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ARE PERFORMANCE STANDARDS OVER-RATED

by R A Pearson

ABSTRACT

Performance standards for road vehicles, the drive to focus on outcomes rather than prescriptive regulations, have gained increasing prominence in the last decade. However, strong supporters of introducing performance standards argue that the pace of change has not been fast enough, that more needs to be done to make heavy vehicle regulations more outcome oriented.

One of the difficulties of performance standards for vehicles is that they would regulate only one aspect of the total environment. Major influences on vehicle performance such as the road environment and driver skills are either ignored or simplified. The major productivity advantages of mass and dimensions (with the possible exception of vehicle height) are unlikely candidates for performance standards. Is all the effort worth it?

This paper examines the role of performance standards in modern regulatory policy in Australia. It examines a range of issues relating to performance standards, including candidate regulations and advantages and disadvantages.

This paper is aimed to stimulate debate on this important subject.

INTRODUCTION

Performance standards have gained increasing prominence in the 1990s. Modern regulatory practice recognises that focussing on outcomes is preferable to prescriptive measures. In other words, the desired outcome is specified leaving (in this case) the road transport industry to determine how to achieve the outcome rather than determining that only one means to achieve the outcome is allowable.

The author has not researched all world regulations, but the most common use of performance standards are in design standards for new vehicles and in some isolated examples for in-service and permit regulations.

Many new vehicle standards specify the performance the vehicle manufacturer must achieve during design and manufacture. Examples include:

- emission standards;
- occupant protection;
- side impact intrusion; and
- braking standards.

In-service standards are more rare, with examples being:

- equivalence to air for single axle drive loads in Europe;
- additional gross mass for permit vehicles in New Zealand; and
- load security devices in Australia.

The Canadian Vehicle Weights and Dimensions study (RTAC 1986) used performance measures as the basis for regulation. This approach is a common method used in many countries, even if not as specific as the Canadian example. However, it seems that moves are underway to introduce performance standards directly into regulation rather than simply as a basis for regulation. The author believes this approach has its drawbacks, and this paper attempts to place performance standards in their proper perspective.

CANDIDATE REGULATIONS FOR PERFORMANCE STANDARDS

Road vehicle regulations are imposed for reasons of infrastructure management, environmental protection and by far the largest category, public safety.

Regulations to protect the environment

Environmental protection or emissions regulations have gained increasing prominence in recent years and are therefore relatively new. Emission standards limit the amount of various gases, particulates and noise which may be emitted from a vehicle.

New vehicle standards for gaseous and particulate emissions are complex performance measures aimed at new vehicles and tested in laboratories. In motor cars, emission controls have seen the end of hand adjusted chokes and the domination of computer controlled emissions, while truck technologies to deal with emissions are more advanced. However, these complex performance measures have not been translated into in-service regulations which remain much less sophisticated performance measures, as in Australia at least it is apparently not possible to test whether the vehicle meets the new vehicle requirements. The in-service performance standard in parts of Australia suggests that smoke should not be emitted for more than 10 seconds. This particular standard is strenuously opposed by sections of industry who claim new vehicles could contravene the in-service regulation.

The new vehicle standards for noise in Australia deal both with stationary and drive by noise emissions, which are much more easily tested provided a judgement (tolerance) is allowed for prevailing noise in the in-service test. One non-standard statement in the design rule is that '*the surface of the test track must be such as not to cause excessive noise*'. The vehicle is also tested unladen. Both these requirements provide significant variations from in-service conditions.

Regulations aimed at infrastructure management

Infrastructure management regulations are some of the oldest, with mass and dimension limits the major regulatory areas. Elements of mass and dimension limits also impact on public safety as highlighted whenever proposals for increases are debated.

Much has been researched and written about vehicle swept path performance, and removal of internal dimension limits are certainly candidates for replacement by a swept path performance measure. However, the major dimension limits are length (overtaking), height (bridge clearance and vehicle stability) and width (capacity and passing safety). These limits are critical for vehicle productivity but less likely candidates for performance standards, particularly width and length. Take, for example, length. It is difficult to accept that an alternative to length limits could be devised. One possibility might be:

> The length of a vehicle travelling at 90km/h on a flat level road must not prevent the overtaking in ‘t’ seconds by a motor car of ‘p’ power and ‘f’ frontal area, starting from 90km/h, accelerating at ‘a’ m/sec^2 and finishing at 110km/h.

Mass limits are even more complex. The individual limits on axle groups are critical for short span bridges, while closely spaced axles are critical for longer span bridges. Do we suggest that a vehicle must not impose a bending moment of greater than ‘m’ kN on a bridge built between 1948 and 1976? I think not. Nor can I envisage that a truck must not exceed ‘n’ ESA per year on chip seal pavements and ‘p’ ESA per year on asphalt pavements. Anyway, the economic rationalists would suggest that charging for road use obviates the need for mass regulations — simply charge for the use the operator makes of the roads and bridges.

Performance standards for height could be devised but require a starting point. One proposal in Australia suggested that vehicle height could be increased if the static roll stability was no worse than the same vehicle at its presently allowed height. This proposal was overlooked for a height concession if the vehicle had a static rollover threshold of 0.35g or less.

Regulations for public safety

Public safety is by far the largest category of road regulations, dealing with:

- traffic regulations or rules of the road;
- driver fatigue;
- occupant protection; and
- aspects of vehicle performance.

It is difficult to see the plethora of road rules changed to their performance standards backbone — don’t crash into another vehicle. Why should we drive on a particular side of the road, limit our speed and stop at red lights? These are all prescriptive measures.

Many countries limit hours of driving as a surrogate for limiting fatigue in heavy vehicle drivers (but not, of course in light vehicle drivers). A performance standard for driver fatigue is relatively simple — do not drive while fatigued. But how does one measure fatigue, or even what is it? In the Australian State of Queensland, the Fatigue Management Program trials have shown the difficulties of performance standards for human fatigue, despite the huge resources and world-wide interest.

Occupant protection is achieved by a combination of performance standards and prescriptive standards. Many new motor cars are now fitted with side intrusion bars and energy absorbing front ends, all built to performance standards. But many occupant protection measures still rely on the prescriptive standard that the occupant must wear a seat belt if it is fitted.

The final group deals with aspects of vehicle performance, a subject which has been the subject of significant study. An eloquent discussion of performance standards for configuration of heavy trucks (Billing 1992) listed seven candidate manoeuvres for safety and capacity. The candidate manoeuvres were:

- acceleration from a stopped condition;
- driving on a straight level road;
- driving on a grade;
- low speed turn;
- high speed turn;
- high speed obstacle avoidance; and
- braking.

Billing identifies seventeen performance measures for these manoeuvres, some of which were presently specified by the equipment purchaser and some under the control of highway authorities. He went on to conclude that:

> ‘If trucks are to be configured using performance standards, then a complete set of standards will be necessary to ensure truck design does not diverge in directions where the set is incomplete.’

Conclusions on candidate regulations for performance measures

The discussion above leads to the view that very few major road regulations are candidates for replacement of prescriptive regulations with performance measures. It would appear that only some dimension limits and aspects of vehicle performance are in that category. Let us now consider these issues in more detail.

PERFORMANCE STANDARDS FOR VEHICLE PERFORMANCE

The seven candidate manoeuvres identified by Billing (1992) were:

- acceleration from a stopped condition;
- driving on a straight level road;
- driving on a grade;
- low speed turn;
- high speed turn;
- high speed obstacle avoidance; and
- braking.

Of these seven, only braking is at present regulated by performance standards, while performance on a low speed turn is the basis for internal dimension limits or swept path performance standards. Some vehicles are regulated by minimum power/weight ratios which affect the first three of Billing’s list, but power/weight ratios are clearly prescriptive rather than performance standards. The maximum speed is regulated, but otherwise minimum power/weight ratios are imposed not as a direct safety measure but to avoid overtaking by frustrated following motorists.

Low speed turning is capable of a performance measure as noted earlier. The remaining two measures are high speed turn and high speed obstacle avoidance. In either manoeuvre, the rear wheels of a vehicle combination may track outside the path of the remainder of the vehicle or the vehicle may overturn. Both events are clearly safety related.

Two issues appear unresolved at this time with both of these measures:

- what is the level (the thin black line) above which vehicles should not be permitted; and
- how is the level to be measured.

Some erudite papers have been published on both manoeuvres, particularly the Canadian Vehicle Weights and Dimensions Study (RTAC 1986) which used baseline measures of 0.4g for static rollover and 0.46 m for high speed offtracking. A National Road Transport Commission Study (NRTC 1993) compared the performance of the Australian truck fleet. No study has given definitive answers to the appropriate level.

Even if an acceptable level is determined, how would they be measured. The cost of full scale testing has led to greater use of computer simulation. However, simulation models require many inputs, including specifications for tyres and suspensions. Even if inputs can be set at agreed values, do all computer models predict the outcomes for a wide range of vehicles with sufficient accuracy?. It appears form the work of Element 4 of the DIVINE (OECD 1997) project that divergence of results from different models is likely.

ADVANTAGES AND DISADVANTAGES OF PERFORMANCE STANDARDS

The main advantage of performance standards are that they focus on outcomes and therefore provide opportunities for innovation. There can be no doubt that the road transport industry can be innovative, driven by the competitive nature of the industry.

Another advantage is that regulations can be condensed. Performance standards would occupy far less space than prescriptive regulations designed to meet the same results.

However, there are also disadvantages. The most quoted disadvantage is difficulty of on-road enforcement. Police and other enforcement officers could not be expected to measure swept path or static roll stability. History shows that the oldest performance measure, maximum distance to brake from a given speed, has rarely if ever been checked in the field. Alternative method of compliance would need to be developed.

Cost is another issue. The cost for the transport industry to determine if particular designs meet the standards would rise. Whether this cost increase is a barrier is yet to be determined, but would almost certainly preclude smaller operators pursuing innovation.

Indeed, the cost would have to be measured against the advantages for safety, the environment and infrastructure management. From a safety perspective, Australian crash studies have not placed vehicle performance high on the list of countermeasures. The most detailed recent Australian research into heavy vehicle crashes, the New South Wales Heavy Vehicle Crash Study (Sweatman et al 1990), listed 18 significant countermeasures to reduce crashes. Of these 18 countermeasures:

- 5 related to road improvements;
- 4 related to drivers;
- 4 related to vehicle crashworthiness (eg frontal design);
- 2 related to enforcement;
- 1 related to education;
- 1 related to load security; and
- 1 related to maximum truck speed.

The load security issue is of interest. New national Australian regulations prescribe performance measures for load security devices. As a consequence, significant research into present securement methods has been undertaken and deficiencies exposed. Another outcome, however, has been that a very detailed book has been produced to explain to industry how to meet the performance requirements. The original regulation is several lines, the book is several hundred pages.

DISCUSSION AND CONCLUSIONS

The main influences on road safety are the road environment the skill of the driver and the vehicle attributes. It can be argued that the driver is the most important of all. For example, if a vehicle has a low static roll threshold, the driver will corner at a lower speed. This is self evident, otherwise all vehicle roll-overs would be livestock vehicles and none would be modern tankers, which of course is not borne out by crash statistics.

The road environment includes the standard of the road itself and the prevailing weather conditions. If the driver is skilled, the main effect of a less safe road environment is lower transport efficiency caused by lower speeds.

Safer trucks are clearly preferable. The move to specify performance standards for vehicles appears to arise from:

- the logical regulatory approach to focus on outcomes; and
- the increase in availability and sophistication of computer simulation models.

Given the limited number of candidate regulations for performance measures, it appears the first could not exist without the second unless expensive full scale testing was carried out. Further the focus on performance standards could in part be driven by the availability of relatively cheap analysis methods.

The author believes caution is necessary in the march towards specifying vehicle performance targets for the following reasons:

- vehicle performance depends upon, inter alia, configuration, freight carried, mechanical specifications and maintenance, and more work is necessary to establish appropriate levels for performance standards;
- standards for validation of computer models need to be developed;
- alternative methods of checking on-road compliance must be developed and tested; and
- the outcomes for road safety do not justify significant resources committed to the preparation of performance standards.

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Bob Pearson is Managing Director of the Melbourne based consulting firm Pearsons Transport Resource Centre. Bob holds an engineering degree from Melbourne University and is one of Australia's most experienced road transport policy maker with 22 years experience in road transport policy and regulation. For 4 years, Bob was Director Technical Standards at the National Road Transport Commission and during that time instigated the Mass Limits Review, and chaired the Steering Committee for that project. He had a major role with introducing B-doubles into Australia and has worked on many major policy and productivity studies including the Review of Road Vehicle Limits Study, the NSW Heavy Vehicle Crash Study and the Western Australian Road Train Access Study.

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