

The Prospective Cost-Effectiveness of Safety Enforcement Measures for the Long-Distance Road Transport Industry in Australia: with Observations from North American Experiences

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Abstract:

This paper investigates the cost effectiveness of safety compliance and enforcement measures in the road freight industry. Possible measures include audits of road transport firms' safety procedures, roadside inspections, inspections at vehicle checking stations, other regulation such as driver licensing, voluntary self-regulation schemes, and schemes which link together the information from all of the above schemes. While such safety measures are expensive to administer and impose significant compliance costs on industry, the issue is whether they confer safety benefits which exceed these costs, especially if they could be targeted towards those individual firms, drivers or trucks most likely to cause accidents. The beginnings of such systems are already in place in the USA and Canada. The paper reviews this North American experience, and speculates on the scope for improvement in cost-effectiveness through integration of separate safety-related data bases and the introduction of computerised systems which recommend appropriate safety checks.

Disclaimer: The views expressed in this paper are those of the authors and do not necessarily represent those of the BTCE, nor the University of Sydney or the University of British Columbia.

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Introduction

This paper is about prospective new safety compliance and enforcement measures in the road freight (or trucking) industry. By compliance and enforcement we mean measures which encourage or ensure the adoption of safe driving procedures and behaviour.

New safety measures need to be cost-effective in order to justify their introduction.

They probably also need to be visionary in their approach, at least in their initial stages, because we sense that established safety measures are maturing and contributing decreasing marginal benefits. But ultimately it needs to be proven that new safety measures are workable and do achieve significant further improvement in road safety.

Some elements of our vision of what it will take to achieve a significant reduction in the number of deaths and injuries on the roads in accidents involving trucks include:

- wholehearted Government involvement and industry participation at all levels;
- possibly unprecedented supervision of truck driving — “big brother will be watching you” which, it may be argued, will conflict with civil liberties and rights of industrial democracy. Such conflicts must somehow be resolved if we are to improve trucking safety;
- extensive coordination and cooperation among Governments to obtain and share information pertaining to truck driving safety;
- significant improvements in the capability of monitoring technology, and an increase in its use;
- considerable attention to the management of truck driver fatigue, stress, drug taking and general safety fitness;
- inducements for, and voluntary compliance with, safety regulations; and
- proven linkages between safety outcomes and compliance with safety regulations

Visions are all very well, accidents are very costly and we would like to have less of them, but we cannot at this stage, state categorically that this visionary safety system should or will become a reality. Because, we don't know how much it would cost, how much each element of the system contributes towards an improvement in safety, what overall results the system will deliver, or whether there are alternative safety measures which constitute an even better vision. A contrary vision may be of just as many accidents, with the road freight industry bound up in red tape, despite considerable expenditures of money and effort. A lot of money we don't have, and we would like to expend our efforts on systems that prove to be effective.

How should we proceed to make a vision the future reality? In what follows, we consider where attention should be focussed in the search for more cost-effective safety measures; we relate this focus to the present state of affairs in safety regulation, and an analysis of what causes accidents and how they might be prevented. We then explore whether there is any experience with the safety measures on which we focus in the USA and Canada. The experiences of these countries, to the extent that they are ahead of us, can help us both to avoid their mistakes and to find out what works in practice.

Where should attention be focussed?

Why focus on safety through compliance and enforcement in truck driving? It is recognised that general measures such as better roads, better vehicles, speed limits, random breath testing and compulsory seat belt wearing have a beneficial effect on truck safety in particular, as well as on the general safety of road use. Despite considerable progress in the application of such general measures however, accidents continue to happen. We hypothesise that the cost effectiveness of searching for further improvements in general safety measures may be declining, as the more obvious solutions are found and it becomes more difficult to progress further. Moreover, further improvements to some components of the road transport system may not help if other components are the more directly the cause of accidents.

There is substantial evidence that we need to focus on driver behaviour and the pressures on the driver emanating from the supply chain. For example, Sweatman and others 1990 (p 250) find that up to 60 per cent of truck crashes could involve some element of driver fatigue, and up to 40 per cent could involve excessive speed by truck or car drivers. Numerous studies in North America indicate that the majority of truck accidents were caused or not prevented by failure of the driver to perform adequately (Patten et al 1990 and Chow 1996).

It may also be cost effective to have special measures for the road freight industry. The promotion of truck driving safety involves some particular issues, calling for special measures, that have been recognised for some time (see for example, HORSCORS 1977, May and others 1984, and Cairney 1991). These special measures would recognise certain differences between the road freight industry and general road use, such as differences in exposure to risk and in the chain of causal factors precipitating accidents. This may well lead to different regulations and possibly higher safety standards for truck driving than for general road use.

Some possible safety measures which appear not to have been given as much attention as perhaps they deserve include:

- the centralised collection and dissemination of information which might be used to measure accident risk and to prioritise actions to improve safety and/or increase compliance with safety regulations;
- investigation of the chain of precipitating factors leading up to each truck accident rather than the immediate trigger factors (for instance, the effects of the safety management practices of the road freight firm and pressures imposed by manufacturers and suppliers); and
- measures to encourage road freight companies to take responsibility for safety.

Our hypothesis is that the enforcement needs to be more certain than it is at present, and compliance less costly, for regulation to be cost effective in further increasing safety.

Perspective on the safety status of truck driving

Truck accidents are only part of the overall road safety problem and truck accidents are relatively rare events. Statistically speaking, an average truck will be driven for approximately 589 years for each fatal crash (Source: calculated from data in Cairney 1991, pages 6,7 and 12) Truck drivers are involved in fewer accidents than the typical automobile driver in terms of accident frequency per kilometre driven. Generally, commercial truck drivers are skilled, experienced, considerate drivers and one can expect truck drivers will not be prone to aggressive or dangerous behaviour.

But the sheer mass of trucks makes them more aggressive, and when a accident involving a truck does occur it tends to have more serious consequences than most other road accidents. Trucks are on the road more, their drivers are subject to greater competitive pressures, they do more distance per year, and this greater exposure means a greater risk of accidents over time. The overall professionalism, efficiency and commitment to safety of the industry may be good, but it is marred by individual cases which detract from this high standard and which result in what may be a less than optimal safety outcome.

The present state of affairs in the safety regulation and enforcement of truck driving

Commonwealth, State and Territory governments share the responsibility for road safety, and they already have some positive results. Fatal accidents have been reduced to approximately half what they were at the peak year of 1970 (FORS 1995)

In the past Australia had multiple jurisdictions, and multiple laws, regulations and penalties governing road use. The efforts of each of the State and Territory Departments or Authorities responsible for building and maintaining roads and for the regulation of road use including safety were fragmented and uncoordinated. This fragmentation was responsible for a dissipation of efforts to improve road safety.

The situation has changed. Considerable progress has now been achieved towards a more consistent national approach to regulating the operating environment for road transport through consultative and cooperative mechanisms, principally through the Councils of Federal, State and Territory Transport Ministers. A National Road Safety Strategy was endorsed through this mechanism on 7 June 1996.

Of particular relevance to road freight was the establishment of the National Road Transport Commission (NRTC) in 1991 by mutual agreement between the Commonwealth, State and Territory Governments with a charter to develop an acceptable policy framework and package of uniform or consistent rules and regulations for road transport.

Some of the matters on which the NRIC has focussed are: compliance with, and enforcement of, national Road Transport Law, inclusion of operators, freight forwarders and consignors in the compliance net, and examination of alternative compliance schemes which allow a lesser degree of on-road enforcement for operators who can demonstrate a high degree of compliance by other means; management of truck driver fatigue; and management of speeding heavy vehicles including placing appropriate responsibility on operators (road freight companies) as well as drivers (NRTC 1992, 1996a, 1996b)

The NRIC efforts represent however, merely the beginning of what may be a massive task. Sweatman and others 1990 find that: "drivers' log books are unreliable", and there is no independent source of information regarding compliance (p 9); drugs, especially stimulants, are thought to be widely used with adverse safety consequences (although it is sometimes suggested that the use of stimulants has safety benefits in preventing fatigue). However, there is no program to routinely test for the presence of such drugs and no practicable means to establish the quantity of stimulants used. Enforcement is difficult if not impossible (p178); and "the only participant in the road freight industry who has to demonstrate competence and be licensed is the truck driver. Yet many aspects of safety are outside the driver's control" (p 189)

Concern has been expressed over unsafe driver behaviour including speeding, drug taking and driving while fatigued. As part of this concern, Australia seems to be moving in the direction of widening the scope of regulations as to who is responsible for safe driving behaviour. But there is as yet no definite proposal which will ensure or even encourage effective compliance with regulations on driving hours, or drug taking; nor any proposal which will attempt to break the relationship between underlying economic conditions and on-road behaviour; nor any proposal to directly regulate any unsafe behaviours other than that of the driver.

There appears to be some industry support for such interventions: The Road Transport Forum is promoting industry self regulation through its Road Team 2000 programme and "There is an emerging indication that at least the more responsible companies within the transport and freight forwarding industry are prepared to acknowledge a responsibility towards the practices adopted by sub-contractors" (Sweatman and others 1990, p188).

Analytical framework: causes of accidents and their prevention

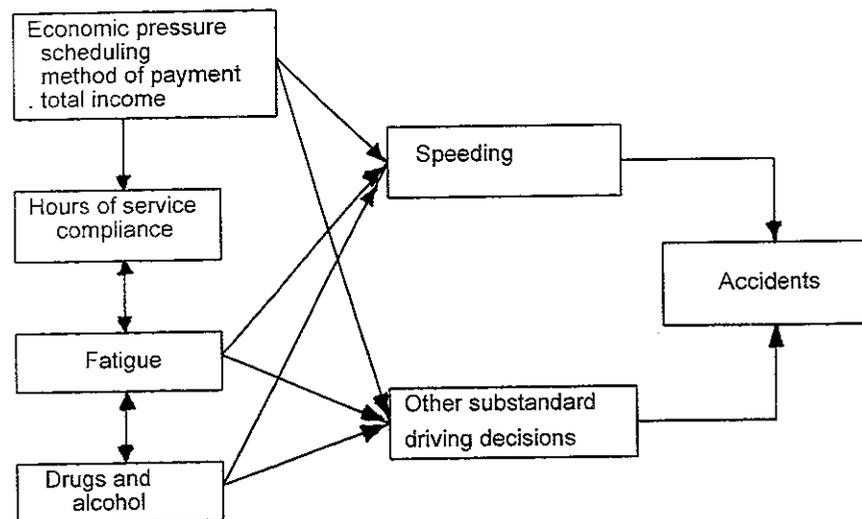
A complex interaction of factors is often involved in precipitating an accident. It might not be really useful to assign only a single fault or immediate cause. Think of an accident as a chain of critical events leading up to catastrophic outcome. (Truck accident causation models may be found in Clarke and others 1987 and Patten, Carroll and Thomick 1990. A general accident causation model may be found in Reason 1990.)

Indeed, it may not be useful to think of 'faults' or blame for causing an accident so much as what actions could be taken by which parties in order to prevent a similar accident occurring in the future. Breaking any one link in the chain of causation, not necessarily the link to which blame is attached, may be sufficient to avoid an accident.

There are three key factors in road accident causation: the state of the road, the state of the vehicle(s) and the state of the people — the driver(s), other road users and pedestrians. As a rough and ready statement of a 'safe' system: if the road is clear, wide and dry; if the vehicles have brakes and steering that work; and if the drivers and others are awake, alert, healthy and experienced, then there is a good chance that a safe outcome can be achieved. But accidents happen even on roads in perfect condition, or to vehicles in excellent condition, or to drivers who are in excellent shape. A deficiency in any one of these factors can jeopardise safety.

There is also a relationship between the underlying economic conditions in the industry and on-road driver behaviour and hence accidents (Chow 1988 and Hensher and others 1991). Most accidents are driver or vehicle-related and management has an influence on all the predisposing factors leading to driver or equipment failure. Moreover, it seems reasonable to propose that, if there are external pressures on the driver to behave unsafely, or determining the safety of the equipment which the driver operates, then the sources of these external pressures (road freight companies or suppliers) should be accountable and encouraged to take responsibility for safety. Otherwise, we would be merely applying band-aids rather than attacking the cause of the problem. A diagram which illustrates some of these situational and predisposing factors leading to accidents is at Figure 1.

Figure 1: Situational and predisposing factors leading to driver-related accidents



Source: Chow 1996

Drivers' skills and behaviour might be improved through better education — leading to better driver attitudes and knowledge, or through more effective driving regulations and their enforcement, or via incentives from road freight companies, the supply/demand chain and the insurance industry. We divide the problem into that of having:

- the appropriate regulations and codes of practice, ie composed of those measures which demonstrably improve safety performance;
- the appropriate level of enforcement of these safety regulations and codes; and/or
- an effective system of auditing of compliance with these regulations and codes;
- the appropriate incentives and penalties; and
- an exchange of information among jurisdictions and a uniform approach

USA and Canadian experiences

In some ways, the USA and Canada appear to be lagging behind Australian road safety initiatives. For example, as of 1996, effective implementation of uniform commercial driver's licence across all jurisdictions in North America was still in process (Chow 1996, page 137)

In other ways, the US and Canadian experience mirrors, or may be ahead of, Australia. Similar to Australia, both the USA and Canada have federal systems in which direct jurisdiction for road safety regulation is vested in the States or Provinces. The US Federal Government intervenes via the Office of Motor Carriers (OMC) of the Federal Highway Administration (FHWA) of the United States Department of Transportation (USDOT), in funding and taking responsibility for the safety of interstate road transport.

Perhaps ahead of Australia, both Canadian Provincial authorities and the United States OMC audit the safety fitness of interstate trucking firms or carriers. In practice, this involves considerable Federal-State/Provincial cooperation (Chow 1996, p107).

Safety audits of North American trucking firms

A trucking firm safety audit (also called a motor carrier safety compliance review) is a process by which a trucking firm's safety fitness is evaluated. An audit process could be a continuous accumulation of evidence that is used to target firms for investigation or to identify firms for remedial action such as warning letters or fines and ultimately revocation of various rights such as licences to operate (Chow 1996). It could also be used to reduce the regulatory costs imposed on those firms regarded as having an excellent safety fitness. Although safety audit programs operate in both the USA and Canada, only the US program has been subjected to detailed benefit-cost analysis.

USA. The OMC safety audit procedure rates firms as "satisfactory" or "unsatisfactory" with regard to their safety status based upon a formula which includes their previous accident record, their roadside inspection record, and a measure of their management of

procedures related to safety, such as having a minimum level of financial responsibility, ensuring their drivers' medical certificates remain current, maintaining records on drivers' duty status, and keeping records of vehicle inspection reports. If a firm is rated unsatisfactory, it may be subject to repeat audits and further regulatory enforcement action, including ultimately a revocation of its licence to operate.

The OMC's powers with respect to the safety audit process and its enforcement are relatively weak and there have been many criticisms. The weaknesses include that of inadequate funding, prohibition from directly imposing fines or long-term operational out-of-service orders, and difficulties with undertaking effective legal action against firms who flout the laws (Chow 1996, p 108 and Cross 1995). Although audit activity has been given a boost in recent years following US road transport deregulation, the program can only cover about 40 per cent of all US trucking firms given current resources. (By 1993, only 113,309 out of 275,283 active firms had been assigned a safety rating.) (Chow 1996) The question therefore arises whether OMC audit activities are taken seriously.

Nevertheless, the OMC approach may be seen as an attempt to grapple with the problem of bringing trucking firms to account and persuading them to take responsibility for safety procedures. A close study by Australian safety authorities of the OMC safety audit process appears worthwhile to the extent that we appear to be heading in a similar direction.

Furthermore, the OMC safety audit process may have at least some effect on the safety procedures of trucking firms. One mechanism for an effect is that of commercial reputation: many firms need a satisfactory safety rating in order to obtain contracts with the US government or with major suppliers. Therefore, this need may induce some firms to improve their safety procedures, although, the need may not apply to all firms, indeed some firms, offering lower standards of service at lower prices, may perceive the expense of compliance with audit procedures outweighs the benefits.

The OMC's self evaluation indicates that their safety audit program induces trucking firms to improve their safety ratings and also to reduce their preventable accidents. They report that around two-thirds of all firms have a 'satisfactory' safety rating. Moreover, they report that of the firms initially rated as 'unsatisfactory', nearly two-thirds are rated 'satisfactory' at subsequent repeat audits.

The OMC's finding is supported by Moses and Savage (1997). They find that the OMC's safety audit program has a benefit to cost ratio of 4.14. Included in this B/C figure are estimated savings valued at \$401 million in 1992 US dollars due to fatalities avoided, \$780 million in injuries avoided, \$134 million in property damage avoided, \$9 million in traffic delays avoided and \$48 million in higher quality service. Against these savings are government costs of \$36 million, estimated costs to trucking firms of \$287 million and estimated deadweight losses of \$8 million. Assuming that Australia could achieve similar rates of safety responses and subject to any scale economies, these

would still be significant figures even when translated to a much smaller Australian trucking industry.

In order to conduct a thorough benefit-cost analysis, Moses and Savage had to make numerous assumptions that are subject to severe criticism and which may have led to an overstatement of the net benefits. (In some instances moreover, if these assumptions are invalid, then there is a risk that OMC's self-evaluation of its audit program may also be invalid)

- 1 They inflate the reportable accident rate as used by OMC to a total accident rate. They state that ... "The accident improvement should also carry over to the far more numerous category of accidents which only involve relatively minor property damage" However, their own data from a 1992 study where total accidents were available showed that the total accident rates of 'satisfactory' rated carriers was only marginally better than 'unsatisfactory' rated carriers (Moses and Savage 1992).
- 2 They make a strong assumption that the effect of a safety audit has an ongoing, albeit declining, effect on reducing accident rates in the future and they count these accidents hypothetically prevented as a benefit. We are sympathetic to the logic behind this assumption but whether there is an ongoing safety benefit, and if so how much, would appear to be an issue which should be checked against actual experience.
- 3 They assume that all firms that improve their safety ratings improve from 'unsatisfactory' to 'satisfactory'. In fact, OMC had an intermediate ratings category known as 'conditional' (with an in-between average rate of accidents) and Moses and Savage are on this account overstating the number of accidents avoided on account of ratings improvements.
4. A spurious relationship may have been assumed when associating changes in firms' safety ratings with changes in accident frequency. This possibly spurious relationship is established because safety ratings are accorded in part on the basis of past accidents. To the extent that these past accidents were purely random rather than due to unsafe behaviour by the trucking firm, the analysis will be subject to 'regression to the mean effects'. If trucking firms exhibit regression to the mean, some firms rated 'unsatisfactory' will tend to improve their safety performance after audits simply because their performance was by chance below average at audit and not because after audit they have undertaken any remedial action with regard to safety procedures. Conversely, firms who actually have a high accident propensity might be rated 'satisfactory' simply because by chance they had a good accident record just prior to audit. (See BICE 1995, page 235, for an excellent discussion of regression to the mean problems.)

However, Moses and Savage do provide an excellent framework for evaluating safety audits. Their benefit/cost framework is rigorous and identifies many necessary data requirements or assumptions and the relationships that we need to know. Among the

most critical issues are what is the relationship between accidents and the firm's safety rating level? And for how long afterwards will a safety audit have a positively beneficial effect on safety behaviour?

Roadside inspections

Both the USA and Canada have programs to undertake roadside inspections of trucks and other heavy vehicles, mostly at fixed and permanent weighing stations

There is substantial evidence that roadside inspections are effective in reducing accidents, particularly vehicle-related accidents (Lentz and Allanach 1991, Lentz 1993) (This is natural since roadside inspections focus on vehicle defects rather than driver deficiencies.) Studies by KPMG 1995 suggest that roadside inspection can have a benefit/cost ratio exceeding unity, however Moses and Savage 1997 find a mid-range b/c ratio of only 0.87.

An issue with roadside inspection in North America is the extent to which the relative inflexibility of procedures results in an understatement of the true level of non-compliance with safety regulations. This arises because drivers can avoid inspection sites when they know that they are not in compliance. Results from random roadside blitzes both in Canada and the USA indicate that there is a significant level of truck bypassing of inspection sites and that bypassers are likely to have violations of safety procedures (Chow 1996).

There is also some evidence of a deterrence effect operating which increases the likelihood of compliance with safety regulations and reduction in accidents as the probability of interception and enforcement increases (KPMG 1995, Lentz 1991)

The effectiveness of roadside inspection as a safety measure is a function of the extent to which:

- safety regulations enforced by the inspections have a meaningful relationship with safety (for example, the relationship between driving hours and fatigue has been closely questioned);
- the probability that inspections will capture violations including potential bypassers; and
- the deterrence effect stemming from truck operators assessment of the probability of and consequences of being detected.

Both the KPMG and the Moses and Savage studies highlight the different types of costs and benefits that should be considered in evaluating the effectiveness of roadside inspections. Noteworthy is the significant cost that roadside inspection imposes on road haulage firms in the form of delays.

Alternative compliance, self-regulation and accreditation

The benefits and costs of current compliance programs and conventional enforcement measures should be analysed in the light of alternative programs. These include voluntary schemes for accreditation, self-regulation and co-regulation in place of direct government regulation or enforcement. This approach may be viable, indeed necessary, in achieving compliance with road regulations concerning vehicles and their drivers. Membership of alternative programs might be induced by exemptions from conventional enforcement if they offered increases in operational efficiency.

Note that alternative compliance will only be effective if conventional enforcement is effective. If conventional enforcement is seen as weak or non-existent, there is no economic incentive to enter into an alternative plan. At the same time, there must be a genuine benefit from alternative compliance, not an exemption from regulatory enforcement which would happen in any case.

To understand alternative compliance, it is necessary to understand that current compliance methods, particularly highway patrol roadside inspections, serve primarily to detect offences and to impose penalties on offenders. The intent is to deter repeat offenses and to deter others from offending at all. The economics of this type of deterrence is based on the sanctions model which can be expressed as an equation:

$$S \times P > B$$

where:

S = severity of the sanction

P = perceived probability of detection and punishment

B = benefit to the offender of the offending behaviour

Alternative compliance relies on incentives to motivate vehicle operators to comply with regulations. That is, an operator who demonstrates a commitment to maintaining a higher level of compliance must be offered a benefit which is not available to others who do not make such a commitment. This has the potential to foster a co-operative approach to compliance and allow regulators to direct enforcement resources in a more cost-effective manner.

Alternative safety compliance schemes are in their infancy in the trucking industry and a detailed analysis is not yet possible.

The Partners in Compliance program developed in Alberta is the best example of alternative compliance in North America. It became operational on April 1, 1995 and as of March 1996, about 18 firms with 1600 power units were in the program. It is supported by the majority of trucking associations across Canada.

Under the program, trucking companies with exemplary safety compliance records are allowed to police themselves in several regulatory areas such as fleet safety, and are exempted from roadside inspections. For example, the firm cannot have more than 0.3 recordable preventable collisions per 16 million kilometres, must have policies and procedures for overall compliance in terms of driver and vehicle safety, have a

maintenance and inspection program that meets or exceeds all Canadian National Safety Code requirements including documented service frequency reports and a North American standard Commercial Vehicle Safety Administrators inspection out-of-service ratio below the industry average.

A bigger picture: linking results of safety audits and roadside inspections

Another feature of the OMC's operations is its maintenance of a computer database, known as "Safetynet" which links reports of accidents and the results of roadside inspections with the results of safety audits and other characteristics of trucking firms drawn from the FHWA's Motor Carrier Census and which may be linked with accident outcomes. Safetynet aims to receive, store, transmit and report all inspections involving commercial vehicles. It is part of a cooperative effort to share commercial motor vehicle data among State and Federal Government safety regulation authorities. It is therefore a critical component of an effort to better focus the use of inspection resources by providing the information needed for effective targeting of enforcement activities.

Complementary truck safety programs, regulatory processes and technology

A number of other government programs complement and support safety audit and roadside inspection programs. They need to be considered because evaluations of alternative safety measures is dependent upon effective implementation. For example, the effect of roadside inspections in reducing accidents has been diminished in the past by:

- the degree to which drivers anticipated and avoided fixed roadside inspection points and dates;
- the inability to keep off the road, vehicles or drivers who had been put out of service for safety violations; and
- the use of multiple drivers' licences

Thus, correct implementation of a program (such as a roadside inspection scheme) requires an overall effective approach to truck safety regulation. Moreover, improvements in the effectiveness of one policy, such as commercial drivers' licences, can have an impact on the effectiveness of others programs, such as inspections.

Licensing and commercial drivers licence

As noted above, the USA and Canada have a problem with the effectiveness of their approach to commercial driver licensing (CDL). According to a 1995 report, the CDL program allows unqualified drivers to become licensed through a series of loopholes including the use of existing multiple licences to hide bad driving records and the submitting of false information. Moreover, the system is unable to update the records of

the driver possessing the CDL. The goal is prompt removal of problem drivers from the roads, but that goal is at present being stymied by the failure of different jurisdictions to pass on reliable information quickly. (Chow 1996)

On-board vehicle electronics

The trucking industry appears to be on the threshold of introducing the use of on-board electronic recording and diagnostic (black box) devices. Such devices promise to allow companies to analyse vehicle operating costs and to manage drivers more effectively. Indeed, there would be unprecedented information potentially available about trips and driver behaviour.

Obviously, we are thinking about the possibilities of using such devices for the purposes of safety compliance and enforcement. Historically, similar devices such as tachometers have met with fierce resistance from drivers, in part possibly because of their potential to reveal inappropriate behaviour. There would also be an issue to resolve regarding possible infringements of civil liberties and commercial secrets.

However, it must be noted that such technology has the potential to permit faster and less costly audits of safety procedures without costly on-road enforcement. It has the potential to reduce almost to zero, the opportunities for breaking regulations concerning driving hours, speeding, et cetera. This has the potential therefore to completely alter the benefit to cost ratio of various enforcement and compliance programs and proposals.

Inspection selection system

One such system currently under trial in the USA is the use of an Inspection Selection System (ISS) under the OMC Motor Carrier Safety Assistance Program for roadside inspections. The ISS was developed to recommend a roadside inspection for those commercial vehicles and drivers of firms with:

1. poor prior safety performance as evidenced by an unsatisfactory safety compliance fitness rating and/or higher than average driver or vehicle inspection out-of-service ratings;
2. very few or no roadside inspections in the previous two years relative to the carrier's size (The goal is to better distribute inspections among firms and to target those with continuous poor safety performance.)

The ISS would involve entry of trucking firm identification numbers into a computer and computer responses showing a recommendation whether or not to inspect, an estimated value for inspection, plus recommendations for specific problem area to check. On the spot personnel would still make final decisions.

The ISS was still in the testing stage as of 1996 (Lantz, 1996). Our main concern is whether it contains all the necessary data to control for extraneous variables contributing to risk exposure (The OMC does not record current mileage of trucking firms.)

Procedural improvements

In the USA and Canada, a number of procedural improvements are reducing the burden of enforcement on compliant trucking firms. For example, coordination between jurisdictions can reduce duplicative procedures such as multiple vehicle inspections. There are numerous circumstances where a vehicle stopped for a roadside inspection in one jurisdiction may be selected for another inspection as it crosses a provincial or state border. An example of such programs is the joint use of Coutts Port of Entry Vehicle Inspection Station which allows truckers to travel north and south without the requirement of stopping in Coutts, Alberta for inspections, and then, 56 kms later, at Shelby, Montana to receive essentially the same inspections. Annual cost savings to the industry have been estimated to be \$400,000 due to reduced down time normally required for two inspections.

Underlying the success of such processes is uniformity across jurisdictions so that one standard is good everywhere.

Ultimately, the consolidation of company, driver and vehicle performance across all of North America will improve the effectiveness of truck safety measures that are company, driver or vehicle focussed. In order to obtain a true picture of safety fitness at the company level, it is necessary to know how many accidents and violations the company has had across all trucks, drivers and jurisdictions. For a truly comprehensive picture to be developed, different jurisdictions must agree on common standards for safety violations as well as having a means of communicating, storing and retrieving this information. In the USA, the beginnings of such systems are found in OMC's Safetynet program which was mentioned earlier.

Lessons

In this paper, we have recognised that much has already been done to improve safety, but we have also identified a pressing need for further progress and good prospects that more can be achieved. A particular focus for future developments in safety regulation are systems to manage driver safety and to encourage trucking firms to take responsibility for safety.

US and Canadian experience with safety compliance and enforcement procedures is mixed. It provides both green and red lights for similar Australian initiatives to promote truck driving safety. There is evidence of wasted effort and expenditure alongside some quite cost effective intervention measures.

New technology and cooperative procedures between jurisdictions has enabled safety enforcement authorities across the United States to create new ways of combining safety audit and roadside inspection systems into a single enforcement mechanism. These new systems in development have the potential to produce timely, focused information at the level of detail that allows real time enforcement and more effective targeting of this enforcement. The use of new technology as demonstrated by the Inspection Selection System will become more feasible as in-vehicle monitoring systems are adopted by road haulage firms for commercial reasons.

Some key elements of a better safety compliance and enforcement system could include:

- a uniform approach to safety regulation across jurisdictions;
- safety audit systems for road freight companies — however, such systems would require the full support of all levels of government and it would necessary to establish that they have a real benefit;
- more cooperation and coordination in the collection, sharing and use of information regarding the safety status of road freight companies, their trucks and drivers gleaned from such programs as safety audits and roadside inspections;
- assisting the above, the possible use of new technologies to record driver behaviour and use of trucks;
- alternative voluntary compliance schemes backed up by effective conventional enforcement measures;
- systems to prioritise the enforcement of safety regulation and to reduce the regulatory burden on firms and drivers who comply with safety regulations; and
- more information on factors precipitating accidents and unsafe incidents.

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