Fatigue

Doctor Anne-Marie Feyer
Dunedin School of Medicine

Presented to the

Institute of Road Transport Engineers of New Zealand

SEVENTH INTERNATIONAL HEAVY VEHICLE SEMINAR

WELLINGTON

16 & 17 July 1998

ALTERNATIVE COMPLIANCE BASED FATIGUE MANAGEMENT PROGRAMS IN THE AUSTRALIAN LONG DISTANCE ROAD TRANSPORT INDUSTRY

Associate Professor Anne-Marie Feyer
New Zealand Environmental and Occupational Health Research Centre

Introduction

Fatigue has emerged as a major occupational hazard for commercial long distance drivers. For example, there is increasing recognition that it is a major risk factor for crashes involving heavy vehicles (Hamelin, 1987; Haworth, Heffernan and Horne, 1989; National Transportation Safety Board, 1995; Mitler, Carskadon, Czeisler, Dement, Dinges and Graeber, 1988; van Ouwerkerk, 1987; Sweatman, Ogden, Haworth, Vulcan and Pearson, 1990). Howarth, Triggs and Grey (1988) estimated that, for articulated vehicles in Australia, between 5 and 10% of all crashes, 20 –30% of casualty crashes and 25 to 35% of fatal crashes are probably caused by fatigue. For particular types of crashes, the involvement of fatigue may be much higher, for example, 40-50% of fatal single vehicle semi-trailer crashes are probably fatigue related (Howarth et al, 1988). If accidents where fatigue is a contributory rather than primary cause are considered, as many as 60% of heavy vehicle crashes have been reported as involving fatigue to some extent (Sweatman et al, 1990).

The search for effective ways of dealing with commercial driver fatigue under operational conditions has been slow to advance, however. In most parts of the world, the focus has been on setting parameters for regulating working/driving hours that will manage driver fatigue. This regulatory approach has not been particularly successful, however. Despite quite different parameters to be found in regulations around the world, commercial driver fatigue remains a serious problem (US Department of Transportation: Federal Highway Administration, 1990). In Australia, for example, it has been found that those states with regulated working hours regimes do not have very different crash profiles from those states that are unregulated (Hartley, Arnold, Penna, Hochstadt, Corry and Feyer, 1996). One possible explanation for this situation is that the focus of regulatory frameworks, largely duration of

work, is too narrow. Evidence from other industrial settings with round-the-clock operation suggests that the pattern of work and rest, rather than merely consecutive hours of operation, are important for managing safe operation. Night work, timing of work periods, number of work periods in succession and time off between periods of work are just some of the characteristics that together have been implicated in determining safety in twenty-four hour operations (Folkard, 1996; Knauth, 1996). Given that none of these factors are reflected in current regulatory approaches for road transport, it is hardly surprising that, as they stand, the regulatory regimes have been of limited effectiveness. Yet, there has been reluctance on the part of regulators to relinquish the traditional regulatory approach.

In March 1994, Queensland introduced changes to the legislation covering the driving hours of heavy vehicle drivers to allow the operation of an alternative compliance regime, the Fatigue Management Program (FMP). A Fatigue Management Program consists of documented assurance systems, policies, procedures and records that demonstrate that management and evaluations systems are in place to ensure compliance with agreed fatigue management standards. The "agreed standards" expect companies to take into account the role of the whole spectrum of risk factors for fatigue, and appropriate countermeasures. An FMP is intended to ensure that companies manage all of the risk factors that contribute to heavy vehicle drivers' fatigue. This model has now been adopted by the National Road Transport Commission and is to be released this year as one of the components of national package entitled Road Transport Reform (Truck Driving Hours) Regulations. This package will govern driving hours in the states where driving hours are currently regulated (ie rules are made and enforced), New South Wales, Victoria, Queensland and South Australia.

The impetus for road transport operators to participate in this alternative compliance regime is that it allows more flexible driving hours and less on-road enforcement than under the traditional regulated regime. Participating operators need to demonstrate that effective management practices are in place to be accredited to operate under the alternative compliance system. To date, the Queensland Department of Transport has developed a pilot program and are currently trialing it with 5 volunteer operators in Queensland.

The potential benefits of the FMP approach

There are three potential benefits of the FMP approach as a way of managing driver fatigue for drivers, operators and enforcement agencies.

1. Attempts to address limitations of current hours of service regulations

The FMP approach recognises that driving hours regulations have a number of key shortcomings for managing driver fatigue. The major advantage of such regulations is that they provide an enforceable way of limiting the number of hours worked, relative to the number of hours of rest obtained. As an approach to management of driver fatigue, however, regulation of the driver's hours of driving, work and rest has a number of critical shortcomings. As discussed above, current regulations place limits on consecutive hours of work and rest irrespective of time of day. Fundamentally, then, regulatory frameworks focus on the amount of time spent on the job and do not take into account the impact of the pattern of work and rest on fatigue.

Second, current regulations are not derived from an empirical research basis. Driving hours regulations are based on arbitrary control limits rather than on scientific knowledge about timing and duration of work activity. There is wide variation from country to country in the form and the time periods specified, without any scientific basis for the efficacy of the chosen regime. Yet, despite considerable international variation in permissible hours of service requirements, driver fatigue remains a serious problem universally, and the impact on fatigue of hours of service, and their regulation, remains largely unresolved.

Finally, driving hours regulations also fail to take into account inter or intra-driver variations. It is likely that different patterns of work will result in different levels of fatigue, for the same driver, and that drivers differ in the tolerance that they develop to the inevitable fatigue that results from driving.

These major limitations mean that hours of service regulations make poor contact with the causes of fatigue. An approach directly targeting risk factors for fatigue is much more likely to be successful in managing the problem.

2. Research based

The second major benefit of the FMP concept is that it incorporates research knowledge. It is clear from research that allowing drivers flexibility to arrange work and rest appears to be an effective way of managing fatigue (Feyer, Williamson et al, 1993, 1995; 1997; Williamson, Feyer et al, 1992; 1994; 1996). When drivers have flexibility, they tend to be very strategic about the way they schedule work and rest, with demonstrably better management of fatigue. From the results of a national survey in Australia, drivers who did the shortest trips and worked the shortest weekly hours were the lowest reporters of fatigue. This is hardly surprising. Rather more surprisingly, longer working hours were not necessarily associated with the highest reporting of fatigue. For all drivers, the influence of time-of-day (circadian) factors was evident in the occurrence of fatigue: it is a greater problem at night and to a lesser extent in the afternoon, for biological reasons. Better management of the problem was evident among drivers who had greater flexibility and were able to arrange the timing of work and rest to more closely coincide with periods of fatigue, that is, at times of biological need, rather than based on operational convenience. This finding was the case despite some drivers doing very long trips.

Several studies using on-road evaluations confirmed the importance of patterns of work and rest. In particular, this work has shown that chronic fatigue (built up across days and weeks of work), as well as acute fatigue (over a work day or a period of driving), appear to be major hazards of the job for long distance drivers. When drivers did very long trips in remote zones, providing a relief driver as part of a two-up operation to ensure that regular breaks from driving were possible, did not guarantee indefinite relief from fatigue accumulated across these very long trips. Fatigue was best offset by judicious use of night rest combined with two-up driving operations. When drivers did relatively short trips in populous zones, these were not immune to the impact of extensive night work and lack of effective night rest. Fatigue accumulated before trips was shown to add to the build up of fatigue due to driving once trips began.

Taken together, the results of our work suggest that driver fatigue needs to be viewed not only in terms of duration of any given work period, but in terms of the overall pattern of work and

rest. Thus the wider ranging sorts of factors that are part of an effective FMP proposal are much more likely to be successful in managing driver fatigue than relying on hours of service regulations as they currently stand.

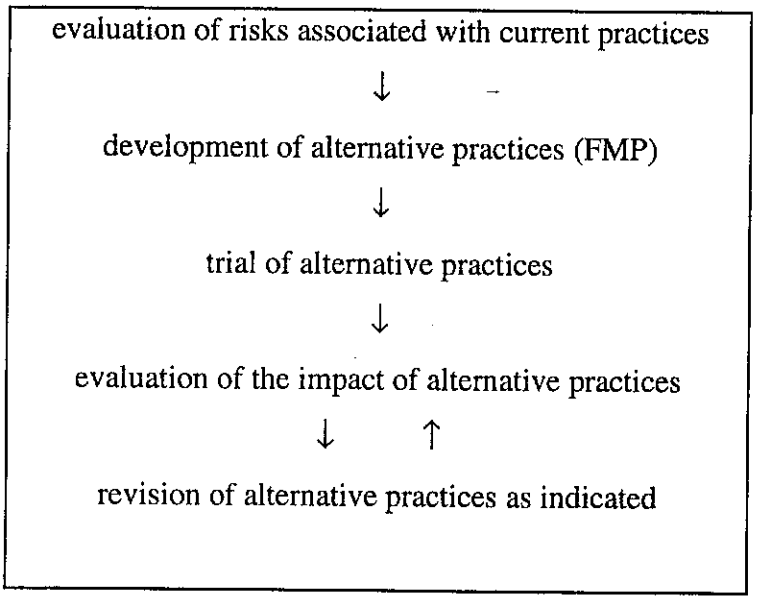
3. Collaborative responsibility for fatigue

Finally, and perhaps most compellingly, participation in the FMP requires companies to take responsibility for managing fatigue. The chain of responsibility can then be expected to extend to all of those involved in the freight task, from individual drivers to freight forwarders to customers. Clearly effective management of fatigue involves the collaboration of all of these players, to ensure that balance is achieved between operational demands and safe work practices.

Current impediments to the success of the FMP

The schematic below shows the general process for development of alternative fatigue management practices. Clearly, the success of an FMP depends critically on identifying practices which impose increased risk of driver fatigue and developing alternative practices which reduce the risk of the problem.

Outline of the process for development of fatigue management practices in an FMP



During the pilot currently being undertaken by Queensland Department of Transport, two main problems have emerged as potential impediments to the effectiveness of the FMP approach:

First, there appears to be a lack of knowledge in the industry about the wide range of factors which cause fatigue and about how to go about managing them. This means that it has been difficult for companies to identify the sources of fatigue in their current operational practices and the alternative practices which would need to become part of their FMP. Guidance is needed in balancing the fatigue-related aspects and operational aspects of practice if companies are to effectively participate in the FMP approach.

Second, evaluation of the impact of the FMP, both in terms of operational efficiency as well as reduced driver fatigue, is central to demonstrating the success of the program. To do this, the most accessible, cost-effective and reliable measures of the impact of the FMP need to be developed. Considerable progress has been made by Queensland Department of Transport in developing a questionnaire-based evaluation of fatigue and business variables. It is important to validate these subjective outcome measures against more objective outcome measures such as on-road fatigue, overall fatigue levels and driving performance. Such validation is yet to be undertaken. However, it is unlikely that such subjective measure alone will be enough. They do not provide public confidence. Nor are they particularly compelling evidence for regulators or enforcement officers. Therefore, there is also a need to address the problem of objective measurement of fatigue. There is a lack of measures which have a known dose response relationship to fatigue, can be used in operational settings and that can reflect the real world consequences of fatigue.

Conclusion

The flexibility in work arrangements inherent in the FMP approach offers considerable scope for operators to be strategic about the way they schedule work and rest. There has been some difficulty in moving beyond a pre-occupation with counting hours as a feature of thinking with respect to fatigue management, both for regulators and for participating companies. For

example, the requirement for companies to come up with overall parameters within which flexibility is allowed has often seen the selection of the broadest possible operating limits, with maximum limits becoming de facto minimum limits. Similarly, assessment of proposals by regulators has often seen consideration of the total number of hours proposed overshadow consideration of the countermeasures contained in proposals. Better fatigue measurement strategies and guidance in how to balance fatigue-related aspects and operational aspects of practice are needed. These developments are essential if the transition is to be made to effective fatigue management, rather than simply exchanging one regulatory framework for another.

References

Feyer, A-M. and Williamson, A.M. (1995) Work and rest in the long distance road transport industry. Work and Stress, 9 (2/3): 198-205.

Feyer, A-M., Williamson, A.M and Friswell R.(1995) Strategies to combat fatigue in the long distance road transport industry. Stage 2: Evaluation of two-up operations. Report No CR 158, Federal Office of Road Safety, Canberra.

Feyer, A-M., Williamson, A.M and Friswell (1997) Balancing work and rest to combat driver fatigue: An investigation of two-up driving in Australia. Accident Analysis and Prevention, 29(4):541-553.

Feyer, A-M., Williamson, A.M, Jenkin R. A. and Higgins, T (1993) Strategies to combat fatigue in the long distance road transport industry. The bus and coach perspective. Report No CR 122, Federal Office of Road Safety, Canberra.

Folkard, S. (1996) Effects on performance efficiency. In: W.P. Colquhoun, G. Costa, S. Folkard and P. Knauth. Shiftwork: problems and solutions. Peter Lang: Frankfurt am Main.

Hamelin, P. (1987) Lorry drivers' time habits in work and their involvement in traffic accidents. Ergonomics, 30:1323-1333.

Hartley,L.R., Arnold, P.K., Penna, F., Hochstadt, D., Corry, A. and Feyer, A-M. (1997) Fatigue in the Western Australian road transport industry. Part one: the principle and comparative findings. Technical report.

Howarth, N.L., Heffernan, C.L. and Horne, E.J. (1989) Fatigue in truck crashes. Report No 3, Monash University Accident Research Centre: Melbourne, Australia.

Haworth, N.L., Triggs, T.J. and Grey, E.M. (1988) Driver fatigue: concepts, measurement and crash countermeasures. Report No CR 72, Federal Office of Road Safety: Canberra.

Knauth, P. (1996) Design of shiftwork systems. In: W.P. Colquhoun, G. Costa, S. Folkard and P. Knauth. Shiftwork: problems and solutions. Peter Lang: Frankfurt am Main.

Mitler, M.M., Carskadon, M. A., Czeisler, C.A., Dement, W.C., Dinges, D.F. and Graeber, R.C. (1988) Catastrophes, sleep, and public policy: consensus report. Accident Analysis and Prevention, 17: 67-73.

National Transportation Safety Board (1995) factors that affect fatigue in heavy truck accidents. PB95-917001. NTSB/SS-95/01.

van Ouwerkerk, F. (1987) Relationship between road transport working conditions, fatigue, health and traffic safety. Report No. VK87-01, Traffic Research Centre: University of Groningen, Haren, The Netherlands.

Sweatman, PF., Ogden, K.J., Howarth, N.L., Vulcan, A.P. and Pearson, R.A. (1990) NSW heavy vehicle crash study final technical report. Report No CR 92, Federal Office of Road Safety: Canberra.

US Department of Transportation: Federal Highways Administration (1990) hours of Service Study: Report to Congress.

Williamson, A.M., Feyer, A-M., Coumarelos, C. and Jenkins, T (1992) Strategies to combat fatigue in the long distance road transport industry. Stage 1: The industry perspective. Report No CR 108, Federal Office of Road Safety, Canberra.

Williamson, A.M., Feyer, A-M. and Friswell, R (1996) Impact of work practices on fatigue in long distance truck drivers. Accident Analysis and Prevention, 28(6): 709-719.

Williamson, A.M., Feyer, A-M., Friswell, R. and Leslie, D. (1994) Strategies to combat fatigue in the long distance road transport industry. Stage 2: Evaluation of alternative work practices. Report No CR 144, Federal Office of Road Safety, Canberra.