely.

¹ Kulakowski, B (2003) 'Performance-Based Standards — The Time Has Come', *International Seminar on Performance-Based Standards*, National Road Transport Commission, Melbourne, February 2003.
<http://www.ntc.gov.au/FileView.aspx?page=A02303405400250020>

² Convened by the International Forum for Road Freight Technology and hosted by the Australian National Road Transport Commission and New Zealand Land Transport Safety Authority.



Source: Kulakowski 2003.

Figure 2. Mathematical representation of prescriptive versus performance standards.

Under prescriptive regulations derived in this way, it is difficult, although not impossible, for regulations to be formed as anything other than a one-size-fits-all approach. What is suitable for one part of the road network will impose an unacceptable risk on other parts of the road network, and what is the minimum appropriate for some parts will leave untapped significant levels of potential additional capacity in other parts of the road network. Without a good understanding of the second set of transformations in Kulakowski's description, that is, the relationships between performance characteristics of vehicles and outcomes in traffic, these risks and the potential for additional capacity in some locations cannot be addressed.

In most cases the prescriptive rules have not been developed with compliance outcomes in mind, nor alongside mechanisms for enforcement. For example, limits on bridge loadings are set in Australia on the assumption that some vehicles will not comply with the limits. Therefore a substantial allowance for vehicles being overloaded is built into the analysis of bridge capacity.

A further limitation of prescriptive rules is that as they are not directly linked to the outcomes they seek to ensure, the intent of the rules can become, and often is, obscured.

This leads to two problems:

- it reduces the likelihood that trucks and buses will comply with the requirements as they are not clear why they need to do so³; and
- regulators and politicians are inclined to allow changes to the rules as the impacts are unclear and it is therefore hard to justify why any particular limit should be set.

One of the major drawbacks of prescriptive rules is that each time a technological development occurs or someone develops an innovative approach to vehicle design, the rules need to be reconsidered. This is a particular problem in Australia where there is a tradition of innovation in vehicle design. Combined with the wide variations in road and traffic conditions between remote parts of Australia, rural agricultural and secondary industry areas and urban developments, this leads to constant calls for revisions to prescriptive rules or exemptions to be granted for special circumstances or freights.

³ There is a significant literature in regulatory theory indicating this is a significant factor in non-compliance. See, for example, Parker 2000.

AUSTRALIAN INITIATIVE TO DEVELOP A NEW REGULATORY APPROACH

As a result of the pressures described above and limitations associated with prescriptive rules, in 1999 Australia embarked on a major initiative to develop a performance-based standards (PBS) approach to regulating heavy vehicles. This approach is to operate as an optional alternative to prescriptive rules on mass, dimension and configuration. Other elements of the regulatory system, such as vehicle lighting, braking and other design requirements, vehicle registration and driver licensing arrangements will continue to apply.

The approach is based on a policy framework that was agreed by Australian transport Ministers early in the development of the approach. Key among these was that the PBS approach is to be optional, at least in the initial phases while the approach is proven. This is in part because the impacts of excluding vehicles from the road system that have had ongoing access rights for a long period without clear evidence of a safety problem, would be difficult to manage. It is also because a shift to regulations based on performance outcomes rather than prescribing inputs poses a significant adjustment and challenge to many of those affected, including the broader community.

Another key aspect of the policy framework for the PBS approach is that vehicle requirements are to be matched with road and traffic conditions in which the vehicle is to operate. This is in order to extract the most out of the available capacity within different parts of the road network while also minimising risks of adverse outcomes occurring⁴.

WHAT IS CONTROLLED

A national set of safety and infrastructure protection performance standards, comprising performance measures and performance thresholds, has been established. These standards will form the criteria for establishing whether proposals for vehicle operations are suited to operate under PBS approach.

Safety standards

The safety-related performance standards include standards to control:

- interaction with other traffic
- the amount of road space required for various manoeuvres; and
- stability.

They require the vehicle to be able to turn, travel in a straight line, brake and perform emergency manoeuvres in a safe fashion.

These standards require a higher degree of safety from PBS vehicles than many existing vehicles in exchange for greater flexibility in vehicle design. Vehicles currently able to operate under prescriptive rules and various permit arrangements, such as road trains operating in remote parts of Australia, are not affected by the standards.

Infrastructure protection standards

The infrastructure protection standards ensure that PBS vehicles cause no more road or bridge wear than their prescriptive equivalents. They control vertical and horizontal pavement loads, tyre pressure and bridge loadings. Further work is needed to improve the understanding of horizontal pavement loads and tyre contact pressure distribution to move to full performance standards for these factors, which will be controlled by prescriptive proxies in the interim.

Noise and emission standards

The national set of safety and infrastructure protection performance standards is to be accompanied by additional standards for noise and emissions, the details of which are still under development. These additional standards will ensure that PBS vehicles are quieter and cleaner than other heavy vehicles.

⁴ The full set of policy principles underlying the PBS approach is available in NRTC 2001.

The noise and emission standards will require vehicles to demonstrate they meet either the most recent standards applicable in Australia or do better than the older standards currently in place. Obligations to take steps to ensure these requirements are met in an ongoing manner are also central to the proposals.

HOW THESE CONTROLS ARE TO BE APPLIED

Description

The regulatory framework for applying the performance standards is not yet finalised, but is now well developed. It embodies four separate phases, as illustrated in Figure 3. The underlying concept is that vehicles will operate under a PBS approval. This approval provides in-principle permission for a PBS operation to occur. Vehicles and operators will then need to be certified to operate under the approval. Multiple vehicles and multiple operators can operate under the one approval.

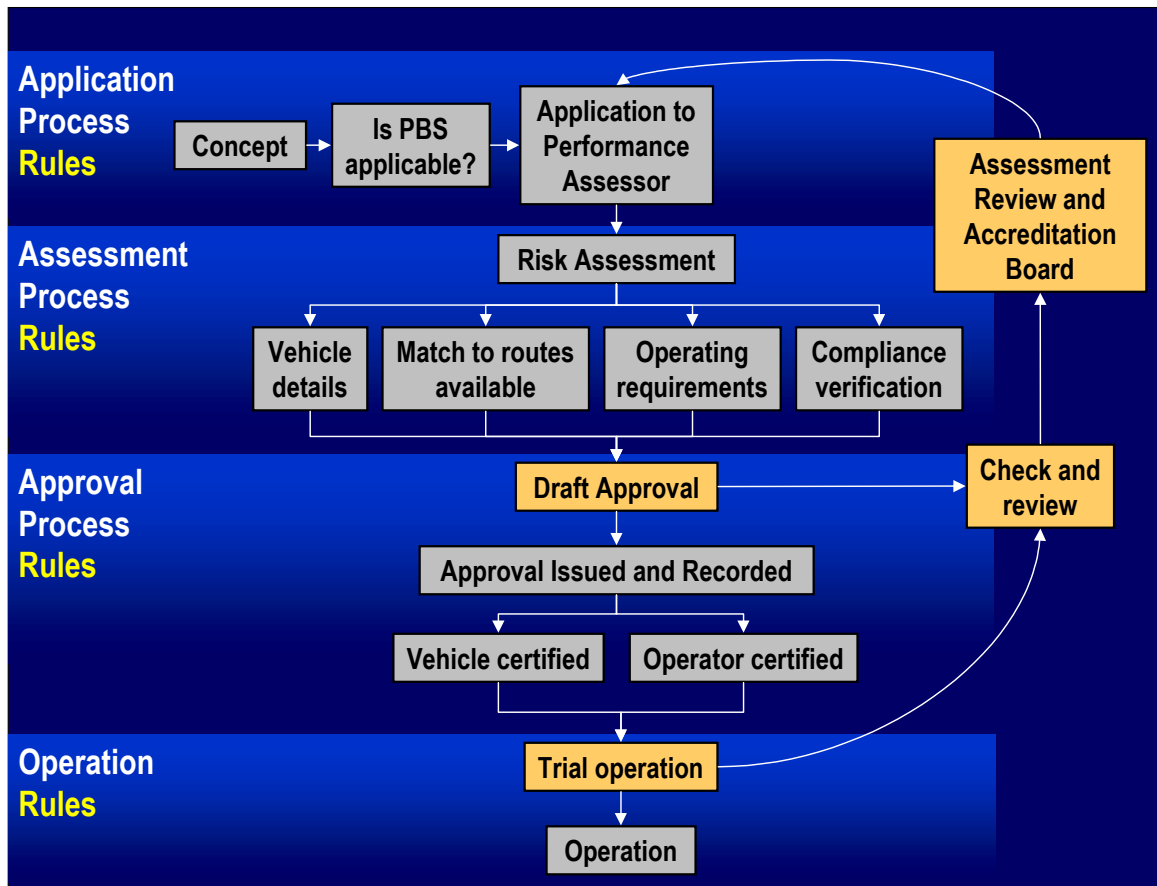


Figure 3. Regulatory framework for applying performance standards.

It is intended that anyone be able to apply for a PBS approval in the first phase of the process. This approval would set out how, and where, a vehicle configuration(s) would be operated. By allowing anyone to apply for an approval, vehicle manufacturers, industry associations and government departments will all be free to put forward a proposal for a PBS operation, and later pass on the rights to operate under this approval to whomever they wish, either freely or on a commercial basis.

An accredited performance assessor, who will normally be a third party contracted by the applicant, will undertake the assessment. This is the second phase of the process. Performance assessments will be supervised and audited by an Accreditation Review and Audit (ARA) Board. This body is likely to be a collegiate of the various road agencies in Australia. The performance assessment will be a risk-based process. It will not only check that a proposed PBS operation meets the required performance standards, but will also identify a series of requirements that provide solid guarantees that the operation continues to meet these standards once a vehicle is out on the road system.

These requirements will include:

- the vehicle details that should be checked to ensure that a physical vehicle is consistent with the approval
- any specific route restrictions that should apply within the (for example, as a result of bridge loadings produced by the operation, or to minimise risks of overtaking crashes as a result of the length of the combination); and
- the appropriate operating conditions that will ensure the vehicle in operation is consistent with the performance standards.

The operating conditions will comprise two parts:

1. Operating requirements such as
 - a) what type of load is to be carried, to ensure the centre of gravity is not so high that the vehicle does not meet the performance standards relating to stability;
 - b) how the load must be distributed across the vehicle's axles to ensure it meets the pavement vertical loading standard;
 - c) requirements for particular maintenance activities to occur to ensure the vehicle continues to perform as originally envisaged; or
 - d) requirements for prime movers and trailers to be connected in a particular order, for multi-trailer combinations.
2. Compliance verification requirements that set out how compliance will be ensured, taking account of the risks of not meeting the operating requirements, in terms of both likelihood and impacts.

These requirements will ensure that where the risks of non-compliance are high that the approach provides solid guarantees that compliance will be achieved, and equally where these risks are low, lower cost enforcement approaches can apply. For example, where it is vital that a vehicle stays on the approved routes, real-time location monitoring may be required. Where this is very important, but not as vital, automated location monitoring with regular reporting of any instances where the vehicle uses the wrong route would occur. Where location was not significant, normal on-road observation and checking by enforcement officers would be sufficient.

Phase three of the process will see a draft approval checked by the ARA Board, and is satisfactory, an approval will be issued. Vehicles can then be certified as meeting the requirements of the approval and operators can be certified to show that they have in place the necessary management systems to meet the operating conditions, in particular the compliance verification requirements.

It is only when all this has been done that a vehicle would be able to be operated. This forms phase four of the process. Initially all PBS operations will be monitored for a fixed length of time so that if problems occur the ARA Board can adjust the operating conditions or review the assessment process. Over time, not all PBS operations are expected to go through this monitoring process, as confidence in the system builds. However, more sensitive or more unusual vehicles will continue to have a monitoring period. After the monitoring period is complete and any adjustments made, full PBS operations will begin.

Key features

The approach outlined contains a number of checks and balances to ensure that PBS operations are tightly controlled. Opportunities for road agencies to have direct input to and oversight of PBS decisions have been provided. This ensures that they can be confident their responsibilities for managing access to the road network have been met, while providing a mechanism that ensures PBS decisions will be made consistently and can therefore be automatically recognised by all States and Territories through mutual recognition arrangements. This latter feature is of particular importance to the transport industry, who have struggled for years to provide cross-border or multi-jurisdictional services due to inconsistent rules and lack of mutual recognition arrangements.

Another key aspect of the approach is that a range of mechanisms has been sought to ensure that access to PBS is as widely available at as low a cost as possible. This constantly needs to be balanced by the need for a high level of confidence in the outcomes achieved. Some suggestions have been made that once a PBS approval has been issued, it should be available to all operators, free of charge, to utilise. Intellectual

property considerations, along with the need to retain some incentives for individuals to invest in the research and development necessary to establish innovations, have dictated that this approach is not possible.

The approach is intended to provide as much flexibility as possible to PBS proponents. At the end of the day it will be up to individual operators to determine how much flexibility it is worth their while to pursue. Operators might find that to achieve the productivity outcomes they seek they need to use a particular brand of components such as tyres to achieve the required performance outcomes. They will need to assess whether the restrictions this places on their operations and maintenance practices are too onerous.

Similarly, while PBS operators will not be prevented from on-selling PBS certified vehicles, the rights to operate under a PBS approval will not automatically flow to the new owner. The new owner will need to be separately certified as a PBS operator in order to use the vehicle under the PBS approval. Some vehicles will not be able to be legally operated outside of a PBS approval, further limiting their re-sale potential. Lastly, PBS vehicles may have route restrictions, such as those that are approved for Level 2, 3 or 4 routes. New owners, even if certified to operate under the appropriate PBS approval, will still be restricted in where the vehicle can operate. All of these factors suggest that the re-sale value of PBS certified vehicles may be lower than comparable vehicles under the prescriptive regulatory regime. PBS applicants will need to weigh these factors against the productivity gains they are able to achieve through the increased flexibility the PBS approach provides.

COMMUNITY ACCEPTANCE

Community acceptance has proven to be a major issue in the establishment of the PBS approach. Australia has a highly urbanised society, with high expectations of the quality of life that will be possible. As a result, there is significant community concern about freight vehicles, their impact on urban amenity and their perceived safety. Initiatives to allow broad access to larger, heavier vehicles have met with significant community and political resistance. In some areas, changes to road infrastructure (such as the introduction of tollways) or industrial developments have led to significant increases in truck traffic on particular roads which have been met by strong opposition from local community groups. Road agencies are particularly conscious of this and some have pushed strongly for the PBS approach to include measures to counter these concerns.

In response, the National Transport Commission has done three things:

- noise and emission standards have been included in the proposals to ensure that PBS vehicles are quieter and cleaner than other vehicles;
- safety standards have been set so that, collectively, they mean that PBS vehicles will be safer than vehicles that meet the current prescriptive rules; and
- compliance verification arrangements are being designed so that there can be a high level of confidence that PBS vehicles meet their requirements, regardless of the presence or absence of on-road enforcement.

At the same time, the local government sector is being involved in the task of classifying roads that they are responsible for managing to assess which level of PBS access is appropriate to the local conditions. This includes the need to adequately plan for freight vehicle access in considering the function of different roads and planning land use. As local governments work most closely with local communities, engaging local government in the acceptance and application of PBS is an important part of the process of engendering broader acceptance of the approach.

EXPECTED OUTCOMES

The PBS approach is expected to result in improved safety, infrastructure protection, environmental and amenity outcomes, while also providing potential for innovation and productivity improvements. Initial estimates based on conservative analyses suggest that the benefits will significantly outweigh the costs of the approach, although the costs of the regulatory framework have not yet been fully established (NRTC 2003, Austroads 2003).

Conservative estimates of the benefits have been based around adoption of additional axle groups, redistribution of mass across axles and some minor configuration changes. It is likely that specialist applications will be developed in response to specific needs. The benefits of these may be substantial, but are difficult to estimate as they are unknown.

Safety and environmental benefits have not been significantly factored into the formal estimates of benefits produced to date. However, these are expected to be substantial for those vehicles that move into the PBS system. As the approach is intended to operate as an optional alternative, many of the poorer performing vehicles are expected to continue to operate for the time being under the prescriptive rules. This reduces the overall safety and environmental benefits from that which would apply if all vehicles operated under the PBS regime.

A major issue of concern in some quarters is the impact of the approach on modal share. Some argue that making road freight movements more productive will attract freight away from rail, and that this is an inappropriate outcome. Others suggest that the PBS approach may reduce the costs of intermodal transfers and shifting of freight to rail heads more attractive, thereby increasing the attractions of use of rail freight. The outcome will, of course, be highly dependent on the innovations that emerge.

REFERENCES

1. ARTSA (2003), PBS Explained: Performance Based Standards for Road Transport Vehicles, Issue 1 September 2003, Australian Road Transport Suppliers Association, Melbourne. http://www.artsa.com.au/PBS_Explained_Sept_03.pdf
2. Black J, (2001), 'Managing Discretion', proceedings of the Australian Law Reform Commission Conference, Penalties: Policy, Principles and Practice in Government Regulation, Dockside, Cockle Bay Darling Harbour, Sydney, June 7 2001.
3. Kulakowski B (2003), 'Performance Based Standards: The Time Has Come', Proceedings of Performance Based Standards International Seminar, NRTC, Melbourne, Feb 10-12, 2003, <http://www.ntc.gov.au/FileView.aspx?page=A02303405400250020>
4. Borbely, C.L., Gilks, G. and Pearson, J. (2000). Challenges to using performance criteria as a basis for vehicle weight and dimension regulations. Proceedings of the 6th International Symposium on Heavy Vehicle Weights and Dimensions, Saskatoon, Canada, June 18-22, 2000.
5. Drahos P and Braithwaite J, (2000), Global Business Regulation, Cambridge, Cambridge University Press, pp 476-477.
6. Edgar, J. (1995). Regulating Heavy Vehicle Safety in New Zealand using Performance Based Standards, Road Transport Technology-4, UMTRI, Ann Arbor, MI, USA.
7. NRTC (2000b) Specification of Performance Based Standards and Performance of the Heavy Vehicle Fleet, Performance Based Standards-NRTC Austroads Project A3 and A4, Discussion Paper, prepared by ARRB Transport Research, Pearsons Transport Resource Centre, Phillips Fox, Economic Associates, Woodrooffe & Associates, Transport Engineering New Zealand, August.
8. NRTC (2001), Performance-Based Standards: Policy Framework for Heavy Vehicle Regulation Regulatory Impact Statement, NRTC, Melbourne.
9. NRTC (2002). Performance Characteristics Of The Australian Heavy Vehicle Fleet, Working Paper, Available at <http://www.nrtc.gov.au>
10. NRTC (2003), Performance-Based Standards: Regulatory and Compliance Processes Discussion Paper, NRTC, Melbourne.
11. NRTC (2003b), Performance-Based Standards: Phase A Standards and Measures Regulatory Impact Statement, prepared by Economic Associates P/L, Pearsons Transport Resource Centre P/L, RT Dynamics P/L, Project Managed by: ARRB Transport Research Ltd, NRTC, Melbourne.
12. OECD, (2000), Reducing the Risk of Policy Failure: Challenges for Regulatory Compliance, OECD, Paris.
13. Parker C, (2000), 'Reinventing Regulation within the Corporation: Compliance-Oriented Regulatory Innovation', Administration and Society, 2000:32:5:529-565.