NATIONAL ROAD TRANSPORT COMMISSION

DRIVER FATIGUE: A SURVEY OF LONG DISTANCE TRANSPORT COMPANIES IN AUSTRALIA

Information Paper

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Prepared by

Anne-Marie Feyer
New Zealand Environmental & Occupational Health Research Centre, University of Otago, New Zealand

Ann Williamson
NSW Injury Risk Management Research Centre, University of NSW

Rena Friswell
School of Psychology, University of NSW

Samantha Sadural
School of Psychology, University of NSW

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Authors: Feyer, A.-M.; Williamson, A.; Friswell, R.; Sadural, S.

Address: National Road Transport Commission
PO Box 13105
LAW COURTS VIC 8010
E-mail: nrtc@nrtc.gov.au
Website: www.nrtc.gov.au

Australian Transport Safety Bureau
GPO Box 967
CANBERRA ACT 2608
E-mail: research@atsb.gov.au
Website: www.atsb.gov.au

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Objectives: To document the fatigue management practices of long distance road transport companies in Australia.

NRTC Programs: Road Safety: Heavy Vehicle Driver Fatigue – Review of Regulatory Approach

Abstract: This report describes the results of a national survey of transport companies in Australia. The aim was to survey companies about knowledge and awareness of fatigue, about work-rest scheduling practices and about the factors which underlie the way schedules are organised. The survey was designed to provide complimentary information to that obtained in a national survey of drivers undertaken at the same time, and reported elsewhere. Telephone interviews with 200 companies carrying freight over distances greater than 300km were undertaken, covering all regulated mainland states of Australia, and the Northern Territory.

One of the key findings of this report was that there is a lag between increased awareness of fatigue and changes in operational practice. The majority of companies reported that awareness of fatigue had increased, both for themselves and their company, as well as for the industry at large over the last 5 years. However, from the results it seems that this increased awareness does not guarantee better management of the problem.

Key words: Fatigue, Transport company, Long distance road transport

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FOREWORD

The research reported here was supported by a grant from the Australian Transport Safety Bureau, and was managed in collaboration with the National Road Transport Commission (NRTC). A companion report, *Driver Fatigue: A Survey of Long Distance Heavy Vehicle Drivers in Australia (CR198),* was released in late 2001. The information gained from the two surveys will be used as an input into the review of the regulatory approach to heavy vehicle driver fatigue, which is being co-ordinated by the NRTC.

Dr Anne-Marie Feyer has been the Director of the New Zealand Environmental and Occupational Health Research Centre and a Professorial Research Fellow in the Department of Preventive and Social Medicine at the University of Otago since 1997. Before taking up these appointments, she worked as a Senior Research Scientist at NOHSC in Australia. Dr Feyer has been involved in driver fatigue research both in Australia and New Zealand and is currently a member of the NRTC Technical Expert Working Group on Options for Regulatory Approaches to Fatigue in Drivers of Heavy Vehicles in Australia and New Zealand. She is also a member of the Project Team for the Queensland Department of Transport Fatigue Management Pilot Programme.

Dr Ann Williamson is currently the Executive Director of the New South Wales Injury Risk Management Research Centre. Until recently she was a Senior Lecturer in Organisational Psychology at the University of New South Wales and prior to that was a Principle Research Scientist at the National Occupational Health and Safety Commission (NOHSC). Dr Williamson is involved in the NRTC Technical Expert Working Group on Options for Regulatory Approaches to Fatigue in Drivers of Heavy Vehicles in Australia and New Zealand. She has been conducting research on long distance heavy vehicle driver fatigue in Australia for over 10 years.

Rena Friswell and *Samantha Sadural* are currently employed as Research Assistants at the University of New South Wales, and have been involved in driver fatigue research for a number of years.

CONTENTS

LIST OF TABLES

SUMMARY

This report describes the results of a national survey of transport companies in Australia. The aim was to survey companies about knowledge and awareness of fatigue, about work-rest scheduling practices and about the factors which underlie the way schedules are organised. The survey was designed to provide complimentary information to that obtained in a national survey of drivers undertaken at the same time, and reported elsewhere. Telephone interviews with 200 companies carrying freight over distances greater than 300km were undertaken, covering all regulated mainland states of Australia, and the Northern Territory. Companies were selected randomly from the telephone directory. The Northern Territory was included because it provided a comparison with an unregulated state. A middle management staff member, familiar with line haul operations was interviewed from each company. This report presents the main descriptive data obtained in the survey and provides an overview of views, knowledge and practices with respect to fatigue management. Key comparisons were drawn with the data obtained from the driver survey undertaken at the same time.

One of the key findings of this report was that there is a lag between increased awareness of fatigue and changes in operational practice. The majority of companies reported that awareness of fatigue had increased, both for themselves and their company, as well as for the industry at large over the last 5 years. However, from the results it seems that this increased awareness does not guarantee better management of the problem. Only half of the companies surveyed reported that they believed that fatigue was well managed in the industry and one fifth reported that it is badly managed. Even so, this is more optimistic compared with the verdict of drivers, half of whom reported that fatigue is badly managed in the industry.

Further evidence of the lag between increased awareness about fatigue in general and companies actually coming to grips with better management of the problem came from views of causes of and strategies to manage fatigue. Virtually all companies endorsed the significance of sleep and recovery before and during trips, and the contribution of long hours. However, other key contributors to fatigue were grossly underestimated. Company representatives failed to report the significance of night work as a prime contributor to fatigue and consolidated night sleep as prime strategy for reducing fatigue. Similarly, there was lack of recognition by companies of the substantial contribution of non-driving work, particularly loading and unloading, to the overall burden on drivers, and accordingly lack of endorsement of limits for such work as a fatigue management strategy. This picture is in sharp contrast to that presented by drivers, where awareness of the key contributors and likely effective strategies was much more in line with current knowledge.

It is hardly surprising that fatigue has become a more prominent feature of companies' risk management agenda. There have been a number of high profile initiatives in safety promotions and legislative directions over the last decade all aiming to focus industry attention on better management of driver fatigue. The results of the survey highlight that increased awareness does not immediately translate into increased knowledge and operational changes.

This systemic inertia was also evident in the persistence of industry perceptions that the freight task needs to be maximally responsive to the demands of customers and freight forwarders, often described as the chain of responsibility. In fact, the picture presented by the companies themselves was rather different. The majority of companies reported that they have considerable control over schedules, with only a minority reporting that their work was mostly irregular. Strict estimated times of arrival were uncommon and trip times were mostly based on company and driver estimates, according to the companies surveyed. In other words, companies appear to have potential for far greater control over their schedules than is recognised or exercised.

The study provided some evidence that better attitudes to fatigue were associated with company practices that were more likely to manage fatigue effectively. For example, more aware companies were more likely to monitor fatigue and were more likely to change their schedules to accommodate driver fatigue. In contrast, companies who relied on the industry in general for management of fatigue and/or in the working hours regulations were less likely to be paying attention to the problem, were less likely to monitor fatigue and were more likely to change schedules to suit customer demands rather than for driver fatigue. They also used fewer management strategies and were less likely to otherwise restrict hours. These findings suggest that while attitudes do not seem to have a dramatic effect on practice, education and information for companies is a useful strategy for actively involving companies in better management of fatigue and for overcoming complacency about the driver fatigue problem.

Fatigue management strategies reported by companies surveyed focused on limitations of daily and weekly hours of service. Not surprisingly, there was less intervention and active management of fatigue for non-employee drivers. Active fatigue management strategies, monitoring of fatigue, or even formal policies for fatigue management for sub-contractor and independent drivers were reported by only a small minority of companies. Yet half of the companies surveyed reported that they hire these types of drivers. In many cases fatigue management for non-employee drivers is likely to become, by default, the responsibility of the individual driver. This is a serious problem because effective fatigue management is unlikely to emerge without not only company co-operation, but also active and formal company collaboration.

Surprisingly few differences were evident between companies of different sizes. Obvious and predictable structural differences were reported, for example greater reliance of smaller companies on non-employee drivers. Also predictably, formal policies and technical monitoring approaches were less common, reflecting the resource intensive nature of these strategies. However, little impact was seen of company size on the attitudes to fatigue and scheduling practices reported by companies surveyed. This pattern of findings suggests that the translation of fatigue awareness into operational practices is universally slow, and is not just a feature of some segments of the industry having reduced access to information and so forth.

Overall, this survey suggests that there is considerable scope for improving understanding and management of fatigue in the industry. Companies do not seem to be doing all that could be done to improve management of fatigue. Partly, this seems to reflect a lack of understanding about the phenomenon. There was poor understanding among line haul managers of how driver fatigue develops, the key role played by time of day and the contribution of total burden of work, not just driving. There needs to be greater

understanding in the industry that the problem requires a more sophisticated approach than simply restricting hours of driving. Education and information for companies is likely to be a useful strategy to alert companies to the most appropriate practices and to overcome complacency about the problem. The survey revealed that approaches affecting global attitudes, general increases in awareness and so forth, have had little impact on practices. On the other hand, they are likely to have been important for raising the profile of the problem in the industry and laying the groundwork for more targeted information and education. Indeed, it is hard to imagine how transport operators could develop the most effective interventions for their particular freight task, as demanded by Fatigue Management Programs, without being better informed. From the results of this survey, improved understanding of fatigue and its characteristics among transport managers must be seen as an immediate priority.

1. INTRODUCTION

In 1991, a national survey of long distance road transport drivers in Australia showed that fatigue was a common experience for drivers and presented a substantial problem to a significant proportion of them (Williamson, Feyer, Coumarelos and Jenkins, 1992). Patterns of fatigue occurrence were very consistent, with long hours of driving, night work and poor work/rest balance being key determinants of fatigue for drivers. These factors are entirely consistent with the vast literature on causes of fatigue. Monotonous tasks, like driving, are well known to present problems for vigilance (Krueger, 1989), fatigue and fatigue related decreases in performance are most likely in the early hour of the morning in line with the circadian trough (Folkard and Monk, 1979; 1985) and sleep loss, both chronic and acute, seriously compromises alertness and performance (Mitler, Carskadon, Czeisler, Dement, Dinges and Graeber, 1988; Mitler, Miller, Lipsitz, Walsh and Wylie, 1997).

The 1991 survey also revealed the effects of pressures working in the industry, with many of these related to the work organisation, in particular the organisation of work and rest (Feyer and Williamson, 1995). Drivers cited tight scheduling, the need to be involved in substantial amounts of non-driving work and inefficient loading and unloading practices as being key organisational factors contributing to the development of fatigue. Several subsequent on-road studies confirmed the importance of these factors, and the significant deterioration in performance that resulted (Williamson, Feyer and Friswell, 1996; Feyer, Williamson and Friswell, 1997).

In the decade since the 1991 survey, there have been a number of significant changes in the long distance road transport industry in Australia. Unquestionably, the prominence of fatigue as a risk factor to be managed in the industry has risen dramatically. This has, in part, been due to a general raising of awareness of the problem of fatigue. This is clearly reflected in a range of high profile initiatives such as the Queensland Department of Transport Fatigue Management Pilot Programme and the Australian Trucking Association's Trucksafe programme. The Transitional Fatigue Management System, adopted in 1998/99 in most Eastern States, introduced modifications to the regulatory regime in these States specifically aiming to focus industry attention on better management of work and rest in trucking operations.

All of these developments over the last decade may well have made a substantial impact on the management of fatigue and on the level of fatigue experienced by drivers working in the industry. With this in mind, a study was undertaken to re-survey drivers in the long distance road transport industry in Australia about changes in awareness of fatigue, changes in work/rest practices and changes in fatigue experience. The results of that survey are the subject of another report (Williamson, Feyer, Friswell and Sadural, 2001).

As a complimentary study, companies were also surveyed. Given that fatigue management relies on company as well as driver practices, a better understanding of company awareness and company practices would provide a much more complete picture of the problem and its management in Australia currently. The aim of the present work was to survey companies in Australia about knowledge and awareness of fatigue, about work-rest scheduling practices, and about the factors which underlie the way schedules are organised.

2. METHOD

2.1 Sample selection

The aim of sampling was to obtain telephone interviews with approximately 200 companies in all regulated mainland states in Australia (New South Wales, Victoria, South Australia and Queensland) and one unregulated state (Northern Territory). Interviews were not conducted with companies in Western Australia because a code of practice had recently been implemented which may have changed the way companies were managing fatigue, making them more like the regulated states and somewhat more interventionist than the Northern Territory. Also, a survey of Western Australian companies had been undertaken in 1995, prior to the introduction of the Code of Practice (Arnold, Hartley, Penna, Hochstadt, Corry and Feyer, 1996).

The overall sampling frame was guided by the most current information available from the NRTC on the proportion of fleets by fleet size and state/territory (NRTC, unpublished). There were two caveats on sampling in order to provide meaningful cell sizes:

- medium and large fleets (>5 trucks) were over-sampled
- Northern Territory operators were over-sampled

Transport company names were compiled at random from the Yellow Pages website using the category Transport Services and associated categories. These were contacted in sequential order until the required sampling frame was fulfilled.

2.2 Questionnaire

A questionnaire was designed which obtained information about:

- the company's operations
- company fatigue management policies and strategies
- scheduling practices
- views of fatigue and its management
- views of the current regulations

A complete copy of the questionnaire is included in Appendix 1.

2.3 Procedure

The survey was undertaken by telephone interview. A middle management staff member, familiar with line haul operations was interviewed from each company. Screening questions before the interview commenced identified if the company undertook operations in line with study definitions. These were broad and designed to ensure that the

participating companies indeed undertook long distance operations as defined for the driver survey, that is carried freight over distances greater than 300 km.

2.4 Analysis

In the main, descriptive data are presented in this report to provide an overview of company views, knowledge and practices with respect to fatigue and its management. ANOVA and Chi square tests were performed where appropriate. Because of the exploratory and descriptive nature of the study, a large number of statistical comparisons were undertaken. A liberal but cautious approach was taken to the issue of statistical significance. The Bonferroni correction for multiple comparisons was not used, but a more conservative significance level was used. Tests with an alpha of 0.01 were considered significant; those with an alpha between the more usual 0.05 and 0.01 were considered to be trends.

Where appropriate, comparisons are drawn with the driver survey undertaken at the same time as the present survey (Williamson et al., 2001).

Examination of the data by geographic distribution is not reported here. That analysis forms part of another report currently being prepared, which examines the impact of operating in regulated and unregulated zones on views of fatigue and fatigue management. Similarly, there were no comparisons with the only other survey of company views, knowledge and practices with respect to fatigue, the Western Australian survey undertaken in 1996 (Arnold et al., 1996). Clearly differences between the current survey and the findings of Arnold et al. (1996) may reflect a combination of factors, but are likely to primarily reflect the impact of road transport regulated vs unregulated zone, and are therefore more appropriately discussed in that context.

3. RESULTS

3.1 Description of the sample

In all, 711 potential participating companies were identified from the Web and contacted and, of these, 28% participated in the survey to provide the sample of 200 companies required (Table 1). Refusal rate was low (less than 10%) but many companies could not be contacted or were not appropriate for the needs of the survey. In general terms, the geographic distribution approximated the most recent estimates of national distribution of companies provided by the NRTC (NRTC, unpublished). The largest representation came from NSW and Victoria, and the least from South Australia and the Northern Territory (Table 2).

Table 1: Response rate achieved in the survey, as a percentage of sample identified.

	n	**% of companies approached**
• Completed interviews	200	28.1
• Refusals	65	9.1
• Unsuitable	296	41.6
• Quota full or unavailable	94	13.2
• Unable to contact	56	7.9
TOTAL	**711**	**100**

This distribution by state showed a similar pattern to that obtained for the driver survey, with two exceptions. The preponderance of responses from NSW was slightly more pronounced in the company survey and South Australian companies were somewhat under-represented compared with the distribution of drivers. The purposeful over sampling of the Northern Territory also distinguished the company sample from the driver sample.

Most companies participating in the survey had less than 50 trucks (Table 3). However, only one fifth had less than 5 trucks. This distribution is rather different to that indicated by the only available evidence which suggests that about 90% of the industry is accounted for by operators with 1 or 2 trucks (NRTC, 1999). Again this reflects successful purposeful over-sampling of larger companies in order to provide enough respondents to examine the impact of company size.

Table 2: Geographic distribution of participating companies.

	n	% of companies
• New South Wales	74	37.0
• Victoria	47	23.5
• Queensland	41	20.5
• South Australia	19	9.5
• Northern Territory	19	9.5
TOTAL	**200**	**100**

The majority of companies mainly reported hiring employee drivers, but close to half also employed some sub-contractors and one quarter also employed independent drivers (Table 3). Only a minority of companies mainly hired non-employee drivers. By far the most common operation used was single driving, although between one fifth and one quarter of companies reported using two-up and staged operations as well (Table 3). Exclusive use of the latter was rare, which is the case in the industry, although exclusive use of two-up would most likely have been a little higher had Western Australian-based companies been included.

Overwhelmingly, the type of freight most commonly carried by the participating companies was general and other bulk freight (Table 4). These two types of freight were reported by nearly three quarters of the sample.

Comparison of driver and freight types reported in the company and driver surveys

The pattern of driver type and freight type found in the company survey was very similar to that found in the driver survey. Employee drivers dominated the driver survey (69.1%), with owner drivers making up a substantial minority of respondents, confirming the hiring practices reported by companies. Like the companies, the majority of drivers (50.0%) reported carrying general freight.

Table 3: Characteristics of the participating companies.

	n	% of companies
Company size:		
• < 5 trucks	42	21.0
• 5-10 trucks	64	32.0
• 11-50 trucks	72	36.0
• > 50 trucks	21	10.5
Driver types hired: [1]		
• Employee	185	92.5
• Sub-contractor	84	42.0
• Independent	48	24.0
Main driver type:		
• Employee	162	81.0
• Subcontractor	23	11.5
• Independent	13	6.5
Main operation type (Type used exclusively):		
• Single	185 (130)	92.5 (90.9)
• Two-up	34 (5)	17.0 (3.5)
• Staged	48 (8)	24.0 (5.6)

[1] Percentages do not sum to 100 because multiple responses were allowed.

Table 4: Type of freight carried by the participating companies (participants allowed to report more than one freight type).

Type of freight	n	% of companies
• Livestock	16	8.0
• Refrigerated	24	12.0
• Dangerous materials	17	8.5
• Farm produce	19	9.5
• Other Bulk	43	21.5
• Machinery	12	6.0
• Building materials	24	12.0
• Groceries	16	8.0
• Manufactured goods	7	3.5
• General freight	106	53.0
• Car carrying	4	2.0
• Express freight	9	4.5
• Other (inc. removals)	25	12.5

3.2 Payment methods

Table 5 shows the payment systems and rates reported by companies. The majority of drivers of all types were paid trip rate per kilometre, with nearly two thirds of companies reporting this payment method. The second most common method differed by type of driver: employees were likely to paid an hourly rate (around one third of companies) whereas sub-contractors and independents were likely to be paid flat rate/load (around one quarter of companies).

Overall, the majority of respondents readily knew the pay rate for employees, but a substantial proportion, one in five, were unaware of pay rates for non-employee drivers. Irrespective of employment arrangement, approximately half of drivers were not paid the award rate. Of those not being paid the award, most companies reported that employees received more than the award, but nearly half of respondents representing companies reported that they did not know whether the rate at which their non-employee drivers were paid was above or below the award.

Non-driving work was much more likely to be paid for employee drivers than for sub-contractors or independent drivers. Nearly three quarters of companies reported that employee drivers were paid for non-driving work, compared to only around one third reporting this for non-employees. Irrespective of driver type, the majority were paid at driving rates for non-driving work.

Table 5: Payment systems and rates for each driver type reported by the participating companies (%).

Payment	Employee (n=185)	Subcontractor (n=84)	Independent (n=48)
System:			
• Hourly rate	30.3	6.0	4.2
• Flat day rate	3.2	1.2	2.1
• Day rate with overtime	4.3	0	0
• Weekly rate with overtime	5.4	0	0
• Flat rate per load	3.8	26.2	25.0
• Trip rate per km/tonne	60.5	61.9	58.3
• Other	15.1	10.7	10.4
Rate relative to award:			
• Don't know	0.5	20.2	22.9
• At award rate	49.2	33.3	25.0
• Not at award rate	50.3	46.4	52.1
Of those not paying award rates:			
% < award	0	0	0
% > award	97.8	59.0	56.0
% don't know	2.2	41.0	44.0
For non-driving work:			
• Don't know	2.2	8.3	6.3
• Yes	79.5	35.7	39.6
• No	18.4	56.0	54.2
Of those paying non-driving work:			
% paying driving rate	57.8	66.7	57.9
% not paying driving rate	37.4	23.3	26.3
% don't know	4.8	10.0	15.8

Comparison of payment systems reported in the company and driver surveys

This pattern of payment methods confirmed the pattern reported by drivers. The main method of payment in the road transport industry for all types of drivers is trip rate per kilometre or per tonne. Owner drivers, confirming the information provided by companies, reported that they were also commonly paid by flat rates per load and hourly rates were more common for employees, particularly those working for large companies.

3.3 Awareness and knowledge of fatigue

The majority of respondents reported that awareness of fatigue had increased both for themselves and for the industry, with somewhat greater increases reported for the industry (Table 6). Knowledge of contributors to fatigue provided a mixed picture of accurate awareness of the causes of fatigue (Table 7). Nearly all companies recognised that inadequate rest, both before and during a trip, and long driving hours were important contributors to fatigue. However, many key contributors to fatigue were not well acknowledged when asked whether or not they contribute to fatigue. Night driving, one of the key contributors to fatigue was only recognised by a minority of companies in the sample (one in three), and well behind many less influential factors. Similarly, un/loading, another well-demonstrated key contributor to fatigue, was endorsed as contributor by only just over half of companies, well behind less influential factors. Other factors that were not acknowledged were early afternoon driving which has been shown to be at higher risk of fatigue, and having to rest away from home which can also be a contributor to fatigue.

Table 6: Perceived changes in awareness of fatigue over the last 5 years for companies (%) compared with driver survey data (Williamson et al., 2001).

Nature of change in fatigue awareness	In industry		Personally	
	Company survey	Driver survey	Company survey	Driver survey
• Increased a lot	60.5	34.3	49.5	26.1
• Increased	33.0	39.9	35.5	32.5
• No change	3.5	20.0	14.0	38.4
• Decreased	1.0	3.1	0.5	1.9
• Decreased a lot	0.5	2.6	0.5	1.2
• Don't know	1.5	N/A	0	N/A

Table 7: Contributors to fatigue (%) reported by companies compared with driver survey data (Williamson et al., 2001).

Contributing Factor	Company survey [1]	Driver survey [2]
• Inadequate pre-trip sleep	96.5	22.8
• Insufficient rest breaks	93.0	23.2
• Long driving hours	92.0	47.9
• Family problems	90.5	15.7
• Use of alcohol	90.0	7.2
• Irregular/inadequate sleep during trips	87.5	38.2
• Poor diet/irregular eating	87.5	27.2
• Poor weather conditions	86.0	38.5
• Poor road conditions	82.5	41.9
• Poor truck ventilation	81.5	18.4
• Boring/monotonous route	78.0	32.4
• Poor cab design	73.5	14.8
• Dawn driving	72.0	59.4
• Heavy city traffic	70.5	23.2
• Too much non-driving work	66.5	30.0
• After-effects of stay-awake drugs	66.5	8.5
• Waiting to un/load	66.0	56.2
• Truck vibration	63.5	11.0
• Heavy highway traffic	62.5	13.6
• Having to un/load	59.5	35.8
• Insufficient night sleep	58.5	23.4
• Dusk driving	48.0	22.8
• Working to regulations	48.0	N/A
• Night driving	33.5	11.1
• Early afternoon driving	26.0	18.3
• Rest away from home	24.5	11.3
• Checking the load	17.5	3.5
• Other	25.0	6.8

[1] Companies were asked whether each factor was a contributor
[2] Drivers were asked to identify contributors to their own fatigue

While strategies providing temporary relief were commonly rated as helpful (eg kicking the tires, listening to music and increasing the ventilation), companies were well aware that very helpful strategies were ones which provided more substantial and direct fatigue relief (Table 8). Stopping for a rest and stopping to sleep were the strategies rated as very helpful by the majority of companies and by far more often than other strategies. Other break related activities, such as stopping for a meal and stopping to take a shower were the next most commonly endorsed strategies. Highly temporary strategies such as singing, listening to music and so forth were rated as very helpful by few companies. Although stay awake drugs were rated as helpful by a substantial minority of companies (one in five), only very few companies rated them as very helpful.

Table 8: Driver strategies rated by companies as helpful and very helpful to manage fatigue (%).

Driver strategy	Very helpful	Helpful
• Stop to sleep	76.0	23.0
• Stop to rest	65.5	34.0
• Shower	43.0	51.5
• Stop for a meal	34.0	55.0
• Stop to eat	23.0	68.5
• Adjust ventilation	22.5	69.0
• Kick tyres/walk around	19.5	64.0
• CB	15.5	59.5
• Music	14.5	65.0
• Non-caffeinated drinks	3.5	61.0
• Singing	3.5	45.5
• Stay-awake drugs	2.5	23.5
• Caffeinated drinks	2.0	61.5
• Eat while driving	2.0	33.0
• Ignore regulations to get home	1.5	27.5
• Smoking	0	21.5

Comparison of company and driver views of fatigue awareness

There were some key differences between awareness as reported by companies and the reported awareness found in the driver survey. Like companies, the majority of drivers reported that awareness had increased, both in the industry and for them personally. However, companies endorsed the increased awareness more overwhelmingly, particularly in the case of industry awareness. Companies were nearly twice as likely to report that industry awareness had increased a lot over the last 5 years (60.5%), compared with drivers (34.5%). Like drivers, companies were much more likely to report that their personal awareness had remained unchanged than they were to report that industry awareness had remained unchanged. However, overall a much smaller proportion of companies than drivers were likely to report that either industry awareness or (3.5% vs 20%, respectively) or personal awareness (14.0% vs 38.4%, respectively) was unchanged.

The pattern of contributors to fatigue endorsed by companies was also different to that found among drivers. First, there seemed to be much less consistency among drivers than among companies about the contributors. The most commonly endorsed factors among companies were endorsed by more than 90% of survey participants, whereas the most common factors for drivers were only endorsed by 50% to 60% of the survey sample. The pattern of contributors was also somewhat different: for drivers it was dawn driving, waiting to un/load, long driving hours, poor roads and poor weather. The top six factors for both companies and drivers included long driving hours and irregular sleep during trips. However companies endorsed two personal factors, family problems and effects of alcohol, among the top 6 factors; in contrast, these were in the bottom 5 for drivers. Inadequate pre-trip sleep was in the top six factors for companies, but ranked lower on the list for drivers. Although still in the top 10, inadequate pre-trip sleep was only endorsed by a quarter of drivers. The top driver contributors, on the other hand, long delays in un/loading and dawn driving were well down the list among companies, and in the bottom 50% of contributing factors.

Like drivers, companies commonly endorsed temporary strategies, like music and ventilation, as being helpful. However, overwhelmingly, companies rated sleep and rest as being the main strategies that were very helpful. In stark contrast, although the majority of drivers reported that they used sleep and rest at least sometimes to manage fatigue, only one third of those using the strategies reported that they found it helpful. Although only used by a minority of drivers (about one in five drivers), the proportion of those who did use them and who rated drugs as most helpful was similar to the proportion reporting that sleep was helpful. Only a relatively small minority of companies endorsed drugs as a helpful strategy, and only a handful of those reported that they were very helpful.

3.4 Management of fatigue

Fatigue was seen as being at least quite well-managed in the industry by only just over half of companies (Table 9). Only half of companies indicated that the current regulations allow effective fatigue management (Table 10).

Table 9: Company views of fatigue management in the industry (%) compared with driver survey data (Williamson et al., 2001).

How well is fatigue managed in the industry?	Company survey	Driver survey
• Extremely badly	4.5	21.7
• Quite badly	17.5	30.6
• Quite well	50.5	28.2
• Extremely well	7.0	5.2
• No opinion	6.0	12.3
• Other	14.5	N/A

Table 10: Views of fatigue management by current regulations.

Current regulations allow effective fatigue management	% of companies (n=200)
• Yes	56.0
• No	40.0
• Don't know	4.0

Formal company policies were more commonly reported for employee drivers compared with sub-contractors and independent drivers. For employee drivers, just less than half of companies reported that formal management policies were in place for fatigue management, with a little over half reporting that formal medical policies were in place in their company (Table 11). Only one fifth to one quarter of respondents reported that their company had either sort of policy in place for non-employee drivers.

The majority of companies reported that they monitor fatigue (Table 12). Most commonly companies reported that they reviewed log books or other work records, and that they asked drivers about their current state. The focus on hours of service evident in monitoring strategies, was also reflected in the most commonly used fatigue management strategies. Monitoring work hours, flexible scheduling and restricting hours were the most common strategies reported by companies (Table 13).

Table 11: Formal company policies reported by participating companies for different driver types (%).

	Employee (n=185)	Subcontractor (n=84)	Independent (n=48)
Formal fatigue management policy:			
• Yes	47.6	25.0	20.8
• No	51.4	72.6	77.1
• Don't know	1.1	2.4	2.1
Formal medical policy:			
• Yes	61.1	27.4	22.9
• No	36.8	69.0	70.8
• Don't know	2.2	3.6	6.3

Table 12: Fatigue monitoring strategies reported by participating companies (participants were allowed more than one response).

Fatigue monitoring strategy	% of companies
• Companies who reported monitoring fatigue	74
Strategies used by companies who monitor fatigue:	(n=148)
• Review log books	48.0
• Other work records (trip diaries, departures times, arrival times) [1]	30.4
• Ask drivers	29.1
• Review truck computer records	18.9
• Use monitoring devices	13.5
• [1] Observe drivers	7.4
• Review accidents and incidents	2.0
• Other	6.8

[1] Category volunteered by company.

Table 13: Fatigue management strategies reported by participating companies (participants were allowed more than one response).

Fatigue management strategies	% of companies (n=200)
• Companies endorsing more than 1 strategy	67.0 [1]
Strategies endorsed:	
• Don't know	0.0
• None	2.5
• Monitor work hours	44.5
• Flexible scheduling	38.5
• Restricting hours	26.5
• Monitor schedules	16.5
• Compulsory rest breaks on trips	11.5
• Providing time to sleep between trips	11.0
• Fatigue education	9.0
• No un/loading	6.5
• Health education	2.5
• Minimise night driving	1.5
Breakdown of "Other" strategies volunteered:	
• Relief drivers	7.0
• Leave rostering arrangements	5.5
• Driver consultation	5.5
• Work to regulations	4.5
• Provide sleeping facilities	3.5
• Two-up operation	2.0
• Regular medicals	1.5
• Maximise truck comfort	1.0
• Staged/shuttle operation	1.0
• Not elsewhere classified	8.5

[1] Mean number of strategies reported by all companies = 2.02, SD = 1.06, Median = 2.00

Respondents were asked how working hours were managed in their company for different types of drivers. For all types of restrictions, work restrictions were much more common for employee drivers than for non-employee drivers (Table 14), approximately twice as commonly for employees, irrespective of restriction type. For employees, the majority of

Table 14: Restrictions of working hours by companies for different types of drivers.

Type of work restrictions	Restrictions applied? (% relevant companies)			Nature of restriction			
	Yes	No	Don't know	Mean	SD	Median	n
OVERALL RESTRICTION							
Work to regulations:							
• Employees (n=185)	86.5	11.4	2.2				
• Subcontract (n=84)	56.0	35.7	8.3				
• Independent (n=48)	52.1	43.8	4.2				
SPECIFIC RESTRICTIONS							
Hours/day:				***Limit on number of hours/day***			
• Employees (n=185)	77.3	18.9	3.8	12.28	1.60	12.00	143
• Subcontract (n=84)	38.1	56.0	6.0	12.09	1.55	12.00	32
• Independent (n=48)	43.8	56.3	0.0	12.05	1.02	12.00	21
Hours/week:				***Limit on number of hours/week***			
• Employees (n=185)	70.3	23.8	5.9	66.65	10.74	72.00	121
• Subcontract (n=84)	38.1	53.6	8.3	68.70	8.69	72.00	30
• Independent (n=48)	39.6	56.3	4.2	68.67	9.22	72.00	18
Continuous days:				***Limit on number of continuous days***			
• Employees (n=185)	81.6	15.7	2.7	5.54	1.17	6.00	149
• Subcontract (n=84)	40.5	53.6	6.0	5.76	1.37	6.00	34
• Independent (n=48)	37.5	60.4	2.1	5.33	1.03	6.00	18
Nights/week:				***Limit on number of nights/week***			
• Employees (n=185)	61.6	34.1	4.3	4.67	1.78	5.00	114
• Subcontract (n=84)	32.1	63.1	4.8	5.11	1.42	6.00	27
• Independent (n=48)	33.3	64.6	2.1	5.44	0.89	6.00	16

companies reported overall restriction of hours to the regulations, to the hours worked per day and per week, as well as restriction of continuous days. Fewer companies reported restriction of nights per week. The pattern of restrictions was similar for non-employee drivers, with the caveat that work restrictions by companies were much less common overall for sub-contractors and independent drivers.

Comparison of company and driver views of fatigue management in the industry

There were key differences between drivers and companies in their views about current and possible management of fatigue in the industry. The majority of drivers (75.9%) reported that fatigue was a substantial or major problem in the industry. They viewed the management of fatigue by the industry considerably more negatively than did companies, with 53% reporting that fatigue was badly managed in the industry, compared with about one in five companies. When drivers were asked about what their company does, should do and should not do to better manage fatigue, they confirmed the most common strategies that companies reported currently doing, namely easing tight schedules and allowing more time for sleep on the road. Drivers also confirmed that it was relatively less common for companies to minimise night driving as a fatigue management strategy (although considerably more companies reported doing this than was indicated by drivers). In contrast, around three quarters of drivers reported that companies should have more efficient un/loading and around two thirds reported that companies should not involve drivers in un/loading. Companies rarely reported restricting loading activities or streamlining them in order to better manage fatigue. Drivers did not support minimisation of night driving, more time off between trips and more breaks between trips, in agreement with the low priority accorded to these strategies by companies. Notably, very few companies reported staged or two-up operations, and drivers were clearly in complete agreement: two thirds of drivers reported that companies should not use two-up operations and two thirds reported that companies should not use staged operations.

3.5 Management of schedules

Nearly half of the companies reported that all or most of their work has regular trip times and destinations. Only one quarter of companies reported that their work was rarely or never regular (Table 15). In line with this level of control of schedules, only half of companies reported that they always had estimated times of arrivals (ETAs) for their work and most companies reported sometimes being late (Table 15). When ETAs were in place for work, most companies reported that they and/or the drivers set these times (Table 16). Trip times were most likely to be based on management and/or driver estimates (Table 16). Companies were also asked about whether they monitor arrival times. While around half of companies (57%) with ETAs reported monitoring actual arrival times, bonus systems for early arrival and penalty systems for late arrival were rare. Only about 2% of companies reported the use of such systems. The majority of companies reported changing schedules to suit customer demands at least sometimes, with nearly one third reporting that they mostly did so (Table 15). In contrast, only one in ten companies reported changing schedules to accommodate driver fatigue, and only about half of companies reported doing so sometimes.

Table 15: Scheduling practices reported by companies (%).

	Most or Often/Always	Sometimes	None or Rarely/Never
• Amount of work with regular trip times and destinations (n=200)	48.0	27.0	25.0
• Amount of work that has an ETA (n=200)	52.5	22.0	25.5
• For those with an ETA, frequency of late arrival (n=149)	5.4	88.6	4.7
Schedule changes:			
• Frequency of delays for driver fatigue (n=200)	9.5	44.2	45.2
• Frequency of changes to suit customer demands (n=200)	30.5	39.5	28.0

Table 16: Control of schedules reported by participating companies.

	% of companies (n=200)
Who sets ETA?	
• Company	52.0
• Customer	26.5
• Driver	23.0
• Other	1.5
How are trip times determined?	
• Driver and management estimates	40.0
• Km/day (or average speed)	18.5
• Management estimates	18.0
• Trial trip	16.5
• Driver estimates	8.5
• Other	13.5

Comparison of schedule management reported in the company and driver surveys

The rareness with which companies reported using bonus/penalty systems was confirmed by the low profile of such schemes indicated by the driver survey. When asked whether such schemes influenced decisions to break the working regulations or the road rules, drivers rarely reported them as reasons (7.6% and 9.3% respectively). However, in contrast to the considerable control that companies reported having over schedules, drivers reported that tight schedules were among the top 3 reasons for breaking work hours regulations (reported by nearly one third of drivers). Frequent rule breakers among drivers were more likely to cite reasons associated with schedules and work organisation, while drivers who rarely breached the rules were more likely to do so due to the desire to reach home, maximise sleep at the end of a trip or due to the needs of livestock. Similarly, the main reasons for breaking the road rules (much less common overall than breaking the working hours rules) were related to operational and scheduling problems of tight schedules, getting enough trips done, and pressures of un/loading.

3.6 The influence of company size

Company size for this study was based on the number of trucks of their own a company reported. There was a trend for sub-contractor and independent drivers to be hired more often by smaller companies and larger companies and for employees to be mainly working for medium sized companies(Table 17). This suggests that smaller and large companies supplement their freight movement capability to a proportionately greater extent by hiring subcontract and independent drivers than do medium-sized companies. In other words, apart from the absolute number of trucks distinguishing companies of different sizes, the ratio of different driver types hired also distinguishes them.

Table 17: Company size by type of driver.

	≤ 10 trucks (n=105)	**11-50 trucks (n=71)**	**> 50 trucks (n=21)**
Main driver type: [1]			
• Employee	76.2	91.5	77.2
• Subcontractor	13.3	8.5	14.3
• Independent	10.5	0.00	9.5

[1] statistical trend $\chi^2(4) = 9.66$, $p=0.047$

3.6.1 Company size and payment systems

In general, there were few differences in payment systems. The majority of all driver types, irrespective of size of company, were paid on trip rate systems (Table 18). Also irrespective of company size, the most common alternative system for a sizeable minority of employee drivers was being paid hourly rates while for a sizeable minority of non-employee drivers it was being paid flat rates per load (Table 18). Few differences were seen in payment rates based on company size. Employee drivers were more likely to get above award payment than sub-contractor and independent drivers, although there was a tendency for small and medium companies to more commonly pay the award rate to their employee drivers. Non-driving work was more likely to be paid for employee drivers than for other driver types, and more commonly paid at the driving payment rate. Lack of knowledge of pay rates was more common concerning sub-contractors and independent drivers than employee drivers, irrespective of company size, with a trend towards this being less common among larger companies.

3.6.2 Company size and awareness of fatigue

Irrespective of company size, the vast majority of companies reported an increase in awareness of fatigue in the industry (Table 19). Smaller companies tended to be slightly more likely to report that awareness in the industry had not changed, or that they did not know about fatigue awareness in the industry. Similarly, the vast majority of companies reported that their own awareness of fatigue had increased over the last 5 years (Table 19). Larger companies tended to be more likely to report an increased awareness, with smaller companies most likely to report that it had not changed.

3.6.3 Company size and management of fatigue

Irrespective of size, the majority of companies reported that fatigue was at least quite well managed (Table 20). Small companies tended to be more likely to report that they had no opinion on this issue. Company size also had little influence on companies' assessment of the effectiveness of the current regulations for fatigue management: Only approximately half of companies reported that the regulations were effective (Table 21). The remainder did not believe that the current regulations allowed effective fatigue management.

Overall, formal fatigue management policies and formal medical policies were considerably more commonly in place for larger companies (Table 22). However, the pattern of usage of such policies for drivers with different employment arrangement did not vary by company size. For companies of all sizes, formal policies were more common for employee drivers than for either subcontractors or independent drivers (Table 22). The influence of company size was also evident in formal fatigue monitoring. While the majority of companies reported monitoring fatigue among their drivers, small companies were significantly less likely to do so than medium and large companies (Table 23). The

Table 18: Company size by payment (%).

Payment	≤ 10 trucks (n=93)			11-50 trucks (n=71)			> 50 trucks (n=12)		
	Employee	Subcontract	Independent	Employee	Subcontract	Independent	Employee	Subcontract	Independent
System:									
• Hourly rate	32.3	5.0	0.0	26.8	3.1	5.3	35.0	16.7	12.5
• Flat day rate	3.2	0.0	4.8	2.8	3.1	0.0	0.0	0.0	0.0
• Day rate with overtime	6.5	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0
• Weekly rate with overtime	6.5	0.0	0.0	2.8	0.0	0.0	10.0	0.0	0.0
• Flat rate per load	4.3	32.5	23.8	4.2	21.9	21.1	0.0	16.7	37.5
• Trip rate per km/tonne	52.7	60.0	52.4	70.4	62.5	68.4	65.0	66.7	50.0
• Other	18.3	10.0	19.0	11.3	12.5	5.3	15.0	8.3	0.0
Rate relative to award:									
• Don't know	1.1	22.5	23.8	0	21.9	21.1	0.0	8.3	25.0
• At award rate	50.5	32.5	14.3	52.1	34.4	31.6	35.0	33.3	37.5
• Not at award rate	48.4	45.0	61.9	47.9	43.8	47.4	65.0	58.3	37.5
• ***Of those not paying award rates:*** [1]									
% < award	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% > award	95.7	33.3	33.3	97.1	42.9	46.2	100.0	87.5	40.0
% don't know	4.3	66.7	66.7	2.9	57.1	53.8	0.0	12.5	60.0
For non-driving work:									
• Don't know	0	5.0	0.0	4.2	9.4	10.5	5.0	16.7	12.5
• Yes	80.6	27.5	52.4	76.1	43.8	26.3	85.0	41.7	37.5
• No	19.4	67.5	47.6	19.7	46.9	63.2	10.0	41.7	50.0
• ***Of those paying non-driving work:***									
% paying driving rate	65.3	72.7	45.5	48.1	57.1	100.0	52.9	80.0	33.3
% not paying driving rate	32.0	27.3	36.4	44.4	21.4	0.0	41.2	20.0	33.3
% don't know	2.7	0	18.2	7.4	21.4	0.0	5.9	0	33.3

[1] There is a statistical trend such that knowledge about nonaward rates paid to subcontracted drivers varies with company size ($\chi^2_{(2)}=7.37$, p=0.025)

Table 19: Company size by perceived changes in fatigue awareness over the last 5 years (%).

Nature of change in fatigue awareness	≤ 10 trucks (n=106)	11-50 trucks (n=72)	> 50 trucks (n=21)
For industry:			
• Increased a lot	60.4	62.5	57.1
• Increased	28.3	36.1	42.9
• No change	6.6	0.0	0.0
• Decreased	0.9	1.4	0.0
• Decreased a lot	0.9	0.0	0.0
• Don't know	2.8	0.0	0.0
Personally:			
• Increased a lot	49.1	51.4	47.6
• Increased	32.1	36.1	47.6
• No change	17.0	12.5	4.8
• Decreased	0.9	0.0	0.0
• Decreased a lot	0.9	0.0	0.0

Table 20: Company size by views of fatigue management in the industry (%).

How well is fatigue managed in the industry?	≤ 10 trucks (n=106)	11-50 trucks (n=72)	> 50 trucks (n=21)
• Extremely badly	4.7	4.2	4.8
• Quite badly	16.0	20.8	14.3
• Quite well	52.8	44.4	57.1
• Extremely well	4.7	11.1	4.8
• No opinion	8.5	2.8	4.8
• Other	13.2	16.7	14.3

Table 21: Company size by views of fatigue management by current regulations (%).

Current regulations allow effective fatigue management	≤ 10 trucks (n=106)	11-50 trucks (n=72)	> 50 trucks (n=21)
• Yes	56.6	56.9	47.6
• No	38.7	40.3	47.6
• Don't know	4.7	2.8	4.8

primary strategies used by companies of all sizes were first and foremost review of log books, and secondly review of other work records. Smaller companies reported asking drivers about fatigue levels twice as often as large companies, reporting this strategy as commonly as they did use of work records. However the major difference found in monitoring strategies was that medium and larger companies were significantly more likely to report the use of truck computer records and monitoring devices, compared with small companies (Table 23).

Most companies, irrespective of size, reported that they used fatigue management strategies, with the majority reporting that they used more than one such strategy (Table 24). However, small companies reported using significantly fewer strategies than larger companies. Among the provided strategies, the predominant ones reported by companies, irrespective of size, were monitoring work hours, restricting hours and using flexible scheduling (Table 24). There was a trend towards fatigue education being more likely to be reported by large companies, and rarely reported by small or medium companies. Among the strategies volunteered by companies, small and medium companies tended to report use of relief drivers, leave rostering arrangements and driver consultation. In contrast, large companies tended to report providing sleeping facilities and working to the regulations, with the only significant difference being more frequent reporting of the use of regular medicals by large companies.

3.6.4 Company size and scheduling practices

While some general patterns were evident in scheduling practices across companies, there were also a few key divergences. Although at least half of companies of all sizes reported that most of their work was regular, fewer small companies tended to have mostly regular work, with medium companies most commonly reporting that their work was largely regular (Table 25). While at least half companies of all sizes reported that most of their work had set estimated times of arrival, small companies tended to more commonly report that none their work had set estimated times of arrival (Table 25). Around half of companies of all sizes reported that they at least sometimes delayed a trip due to a driver's fatigue and around one in ten reported that they always do so (Table 25). The influence of customer demands on schedules also tended to be universal. Around two thirds of

Table 22: Formal company policies by company size (%).

	≤ 10 trucks (n=93)			11-50 trucks (n=71)			> 50 trucks (n=20)		
	Employee	**Subcontract**	**Independent**	**Employee**	**Subcontract**	**Independent**	**Employee**	**Subcontract**	**Independent**
Formal fatigue management policy:									
• Yes	36.6	15.0	19.0	53.5	25.0	15.8	75.0	58.3	37.5
• No	63.4	82.5	81.0	45.1	71.9	78.9	20.0	41.7	62.5
• Don't know	0.0	2.5	0.0	1.4	3.1	5.3	5.0	0.0	0.0
Formal medical policy:									
• Yes	49.5	27.5	38.1	69.0	25.0	10.5	85.0	33.3	12.5
• No	48.4	72.5	57.1	28.2	65.6	84.2	15.0	66.7	75.0
• Don't know	2.2	0.0	4.8	2.8	9.4	5.3	0	0.0	12.5

Table 23: Company size by fatigue monitoring strategies (%).

Fatigue monitoring strategy	≤ 10 trucks (n=106)	11-50 trucks (n=72)	> 50 trucks (n=21)
• Companies who reported monitoring fatigue [2]	65.1	83.3	85.7
Strategies used by companies who monitor fatigue:	(n=69)	(n=60)	(n=18)
• Review log books	43.5	53.3	44.4
• [1] Other work records (trip diaries, departures times, arrival times)	30.4	31.7	27.8
• Ask drivers	33.3	26.7	16.7
• Review truck computer records [3]	7.2	30.0	27.8
• Use monitoring devices	8.7	15.0	27.8
• [1] Observe drivers	8.7	6.7	0.0
• Review accidents and incidents	0.0	3.3	5.6
• Other	7.2	3.3	16.7

[1] Category volunteered by company [2] $\chi^2_{(2)}=9.10$, p=0.01 [3] $\chi^2_{(2)}=11.79$, p=0.003

companies of all sizes reported that they at least sometimes change their schedules to suit customer demands, with around one quarter reporting that they always do so (Table 25). This suggests that some operational flexibility exists in schedules but that it is primarily used to allow responsiveness to customer needs rather than driver needs. The majority of companies of all sizes reported that they set estimated times of arrival for their work (Table 26). However, setting their own ETAs was less prevalent among small companies, for whom it was more common to report that the customer or the driver set the estimated time of arrival. Trip times were most commonly reported as being set by driver and management estimates, irrespective of company size. Driver estimates alone were rarely used by companies of all sizes.

3.7 The influence of attitudes on views of contributors to and management of fatigue

As reported above, companies were asked to report on a range of attitudinal dimensions related to driver fatigue: if awareness of fatigue had changed, how well they thought the problem was being managed by the industry, and how effectively they thought the current regulation managed fatigue. A key question of interest is whether these attitudes concerning fatigue are reflected in any differences in assessment of the nature of the problem of fatigue or its management.

Table 24: Company size by fatigue management strategies (%). Participants were allowed more than one response.

Fatigue management strategies	≤ 10 trucks (n=106)	11-50 trucks (n=72)	> 50 trucks (n=21)
• Companies endorsing more than 1 strategy [1]	58.5	76.4	76.2
Strategies endorsed:			
• None	4.7	0.0	0.0
• Monitor work hours	36.8	52.8	52.4
• Flexible scheduling	41.5	36.1	33.3
• Restricting hours	20.8	30.6	42.9
• Monitor schedules	15.1	19.4	14.3
• Compulsory rest breaks on trips	10.4	16.7	0.0
• Providing time to sleep between trips	10.4	13.9	4.8
• Fatigue education [2]	5.7	9.7	23.8
• No un/loading	6.6	8.3	0.0
• Health education	0.9	4.2	4.8
• Minimise night driving	2.8	0.0	0.0
Breakdown of "Other" strategies volunteered:			
• Relief drivers	7.5	6.9	4.8
• Leave rostering arrangements	4.7	6.9	4.8
• Driver consultation	3.8	9.7	0.0
• Work to regulations	3.8	4.2	9.5
• Provide sleeping facilities	0.9	5.6	9.5
• Two-up operation	2.8	1.4	0.0
• Regular medicals [3]	0.0	1.4	9.5
• Maximise truck comfort	0.9	1.4	0.0
• Staged/shuttle operation	0.0	2.8	0.0
• Other/Not elsewhere classified	4.7	12.5	9.5

[1] Mean (SD) number of strategies reported by companies with ≤10 trucks = 1.8 (0.9), 11-50 trucks = 2.3 (1.2), and >50 trucks = 2.2 (0.9). $F_{(2,198)}=7.24$, p=0.001, such that 1.8 < 2.3.

[2] statistical trend $\chi^2_{(2)}=7.10$, p=0.03 [3] $\chi^2_{(2)}=10.72$, p=0.005

Table 25: Company size by scheduling practices (%).

	≤ 10 trucks (n=106)			11-50 trucks (n=72)			> 50 trucks (n=21)		
	Most, Often or Always	Sometimes	None, Rarely or Never	Most, Often or Always	Sometimes	None, Rarely or Never	Most, Often or Always	Sometimes	None, Rarely or Never
• Amount of work with regular trip times and destinations (n=199)	42.5	25.5	32.1	56.9	26.4	16.7	47.6	38.1	14.3
• Amount of work that has an ETA (n=199)	48.1	21.7	30.2	59.7	20.8	19.4	47.6	28.6	23.8
• For those with an ETA, frequency of late arrival (n=146)	5.5	89.0	5.5	5.2	91.4	3.4	6.7	86.7	6.7
Schedule changes:									
• Frequency of delays for driver fatigue (n=196)	7.7	41.0	51.4	12.7	52.1	35.2	10.0	40.0	50.0
• Frequency of changes to suit customer demands (n=195)	30.4	36.3	33.3	27.8	44.4	27.8	23.8	47.6	28.6

Table 26: Company size by control of schedules (%). Participants were allowed more than one response.

	≤ 10 trucks	11-50 trucks	> 50 trucks
Who sets ETA?	(n=74)	(n=58)	(n=16)
• Company	66.2	70.7	81.3
• Customer	40.5	34.5	12.5
• Driver	37.8	25.9	18.8
• Other	0.0	3.4	6.3
How are trip times determined?	(n=106)	(n=72)	(n=21)
• Driver and management estimates	36.8	43.1	42.9
• Km/day (or average speed)	19.8	19.4	9.5
• Management estimates	18.9	15.3	23.8
• Trial trip	15.1	18.1	19.0
• Driver estimates	10.4	6.9	4.8
• Other	11.3	15.3	19.0

3.7.1 The influence of attitudes on views of contributors to fatigue

It is of interest to know whether company representatives who reported increased awareness of fatigue were more likely to report certain factors as contributors to fatigue that those who showed no such change in fatigue awareness. No matter what their reported level of fatigue awareness, the majority identified long driving hours, insufficient pre-trip sleep, insufficient rest breaks, alcohol and family problems among the top contributors to fatigue (Table 27). Examination of endorsement of each contributor by personal awareness revealed that there were only two statistical trends:

- "Insufficient sleep on trip" – there was a trend towards those companies with increased personal awareness of fatigue being more likely to endorse this factor (88% vs 83.%) and being less likely to report that they did not know if it was a contributor to fatigue (2% vs 10%; $\chi^2_{(2)} = 8.4$ p=0.02).

- "Drug after effects" - there was trend towards those companies who reported increased personal awareness of fatigue being more likely to rate this factor as a contributor (69% vs 50%; $\chi^2_{(2)} = 7.58$ p= 0.02)

Table 27: The influence of change in personal awareness of fatigue on company views of contributors to fatigue: Ranked factors (%).

Rank	Change in personal awareness of fatigue over last 5 years			
	Decreased/Did not change (n=30)		Increased (n=170)	
1	Long driving hours	(100.0)	Insufficient pre-trip sleep	(100.0)
	Insufficient pre-trip sleep	(100.0)		
2	Insufficient rest break	(90.0)	Insufficient rest break	(93.5)
3	Monotonous route	(86.7)	Family problems	(91.8)
	Alcohol	(86.7)		
4	Insufficient trip sleep	(83.3)	Long driving hours	(90.6)
	Family problems	(83.3)	Alcohol	(90.6)
	Poor diet	(83.3)		
5	Weather	(80.0)	Insufficient trip sleep	(88.2)
			Poor diet	(88.2)
6	Poor roads	(76.7)	Weather	(87.1)
	Truck ventilation	(76.7)		
7	Waiting to un/load	(70.0)	Poor roads	(83.5)
8	City traffic	(66.7)	Truck ventilation	(82.4)
	Truck vibration	(66.7)		
9	Cab design	(63.3)	Monotonous route	(76.5)
10	Non-driving work	(60.0)	Cab design	(75.3)
	Insufficient night sleep	(60.0)		
	Dawn driving	(60.0)		
11	Highway traffic	(56.7)	Dawn driving	(74.1)
12	Having to un/load	(50.0)	City traffic	(71.2)
	After effects of stay-awake drugs	(50.0)		
13	Working to regulations	(46.7)	After effects of stay-awake drugs	(69.4)
14	Dusk driving	(36.7)	Non-driving work	(67.6)
15	Rest away from home	(23.3)	Waiting to un/load	(65.3)
	Early afternoon driving	(23.3)		
16	Checking the load	(20.0)	Highway traffic	(63.5)
	Night driving	(20.0)		
17	Other	(16.7)	Truck vibration	(62.9)
18			Having to un/load	(61.2)
19			Insufficient night sleep	(58.2)
20			Dusk driving	(50.0)
21			Working to regulations	(48.2)
22			Night driving	(35.9)
23			Other	(26.5)
			Early afternoon driving	(26.5)
24			Rest away from home	(24.7)
25			Checking the load	(17.1)

There were also few differences in views of contributors to fatigue based on attitudes concerning how well fatigue is managed currently by the industry. Insufficient pre-trip sleep, insufficient rest breaks long hours of driving, family problems and alcohol were the top ranked contributors, irrespective of whether fatigue was considered well or badly managed (Table 28). Examination of endorsement of each contributor by attitude to industry fatigue management revealed that there was only one statistically significant difference and one indication of a trend:

- "Rest away from home" – those companies reporting that the industry manages fatigue badly were more likely to endorse this factor as a contributor (42% vs 20%; $\chi^2_{(2)}$ = 8.86 p=0.01).

- "Poor diet" - there was a trend towards those companies reporting that the industry manages fatigue badly being more likely to endorse this factor as a contributor (100% vs 84.7%; $\chi^2_{(2)}$ = 8.21 p= 0.02).

About half of companies reported that they thought the regulations were ineffective for managing fatigue. Their opinion on this issue did not substantially influence companies' views of contributors to fatigue, but some shifts in emphasis were suggested. Insufficient pre-trip sleep, long driving hours and alcohol were the top ranking factors (Table 29). For those companies who reported that the regulations were effective, the top ranking list of contributors included further specific work-related rest factors while for those companies who reported that the regulations were <u>*not*</u> effective the list included additional personal factors. Examination of endorsement of each contributor by attitude to effectiveness of the regulations revealed that there were three statistically significant differences and one indication of a trend:

- "Insufficient rest breaks" – those companies reporting that the regulations **do not** effectively manage fatigue were *less* likely to endorse this factor as a contributor (86% vs 97%; $\chi^2_{(2)}$ =8.47, p=0.01)

- "Waiting to un/load" – those companies reporting that the regulations **do not** effectively manage fatigue were *more* likely to endorse this factor as a contributor (76% vs 58%; $\chi^2_{(2)}$ = 9.05, p = 0.01).

- "Dawn driving" – there was a trend towards those companies reporting that the regulations **do not** effectively manage fatigue being *more* likely to endorse this factor as a contributor (84% vs 65%; $\chi^2_{(2)}$ = 8.18, p = 0.02)

It is of course not surprising that the contributor "working to regulations" was endorsed twice as commonly by those companies who reported that the regulations are ineffective for managing fatigue compared with companies who reported that the regulations were effective (71% vs 33%; $\chi^2_{(2)}$ = 27.28, p < 0.001).

Table 28: The influence of views of management of fatigue by the industry on ranking of contributors to fatigue: Ranked factors (%).

Rank	Fatigue managed by industry					
	Badly (n=48)		**Well (n=118)**		**Can't say/Other (n=34)**	
1	Poor diet	(100)	Insufficient pre-trip sleep	(96.6)	Insufficient pre-trip sleep	(97.1)
2	Insufficient pre-trip sleep	(95.8)	Insufficient rest break	(93.2)	Long driving hours	(94.1)
					Insufficient rest break	(94.1)
3	Long driving hours	(93.8)	Long driving hours	(90.7)	Insufficient trip sleep	(91.2)
			Family problems	(90.7)		
			Alcohol	(90.7)		
4	Insufficient rest break	(91.7)	Weather	(87.3)	Family problems	(88.2)
	Insufficient trip sleep	(91.7)				
	Family problems	(91.7)				
	Alcohol	(91.7)				
5	Poor roads	(89.6	Insufficient trip sleep	(84.7)	Dawn driving	(85.3)
			Poor diet	(84.7)	Alcohol	(85.3)
					Weather	(85.3)
6	Truck ventilation	(87.5)	Poor roads	(83.1)	Truck ventilation	(82.4)
7	Weather	(83.3)	Truck ventilation	(78.8)	Monotonous route	(79.4)
					Poor diet	(79.4)
8	Waiting to un/load	(77.1)	Monotonous route	(78.0)	Cab design	(73.5)
	Monotonous route	(77.1)				
	City traffic	(77.1)				
	Cab design	(77.1)				
9	Truck vibration	(75.0)	Cab design	(72.0)	Non-driving work	(70.6)
					Poor roads	(70.6)
					Drug after effects	(70.6)
10	Drug after effects	(72.9)	City traffic	(70.3)	Having to un/load	(67.6)
					Waiting to un/load	(67.6)
11	Dawn driving	(70.8)	Dawn driving	(68.6)	Dusk driving	(61.8)
					City traffic	(61.8)
					Highway traffic	(61.8)
12	Non-driving work	(68.8)	Non-driving work	(64.4)	Truck vibration	(55.9)
13	Highway traffic	(66.7)	Drug after effects	(62.7)	Insufficient night sleep	(52.9)
14	Insufficient night sleep	(58.3)	Waiting to un/load	(61.0)	Work to regulations	(41.2)
			Highway traffic	(61.0)		
			Truck vibration	(61.0)		
15	Having to un/load	(56.3)	Insufficient night sleep	(60.2)	Night driving	(29.4)
					Early afternoon driving	(29.4)
16	Dusk driving	(52.1)	Having to un/load	(58.5)	Checking load	(20.6)
	Work to regulations	(52.1)				
17	Rest away from home	(41.7)	Work to regulations	(48.3)	Rest away from home	(17.6)
18	Night driving	(39.6)	Dusk driving	(42.2)	Other	(14.7)
19	Early afternoon driving	(37.5)	Night driving	(32.2)		
	Other	(37.5)				
20	Checking load	(18.8)	Other	(22.9)		
21			Early afternoon driving	(20.3)		
22			Rest away from home	(19.5)		
23			Checking load	(16.1)		

Table 29: The influence of views of the effectiveness of regulations on ranking of contributors to fatigue: Ranked factors (%).

Rank	Regulations effective: Yes (n=112)		Regulations effective: No (n=80)	
1	Insufficient rest break	(97.3)	Insufficient pre-trip sleep	(98.8)
2	Insufficient pre-trip sleep	(94.6)	Family problems	(93.8)
3	Long driving hours	(91.1)	Long driving hours	(92.5)
4	Insufficient trip sleep	(90.2)	Poor diet	(88.8)
	Alcohol	(90.2)	Alcohol	(88.8)
5	Weather	(88.4)	Weather	(86.3)
	Family problems	(88.4)	Insufficient rest break	(86.3)
6	Poor diet	(87.5)	Insufficient trip sleep	(83.8)
			Dawn driving	(83.8)
			Truck ventilation	(83.8)
7	Poor roads	(85.7)	Poor roads	(82.5)
8	Truck ventilation	(79.5)	Cab design	(81.3)
9	Monotonous route	(77.7)	Monotonous route	(78.8)
10	City traffic	(70.5)	Waiting to un/load	(76.3)
11	Cab design	(68.8)	City traffic	(72.5)
12	Non-driving work	(67.0)	Work to regulations	(71.3)
13	Drug after effects	(66.1)	Drug after effects	(68.8)
14	Dawn driving	(65.2)	Truck vibration	(67.5)
15	Highway traffic	(64.3)	Non-driving work	(63.8)
16	Having to un/load	(61.6)	Highway traffic	(62.5)
	Truck vibration	(61.6)		
17	Waiting to un/load	(58.0)	Having to un/load	(60.0)
			Insufficient night sleep	(60.0)
18	Insufficient night sleep	(57.1)	Dusk driving	(50.0)
19	Dusk driving	(45.5)	Other	(35.0)
20	Night driving	(36.6)	Early afternoon driving	(30.0)
21	Work to regulations	(33.0)	Night driving	(28.8)
22	Rest away from home	(24.1)	Rest away from home	(26.3)
23	Early afternoon driving	(23.2)	Checking load	(17.5)
24	Other	(17.9)		
25	Checking load	(17.0)		

3.7.2 The influence of attitudes on views of countermeasures to fatigue

Similarly, different attitudes did not substantially influence endorsement of countermeasures to fatigue. Companies reporting increased awareness did not differ from the remainder: stopping to eat, shower, rest and sleep were commonly the top ranked strategies (Table 30). The top ranked countermeasures among those companies with decreased/unchanged awareness were also likely to include more of the very temporary measures such as music, CB radio and kicking the tyres, compared with companies who reported increased awareness. Examination of endorsement of each strategy by reported awareness of fatigue revealed an important difference. Those companies who reported that personal awareness remained unchanged or had decreased tended to be more likely to endorse stay-awake drugs as a helpful strategy (40% vs 23.5%; $\chi^2_{(2)} = 7.71$, p=0.02).

Attitudes concerning how well fatigue is managed in the industry did not influence views of countermeasures to fatigue. Stopping to sleep, rest and shower as well as use of ventilation were among the top ranked strategies (Table 31). For those companies who reported that the industry managed fatigue well, the list also included stopping to eat. Endorsement of individual strategies did not differ by attitude to industry fatigue management.

Attitudes to the effectiveness of the regulations for fatigue management also had little influence on views of countermeasures to fatigue. Stopping to eat, rest, sleep, shower and use of ventilation were the top ranked strategies (Table 32). Endorsement of individual strategies by attitude to the effectiveness of the regulations revealed one not particularly surprising trend. Those companies who reported that the regulations are ineffective for managing fatigue more commonly rated “ignoring the regulations to get home” as a helpful strategy (39% vs 23%; $\chi^2_{(2)} = 7.61$, p = 0.02).

3.7.3 The influence of attitudes on fatigue monitoring and management practices

While fatigue monitoring and management practices showed some consistent patterns across different attitudes to fatigue and its management, several key differences were also found. Table 33 shows fatigue monitoring and management practices by attitudes to fatigue awareness, to fatigue management in the industry and to effectiveness of the regulations in managing fatigue. Not surprisingly, there was a trend for fatigue to be monitored less commonly by companies who reported that they felt that fatigue was well managed by the industry. Changes in awareness and views about the effectiveness or otherwise of the regulations did not influence whether or not companies monitored fatigue among their drivers.

When specific monitoring strategies were considered, all companies, irrespective of attitudes, reported predominantly relying on log books, other work records and asking drivers as their main monitoring strategies (Table 33). However, companies who reported increased awareness reported significantly greater use of work records and a trend towards less use of observation of drivers, compared with companies whose awareness was unchanged/decreased. Companies who reported that fatigue was well managed by the industry reported significantly more commonly asking drivers about their fatigue levels.

Table 30: The influence of personal awareness of fatigue on views of countermeasures to fatigue: Ranked helpful and very helpful strategies (%).

	Change in personal awareness of fatigue over last 5 years			
Rank	**Decreased/Did not change (n=30)**		**Increased (n=170)**	
1	Stop to eat	(96.7)	Stop to rest	(100.0)
	Stop to rest	(96.7)		
	Stop to sleep	(96.7)		
	Shower	(96.7)		
	Ventilation	(96.7)		
2	Stop for a meal	(90.0)	Stop to sleep	(99.4)
	Kick tyres/ walk around	(90.0)		
3	Music	(73.3)	Shower	(94.1)
4	CB Radio	(66.7)	Stop to eat	(90.6)
			Ventilation	(90.6)
5	Non-caffeinated drinks	(56.7)	Stop for a meal	(88.8)
6	Caffeinated drinks	(53.3)	Kick tyres/walk around	(82.4)
7	Singing	(43.3)	Music	(80.6)
8	Ignore regulations to get home	(40.0)	CB radio	(76.5)
	Stay-awake drugs	(40.0)		
9	Eat while driving	(36.7)	Non-caffeinated drinks	(65.9)
10	Smoking	(13.3)	Caffeinated drinks	(65.3)
11			Singing	(50.0)
12			Eat while driving	(34.7)
13			Ignore regulations to get home	(27.1)
14			Stay-awake drugs	(23.5)
15			Smoking	(22.9)

Table 31: The influence of views on management of fatigue by the industry on endorsement of countermeasures to fatigue: Ranked helpful and very helpful strategies (%).

	Fatigue managed by industry					
Rank	**Badly (n=48)**		**Well (n=118)**		**Can't say/Other (n=34)**	
1	Stop to rest	(100)	Stop to rest	(100)	Stop to rest	(100)
			Stop to sleep	(100)	Stop to sleep	(100)
					Kick tyres/walk around	(100)
2	Stop to sleep	(97.9)	Shower	(95.8)	Shower	(91.2)
					Music	(91.2)
3	Shower	(93.8)	Stop to eat	(94.1)	Stop to eat	(88.2)
					Stop for a meal	(88.2)
4	Ventilate	(91.7)	Stop for a meal	(89.8)	CB Radio	(79.4)
			Ventilate	(89.8)		
5	Stop to eat	(87.5)	Kick tyres/walk around	(80.5)	Caffeinated drinks	(67.6)
	Stop for a meal	(87.5)				
6	Kick tyres/walk around	(81.3)	Music	(78.0)	Non-caffeinated drinks	(64.7)
7	Music	(75.0)	CB radio	(74.6)	Singing	(50.0)
8	CB radio	(72.9)	Non-caffeinated drinks	(63.6)	Eat while driving	(32.4)
9	Caffeinated drinks	(66.7)	Caffeinated drinks	(61.0)	Ignore regulations to get home	(23.5)
	Non-caffeinated drinks	(66.7)				
10	Singing	(43.8)	Singing	(50.8)	Smoking	(20.6)
					Stay-awake drugs	(20.6)
11	Singing	(43.8)	Eat while driving	(33.1)		
			Ignore regulations to get home	(33.1)		
12	Stay-awake drugs	(25.0)	Stay-awake drugs	(28.0)		
13	Ignore regulations to get home	(22.9)	Smoking	(23.7)		
14	Smoking	(16.7)				

Table 32: The influence of views of the effectiveness of regulations on endorsement of countermeasures to fatigue: Ranked helpful and very helpful strategies (%).

Rank	Regulations effective: Yes (n=112)		Regulations effective: No (n=80)	
1	Stop to rest	(100.0)	Stop to rest	(98.8)
	Stop to sleep	(100.0)		
2	Stop to eat	(95.5)	Stop to sleep	(97.5)
3	Shower	(94.6)	Shower	(95.0)
4	Ventilate	(92.0)	Ventilate	(91.3)
5	Stop for a meal	(91.1)	Stop for a meal	(86.3)
			Stop to eat	(86.3)
			Kick tyres/walk around	(86.3)
6	Kick tyres/walk around	(81.3)	CB radio	(80.0)
7	Music	(78.6)	Music	(78.8)
8	CB radio	(69.6)	Caffeinated drinks	(70.0)
9	Noncaffeinated drinks	(66.1)	Noncaffeinated drinks	(62.5)
10	Caffeinated drinks	(60.7)	Singing	(53.8)
11	Singing	(46.4)	Eat while driving	(40.0)
12	Eat while driving	(32.1)	Ignore regulations to get home	(38.8)
13	Stay-awake drugs	(23.2)	Stay-awake drugs	(30.0)
	Ignore regulations to get home	(23.2)		
14	Smoking	(22.3)	Smoking	(22.5)

Companies who were uncertain about the industry's fatigue management performance tended towards being least likely to report the use of technical monitoring devices while companies who reported that the industry managed fatigue badly tended towards being most likely to use these devices. Views about the effectiveness of the regulations for fatigue management made little difference to monitoring strategies used by companies.

Irrespective of attitudes, monitoring hours, restricting hours and flexible scheduling were the predominant strategies reported. Awareness of fatigue made no difference to the pattern of fatigue management strategies reported. Views of the industry's fatigue management performance shifted the emphasis slightly. Those companies who reported that the industry managed fatigue well reported that flexible scheduling was their most common fatigue management strategy; and they tended towards being more likely to use flexible scheduling than those who reported that the industry managed fatigue badly. Not

Table 33: The influence of views of fatigue on fatigue monitoring and management practices (%). (Monitoring strategies n = those who monitor)

	Change in personal awareness of fatigue in last 5 years		How well is fatigued managed in industry			Current regulations allow effective fatigue management [10]	
	Decreased/ No change (n=30)	Increased (n=170)	Badly (n=48)	Well (n=118)	Can't say/Other? (n=34)	Yes (n=112)	No (n=80)
• Monitors fatigue	63.3	75.9	83.3	68.6 [1]	79.4	75.9	73.8
Monitoring strategies used:	*(n=19)*	*(n=129)*	*(n=40)*	*(n=81)*	*(n=27)*	*(n=85)*	*(n=59)*
• Ask drivers	31.6	28.7	15.0	32.1 [2]	40.7	30.6	28.8
• Use monitoring devices	15.8	13.2	22.5	12.3	3.7 [3]	12.9	15.3
• Review log books	36.8	49.6	40.0	55.6	37.0	48.2	49.2
• Use other work records	0.0	34.9 [6]	25.0	29.6	40.7	31.8	23.7
• Observe drivers	21.1	5.4 [5]	7.5	4.9	14.8	4.7	11.9
• Review truck computer	15.8	19.4	30.0	17.3	7.4 [4]	15.3	25.4
Management strategies:	*(n=30)*	*(n=170)*	*(n=48)*	*(n=118)*	*(n=34)*	*(n=112)*	*(n=80)*
• None	3.3	2.4	4.2	1.7	2.9	2.7	2.5
• Monitor schedules	13.3	17.1	16.7	16.1	17.6	17.9	16.3
• Flexible scheduling	50.0	36.5	25.0	44.9 [9]	35.3	38.4	38.8
• Restrict hours	33.3	25.3	25.0	28.0	23.5	19.6	36.3 [8]
• Monitor hours	33.3	46.5	54.2	40.7	44.1	44.6	45.0
• Provide time between trips	10.0	11.2	10.4	13.6	2.9	10.7	11.3
• Fatigue education	6.7	9.4	16.7	6.8 [7]	5.9	6.3	12.5
• Compulsory rest on trip	10.0	11.8	8.3	13.6	8.8	12.5	11.3
• No un/loading	6.7	6.5	4.2	6.8	8.8	4.5	10.0

[1] statistical trend p=0.054 (when dichotomised) [2] statistical trend p=0.045 (when dichotomised) [3] statistical trend p=0.03 [4] trend for linear association p=0.02
[5] statistical trend p=0.04 [6] significant effect p=0.002 [7] suggestion of trend p=0.08 (Fisher's exact test) [8] significant effect p=0.01 [9] statistical trend p=0.02 (when dichotomised)
[10] Those who report that regulations effectively manage fatigue, report fewer company fatigue management strategies ($t_{(140)}$=2.72, p=0.005)

surprisingly, those companies who reported that the regulations effectively manage fatigue also reported using significantly fewer fatigue management strategies. A key difference in strategy choice was also observed between companies based on their views of the effectiveness of the regulations. Those companies who reported that the regulations were ineffective were also significantly more likely to use restriction of hours as a fatigue management strategy.

3.7.4 The influence of attitudes on scheduling practices

Scheduling practices showed remarkably consistent patterns across different attitudes to fatigue and its management. Table 34 shows two key aspects of scheduling practices – use of ETAs and schedule changes - by attitudes to fatigue awareness, fatigue management in the industry and effectiveness of the regulations in managing fatigue. Irrespective of attitudes to fatigue and its management, about half of companies reported that all of their work involved an estimated time of arrival, while between one third and one quarter of companies reported that none of their work involved ETAs (Table 34).

There were few influences of attitudes on preparedness to institute scheduling changes. Companies reporting increased awareness of fatigue tended towards being more likely to change their schedules to suit customer needs (Table 34).

Table 34: The influence of views of fatigue on scheduling practices (%).

	Change in personal awareness of fatigue in last 5 years		How well is fatigued managed in industry			Current regulations allow effective fatigue management	
	Decreased/ No change (n=30)	Increased (n=170)	Badly (n=48)	Well (n=118)	Can't say/ Other? (n=34)	Yes (n=112)	No (n=80)
Amount of work with ETA:							
• All/Most	56.7	51.8	50.0	51.7	58.8	54.5	53.8
• Some	10.0	24.1	22.9	22.9	17.6	20.5	20.0
• None	33.3	24.1	27.1	25.4	23.5	25.0	26.3
Schedule changes:							
• To suit customer							
Always/Often	13.3	30.6 [1]	22.9	33.9	14.7	23.2	33.8
Sometimes	30.0	41.2	39.6	39.0	41.2	46.4	31.3
Rarely/Never	46.7	27.6	35.4	25.4	41.2	29.5	32.5
• Delay due to driver fatigue							
Always/Often	6.7	10.0	16.7	8.5	2.9	8.0	12.5
Sometimes	33.3	45.9	43.8	43.2	47.1	50.0	37.5
Rarely/Never	56.7	42.9	39.6	46.6	47.1	41.1	47.5

[1] trend for linear association $\chi^2_{(1)}=5.33$, p=0.02 (Those whose awareness has increased are more likely to change schedules to suit customers)

4. DISCUSSION

The majority of companies reported that awareness of fatigue had increased, both for them personally and for the industry in general. This is hardly surprising, given the considerable public and regulatory attention focused on the issue over the last decade. The picture reported from the driver survey had not been as strong: drivers were considerably less likely to endorse increased awareness in the industry. It is conceivable that drivers do not know about industry awareness that actually exists, but it is more likely that the discrepancy in views reflects that increased awareness in the industry has not yet translated into practice. Drivers would be most likely to be responding to evidence of fatigue management as an indicator of industry awareness rather than abstract awareness per se.

The views of management of fatigue also suggest a lag between increased awareness of fatigue and changes in operational practice. One in five companies reported that fatigue is badly managed in the industry, and only half reported that it is well managed. This estimation, while not overwhelmingly positive, is nevertheless more optimistic than that expressed in the driver survey: around half of drivers reported that fatigue is badly managed by the industry. Together these views support the suggestion that increased company awareness may not yet have translated into practice to make a substantial contribution to effective management of the problem.

Company views of causes factors and strategies to manage fatigue revealed remarkably consistent recognition of the contribution of aspects of patterns of work and rest to fatigue. Virtually all companies reported the significance of sleep and recovery before and during trips, and the contribution of long working hours. However, two of the key contributors to fatigue, driving at particular times (night and dawn) and non-driving work, particularly un/loading, are not well recognised. Perhaps the key difference between company and driver views on the causes of driver fatigue was the role of personal factors vs the role of work organisation factors. Companies put greater emphasis on personal factors like family problems, and less emphasis on the importance of some aspects of work organisation over which they actually have some control, such as loading work, compared with drivers, and were less likely to recognise the impact of driving at certain times of the day (night and dawn). In fact, considerable research underscores the significance of non-driving work in the development of fatigue (e.g., Williamson et al., 1992; Williamson et al., 1996; Feyer et al., 1997). The impact of time of day on fatigue is perhaps one of the best understood aspects of the problem, both operationally in Australia and theoretically (Feyer and Williamson, 1995; Williamson et al., 1996; Folkard and Monk, 1979). Yet company representatives failed to report the importance of night work as a prime contributor to fatigue and night sleep as a prime strategy for reducing fatigue.

The pattern evident in the strategies rated as helpful by companies for managing fatigue confirmed that the value of rest and sleep were well recognised. The majority of companies endorsed these strategies overwhelmingly as being very helpful. This raises another important discrepancy with the views of drivers. While sleep was commonly reported as being used by respondents in the driver survey, only a minority rated sleep as being helpful. This raised the possibility that access to sleep for drivers is limited and may not allow for quality recovery. When, where and for how long sleep is taken are all factors that

will influence its effectiveness as a recovery strategy. The driver survey found that the proportion of drivers doing very long trips has increased over the last decade, with most doing some night or dawn driving, suggesting factors that would limit the usefulness of sleep. In light of these features of current work practice, the discrepancy between the views of drivers and the views of companies again suggests that increased company awareness has not yet translated into effective practice. Increased awareness of the critical value of sleep needs to be translated into operational practice which recognises that the restorative value of sleep and rest can be decreased or increased depending on how work and rest are scheduled.

Companies are attempting to tackle some of the pressing scheduling issues confronting the industry. They specifically reported monitoring of hours, restriction of hours and flexibility in scheduling among the most common fatigue management strategies used. Yet drivers still reported tight schedules as a major source of driver fatigue. The discrepancy is most likely to reflect that while companies aim for flexibility, they nevertheless reported altering schedules to accommodate customer demands much more often than altering schedules to accommodate driver fatigue.

The survey results confirmed anecdotal evidence from a number of sources including the focus groups with companies conducted as part of earlier surveys of fatigue in the road transport industry (Williamson, Feyer, Coumarelos and Jenkins) that there is a perception in the industry that the freight task needs to be highly responsive to customer demands. In stark contrast to this however, companies in fact reported considerable control over schedules. Only one quarter of companies reported that their work was mostly irregular, strict estimated times of arrival were relatively uncommon and trip times were most frequently based on management and driver estimates. Recent findings elsewhere also indicate that companies actually appear to have more control over schedules than is popularly believed. A survey of long haul drivers in the US, followed by interviews with the motor carrier dispatcher who arranged the drivers' load at time of survey participation showed that tight schedules cannot be attributed solely to customer demands (Braver, Preusser and Ulmer, 1999). Dispatchers reported that the most common determinants of schedules were rule of thumb trip averages estimated by the dispatcher, and that customers rarely demanded the schedules that were assigned. In other words, those setting the schedules may not recognise that the schedules are indeed still tight and that there is more opportunity for flexibility and control of schedules than is currently exercised.

Another important finding of the US study was that most dispatchers did not factor non-driving tasks into trip time estimation, which may have resulted in additional time pressure in schedules (Braver et al., 1999). Few Australian companies reported restricting loading and unloading activities, or even streamlining them, as a way of managing fatigue. This is consistent with the finding that non-driving work was not ranked highly among the list of contributors to fatigue endorsed by companies. Drivers, on the other hand, reported non-driving work as a major factor in causing their fatigue and endorsed such initiatives as being important ways for companies to better manage fatigue in the industry. It seems therefore, that from the perspective of companies, the impact of non-driving work remains under-estimated as a contributor to driver fatigue and as potential feature of management of the problem. Of course, it should be noted that non-driving work is a bigger issue than just company practices, involving the full supply chain with such issues as waiting in queues for loading and unloading and the like also having an impact. Nevertheless, it is problematic that companies do not yet widely recognise the burden of non-driving work.

Overwhelmingly, companies and drivers reported payment on a per kilometre basis, suggesting that distance travelled is the primary determinant of trip value, to both the driver and the company. Although non-driving work was paid work in the majority of cases for employee drivers, only a minority of companies reported paying for non-driving work of sub-contractor and independent drivers. This reflects the general pattern of findings with respect to different types of drivers. Not surprisingly, there was less intervention or active management of fatigue for non-employee drivers. Active management strategies, monitoring or even formal policies to manage fatigue for sub-contractor and independent drivers were only reported by a minority of companies. Yet half of companies reported hiring these drivers. This presents something of a problem, since it leaves the management of fatigue for non-employee drivers entirely to the individual driver in many cases. It is unlikely that fatigue can be effectively managed for non-employee drivers without company co-operation and collaboration.

Company size made some predictable differences to the pattern of findings in the survey. Formal policies and monitoring were more commonly reported by larger companies and they were more likely to use technical monitoring strategies, compared with smaller companies. It is worth pointing out that the adoption and sophistication of fatigue monitoring probably reflects differences in resources. Consequently one might recommend that government and industry provide more and targeted assistance to smaller companies. Perhaps the most relevant difference, however, was that fewer smaller companies tended to have mostly regular work (although half of them still reported that most work was regular). However, the influence of customer demands on schedules was universal: the majority of companies of all sizes reported that they are likely to change schedules to suit customer demands.

Company practices were somewhat related to measures of attitudes to fatigue. Increased awareness of fatigue over the last 5 years was associated with more attention being paid to the problem. More aware companies were more likely to monitor fatigue and were more likely to change their schedules to accommodate driver fatigue. Confidence in the industry's management of fatigue and confidence in the regulations, on the other hand, were associated with less attention being paid to the problem. Those companies who reported that they thought fatigue was well managed in the industry were less likely to monitor fatigue and more likely to change schedules to suit customer demands but not for driver fatigue. Companies who reported confidence in the regulations to manage fatigue used fewer management strategies, were less likely to otherwise restrict hours and were more likely to change their schedules for customer demands but not for driver fatigue. These findings would suggest that while attitudes do not seem to have a dramatic effect on practice, education and information for companies is likely to be a useful strategy to contribute to actively involving companies in better management of fatigue and to overcome complacency about the problem.

Overall, the findings of the survey suggest that there has been some progress in companies' knowledge and understanding of driver fatigue. The importance of sleep and rest is now well appreciated in the industry. Yet, the contribution of some of the other key determinants of fatigue remain under-recognised or under-emphasised in the industry, notably the impact of non-driving work and night work. Management of fatigue reflected these emphases: restriction of night work and non-driving work were not as high priorities for companies as were other fatigue management strategies. It is not surprising that these

structural features of the industry, which are clearly very difficult to modify, remain most resistant to change. However, the extent to which these structural features are difficult to change needs to be questioned in light of the finding that the popular beliefs in the industry are not always supported by the reality. Extent of control over schedules, one of the most often cited structural impediments to better management of fatigue, is in fact underestimated by companies. The ability to change other structural features may be similarly underestimated.

Companies did not seem to be doing all that they could to facilitate fatigue management. This could at least partly be due to lack of understanding of the phenomenon of fatigue. Many line haul managers either did not understand (or were not prepared to acknowledge) how fatigue arises, the role of night work in exacerbation of the problem, the role of night sleep in assisting with management of the problem or the contribution of non-work tasks to overall toll on drivers of total work. There needs to be greater understanding in the industry that the problem requires a more sophisticated approach than simply restricting hours of driving. It must be acknowledged, however, that it is hardly surprising that there is a general belief in the industry in the value of simply counting hours. After all, the current regulations do no emphasise anything but the length of time at the wheel. Clearly, we need to work harder to make transport managers more aware of fatigue and its characteristics.

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6. APPENDIX 1: QUESTIONNAIRE

COMPANY QUESTIONNAIRE

Company Name _____

Address & Telephone Number _____

_____

_____

Contact Name _____

Date Interviewed _____

Interviewer _____

COMPANY CHARACTERISTICS

The first few questions are a little background telling us what your company is like.

1. **Do you mostly employ:**

	YES	**NO**	*(roughly how many)*
Company drivers	( )	( )	( )
Sub-contractors (freelance or company colours)	( )	( )	( )
Independent owner drivers	( )	( )	( )

2. **How many trucks does your company have?**

	(tick one option)
Fewer than 5 trucks	( )
Between 5 and 10 trucks	( )
Between 11 and 50 trucks	( )
More than 50 trucks	( )

3. What are the MAIN types of freight that your company usually transport?

You may tick more than one option

Livestock	( )	
Refrigerated or temperature controlled	( )	***Free response, If not in list choose "other"***
Dangerous materials *eg, fuel, chemicals*	( )	
Farm produce	( )	
Other bulk *eg, grain, coal, quarry materials*	( )	What type of bulk? _____
Machinery	( )	
Building materials	( )	
Groceries	( )	
Manufactured goods *eg clothing*	( )	What type of goods? _____
General/ mixed freight	( )	
Car carrying	( )	
Express freight	( )	
Other (please describe)	_____	
	_____	

4. Does your company do:

You may tick more than one option

Single driver trips	( )
Two-up driver trips	( )
Staged /Changeover trips	( )

5. **We are interested in how your drivers are paid.**

(Ask all below for Company drivers (5a) first, then for subcontractors (5b), and finally for independent owner drivers (5c))

How are your drivers paid?

	(a) Company	*(b) Subcontractors*	*(c) Independent owner drivers*
By hourly rate	( )	( )	( )
Flat day rate	( )	( )	( )
Day rate with overtime	( )	( )	( )
Weekly rate with overtime	( )	( )	( )
Flat rate for every truck load carried	( )	( )	( )
Rate for each trip based on kms travelled and/or tonnage carried	( )	( )	( )
If none, Specify Other	_____	_____	_____
	_____	_____	_____

Are your drivers paid:

	Company drivers	*Subcontractors*	*Independent owner drivers*
The award rate	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )
Don't know	( )	( )	( )
If NO:			
Less than the award rate	( )	( )	( )
More than the award rate	( )	( )	( )

Is non-driving (eg. loading/unloading) work paid?

	Company drivers	*Subcontractors*	*Independent owner drivers*
	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )
If YES:			
Is it at the same rate as driving work?	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )

Are your subcontractors paid the same as company drivers?

If YES, go to next question.

If NO, go back 5(b) & complete for subcontractors.

Are your independent owner drivers paid the same as company drivers?

If YES, go to next question.

If NO, go back to 5(c) & complete for independent owner drivers.

The next few questions are about how your company manages fatigue.

6. Does your company have a formal driver fatigue management policy for:

	Circle one
Company drivers?	Yes / No
Subcontractors?	Yes / No
Independent owner drivers?	Yes / No

7. **Does your company have a formal medical policy for:**

	Circle one
Company drivers?	Yes / No
Subcontractors?	Yes / No
Independent owner drivers?	Yes / No

8. **Does your company monitor the levels of fatigue in your drivers?**

Yes ( )

No ( )

Other _____

_____

(If yes,) how does your company monitor driver fatigue?

	Tick as many as mentioned
Ask drivers how they felt	( )
Use monitoring devices	( )
Review drivers' log books	( )
Review truck computer records	( )
Review accidents and incidents	( )

Other (please describe) _____

_____

_____

9. What does your company currently do to try to manage driver fatigue?

Tick as many as mentioned

Driver education about fatigue	( )
Driver education about health	( )
Monitor schedules to make sure they are not too tight	( )
Monitor the working hours that drivers do	( )
Restricting hours for drivers	( )
Making drivers take compulsory rest breaks when on a trip	( )
Allowing flexible schedules for drivers (eg, allowing rest to be taken when needed)	( )
Using other workers for loading and unloading	( )
Minimise night driving	( )
Allow enough time between trips for drivers to go home and sleep	( )
Other (please describe) _____	

The next few questions are about how your company manages driving and working hours.

10. In your company are hours for drivers managed according to the working hours regulations?

(Tick one for each type of driver)

	For Company drivers	*For Subcontractors*	*For Independent owner drivers*
Yes	( )	( )	( )
No	( )	( )	( )

11. When managing drivers working hours does your company put a restriction on any of the following:

(Circle one for each type of driver)

	For your Company drivers	*For your Subcontractors*	*For your Independent owner drivers*
On the number of hours worked per **day**	Yes / No	Yes / No	Yes / No
If YES, how many?	_____	_____	_____
On the number of hours worked per **week**	Yes / No	Yes / No	Yes / No
If YES, how many?	_____	_____	_____
On the number of **continuous days** worked	Yes / No	Yes / No	Yes / No
If YES, how many?	_____	_____	_____
On the number of **nights** drivers can work in a week	Yes / No	Yes / No	Yes / No
If YES, how many?	_____	_____	_____
On any other aspects	Yes / No	Yes / No	Yes / No
Specify	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

The next set of questions are about schedules, departure and arrival times.

12. Does your company have regular trip times and regular destinations?

Tick one

All of your work	( )
Most of your work	( )
Some of your work	( )
None of your work	( )

13. Does your company estimate times of arrival for:

Tick one

All of your trips?	( )	
Most of your trips?	( )	
Some of your trips?	( )	
None of your trips?	( )	**GO TO Q14.**

Who decides the estimated times of arrival?

Tick one

Company	( )
Customer	( )
Driver	( )
Other (please describe)	_____

Is the driver's actual arrival time monitored?

Yes ( )

No ( )

If YES, what happens when the driver is late?

A penalty is imposed ( )

The schedule is revised ( )

Other (please describe) _____

How often do late arrivals happen?

Never ( )

Sometimes ( )

Often ( )

Always ( )

Does your company offer a bonus for being early or on-time?

Yes ( )

No ( )

14. **How are trip times determined?**

Driver estimates	( )
Management & driver estimates	( )
Management estimates	( )
Based on the number of kilometres a day	( )
Based on a trial trip	( )
Other (please describe)	_____

15. **When trip times are worked out in your company, what percentage of the trip is usually built in for sleep, rest and breakdowns?**

_____ **%**

16. **How often do you change trip schedules to suit customer demands?**

Never	( )
Sometimes	( )
Often	( )
Always	( )

17. **How often do you delay a load because of driver fatigue?**

Never	( )
Sometimes	( )
Often	( )

The next set of questions are about fatigue in the long distance road transport industry.

18. Do you think that AWARENESS of driver fatigue has CHANGED over that last 5 years, *IN THE INDUSTRY* in general?

Has increased a lot	( )
Has increased	( )
No change	( )
Has decreased	( )
Has decreased a lot	( )

19. Has YOUR level of AWARENESS of driver fatigue CHANGED over that last 5 years?

Has increased a lot	( )
Has increased	( )
No change	( )
Has decreased	( )
Has decreased a lot	( )

20. **I am going to read out a list of things that might contribute to driver fatigue. As I read them out please say YES if you think they contribute to fatigue and NO If you think they do not.**

	You may tick more than one option		*You may tick more than one option*
Long driving hours	( )	Driving during early afternoon	( )
Too much non-driving work	( )	Poor road conditions	( )
Insufficient rest break	( )	Uninteresting/ monotonous driving route	( )
Having to load/unload	( )	Heavy highway traffic	( )
Waiting to load/unload	( )	Heavy city traffic	( )
Checking the load	( )	Poor weather conditions (eg, fog)	( )
Having to rest away from home	( )	Poor cab design	( )
Irregular or inadequate sleep during trips	( )	Poor truck ventilation	( )
Inadequate amount of sleep before trips	( )	Truck vibration	( )
Not enough night time sleep	( )	Family problems	( )
Driving at night	( )	Poor diet/ irregular eating	( )
Driving at dawn	( )	After-effects of using stay-awake drugs	( )
Driving at dusk	( )	Use of alcohol	( )
Having to stick to the working hours regulations	( )		

Other (please describe) _____

21. **I am going to read out a list of strategies that drivers might use to manage their fatigue. Would you please rate them on how helpful you think they are for managing fatigue.**

	Very helpful	*Helpful*	*Unhelpful*	*Very unhelpful*
Stopping to eat	( )	( )	( )	( )
Stopping to rest	( )	( )	( )	( )
Stopping to sleep	( )	( )	( )	( )
Stopping for a meal	( )	( )	( )	( )
Eating while driving	( )	( )	( )	( )
Having a drink containing caffeine (eg. coffee, tea, Coca-cola)	( )	( )	( )	( )
Having a non-caffeine drink	( )	( )	( )	( )
Smoking	( )	( )	( )	( )
Taking stay-awake drugs	( )	( )	( )	( )
Ignoring driving hours regulations to finish a trip, when close to home	( )	( )	( )	( )
Kicking the tyres or walking around	( )	( )	( )	( )
Taking a shower	( )	( )	( )	( )
Listening to music/radio	( )	( )	( )	( )
Using the CB radio	( )	( )	( )	( )
Singing	( )	( )	( )	( )
Adjusting the ventilation (eg, windows, heater, air conditioning)	( )	( )	( )	( )

Other (please describe) _____

_____

22. **How well do you feel that fatigue is managed IN THE INDUSTRY NOW?**

Extremely badly	( )
Quite badly	( )
Quite well	( )
Very well	( )
Don't have an opinion	( )

23. **Do you think current regulations allow you to help your drivers to manage fatigue effectively?**

Yes	( )
No	( )

If NO, Why not? _____

_____

_____

24. **Are there any other things that you think could be done to allow you to manage fatigue better among your drivers?**

_____

_____

_____