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**Title and Subtitle**

Strategies to combat fatigue in the long distance road transport industry  
Stage 1: The industry perspective

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**Abstract**

This report investigates strategies that would be effective and practicable in reducing driver fatigue in the long distance road transport industry. Information was collected from correspondence and consultations with international authorities in the area, consultations with major employer and employee organisations in Australia, and a questionnaire based survey of 960 drivers across Australia. It includes assessments of the extent of the problem, and attitudes to a range of possible solutions by these groups, as well as analysis of the experience of fatigue by employment status and type of driving operation (two-up, staged etc)

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**Keywords**

driver fatigue, long distance road transport, staged driving, two up driving

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**Strategies to combat fatigue in the long distance  
road transport industry**

Stage 1: The industry perspective

National Occupational Health and Safety Commission

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May 1992

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## EXECUTIVE SUMMARY

This study was commissioned by the Federal Office of Road Safety to investigate ways of successfully reducing driver fatigue in long distance drivers of heavy vehicles. To achieve this aim, the study was designed to have two stages which would be done in sequence. The first stage was to involve gathering of information about the strategies that would be effective and practicable in reducing driver fatigue and the second was to involve evaluation of a small number of the strategies judged to be most likely to be successful on the basis of results of the first stage of the study. This report is a description of the results of the first stage of the study.

In this first part of the study, information was collected from three major sources; correspondence and consultations with international authorities in the area, consultations with major employer and employee organisations in Australia and a questionnaire-based survey of drivers across Australia. The consultation section involved sending 126 letters to various government, research, industry, library and training organisations from 13 countries. Replies were received from 53.2% of these organisations. In addition, 21 personal consultations were conducted with experts in the field from 6 countries. The main focus of all these communications was on information on hours of service regulations, recommended codes of practice and research and training initiatives in the area of driver fatigue. The results suggested that the status of activity on driver fatigue in Australia is at about the same stage as in the USA, Canada and Europe. It can be concluded, therefore, that the range of possible ways of managing driver fatigue are either already known in Australia, or they have not yet been developed.

For the second source of information, standardised discussions were held with representatives of the industry interest groups. The purpose of these discussions was to determine the group's collective views on a number of issues. These included how much of a problem driver fatigue is for the industry, their views about effects of fatigue on driving, the factors contributing to driver fatigue and

their views on the effectiveness and acceptability of a range of possible strategies that could be used to reduce driver fatigue. It was important to gain judgements about the possible strategies on both the dimensions of effectiveness and acceptability because they jointly govern the success in practice of any new strategies. No matter how effective a strategy might be for reducing fatigue, if drivers and the industry do not find it acceptable, they will not use it, and the strategy must be judged as unsuccessful. Conversely, acceptable strategies might not be effective ones.

Analysis of the views of the groups revealed that most believed that driver fatigue was a major problem for the industry. All groups believed that better training and education about fatigue and improvements to the roads would be effective ways of reducing driver fatigue. Most groups also rated improved off-road rest facilities, greater flexibility in work hours, staged driving, reducing economic pressures on drivers and more efficient loading and unloading as strategies likely to be most effective for managing driver fatigue. Most of the groups did not favour banning driving in the early hours of the morning or stricter driving hours.

The third source of information was gathered from 960 long distance truck drivers using a questionnaire that was either self-administered or administered by interview. For self-administration, the questionnaire was distributed mainly through trucking companies in all mainland states, and also by handing them directly to drivers at truckstops. Virtually all interviews were carried out at truckstops. The questionnaire included questions about details of the driver's experience, type of employment and their working conditions as well as details of their last trip and their last working week. A large section of the questionnaire asked much the same questions about fatigue as were asked of the industry groups, and also included drivers' views and experiences of fatigue especially the effects of fatigue on driving, what factors contribute to their fatigue, how they deal with it and their views about the same range of strategies that could be used to combat fatigue. The results of the pilot study showed that drivers would not use the effective/acceptable distinction, since they regarded any

strategies that were effective as acceptable. Consequently, drivers were only asked about the effectiveness of strategies.

Analysis of the results was performed on the entire sample and on different sectors of the industry. Employees were compared to owner-drivers, and single drivers to those working staged and two-up operations.

The results showed that, similar to the industry groups, most drivers believed fatigue to be a major problem for the industry. In contrast, however, most drivers did not report fatigue to be a major personal problem, although most reported feeling fatigued when driving at least occasionally. Typically drivers reported feeling fatigued by the 14th hour of driving and most particularly in the early hours of the morning. Similarly, most drivers reported that fatigue adversely affected their driving by making them slower to react and producing poorer steering and gear changing. Drivers were also consistent on the factors they believed contributed to their fatigue while driving. These included dawn driving, poor roads, long driving hours, being involved in the loading process and poor weather. Clearly when drivers experience fatigue, even if it is only occasionally, they present an increased risk to the community due to their impaired driving. It is significant also that drivers were aware of their own response to fatigue, indicating that when drivers do not appropriately combat fatigue it may be because their schedules do not allow this rather than because they do not recognise that they are fatigued.

Differences could be seen, however, in fatigue reporting in drivers doing different driving operations. Single drivers and two-up drivers reported fatigue as occurring more often and as a greater personal problem than did staged drivers. Yet staged drivers reported getting fatigued much earlier in the trip than single or two-up drivers.

Analysis of the pressures on drivers working under different driving operations provided some useful insights into why these differences in fatigue experience occurred. Two-up and single drivers could be expected to be more tired as they typically did much longer trips and much longer weekly

working hours than staged drivers. Their greater experience of fatigue may also be partly due to their greater involvement in the loading process. Two-up and single drivers also experienced greater financial pressures as they tended to be paid at lower rates, were more likely to have to negotiate for their loads and their rates were more contingent on the loads that they carried. All these factors would promote the overall greater level of fatigue in single and two-up drivers by emphasising the need to work for more hours than staged drivers.

Some characteristics of single and two-up driving, however appeared to modify the drivers' ability to deal with fatigue such that they reported being able to drive for longer periods than staged drivers without being tired. Single and two-up drivers were less likely to have scheduled start times and less likely to start in the night hours than were staged drivers. They also spent proportionately more time of their trips in breaks, and their breaks were more likely to be for rest rather than for work purposes as well. These characteristics combine to provide a greater flexibility for two-up and single drivers to organise themselves, which in turn allows them to stave off driver fatigue for longer than staged drivers, although, because most of their trips are very long, fatigue is most likely to be the inevitable consequence.

Much the same influences were found for independent owner-drivers compared to company employees, especially those working for large companies. While independent owner-drivers did much longer distances and longer hours compared to large company drivers, both groups were comparatively low reporters of both fatigue on their last trip and fatigue as an overall personal problem. Independent owner-drivers, however, reported experiencing fatigue on most trips more often than large company employees, yet they were able to go further in their trips than large company employees before reporting fatigue. The reasons for this appeared again to be that owner-drivers reported greater flexibility in organising their trips than employees of large companies for the same reasons as two-up and single drivers and this again seemed to buffer to some extent the owner-drivers' ability to deal with fatigue.



Just as drivers demonstrated that they knew how and why fatigue affected them, they also appeared to be aware of ways of dealing with it. Drivers reported on the strategies they selected as being very helpful for reducing fatigue from a list of possible strategies and then to indicate which of them were most helpful. Most drivers reported stopping to sleep as the most helpful of the strategies that they used to combat fatigue. Of the approximately one-third of drivers who reported stay-awake drugs as very helpful for reducing fatigue, about half reported that drugs were the most helpful method. The results revealed good consensus between the sectoral groups and between drivers' views and those of the industry groups. Judged to be very helpful by most drivers were improvements to the roads, more flexible working hours, easing of tight schedules and streamlining of loading and unloading procedures. The same strategies were also judged by drivers to be most helpful along with allowing stay-awake drugs. The only strategy on which there were strong differences between industry groups and drivers was education and training about fatigue. The industry groups emphasised education and training about fatigue as a very helpful strategy for fatigue management, whereas drivers hardly mentioned it. This is not really surprising as the results of this study demonstrated that drivers already had a good deal of information about driver fatigue.

In addition, the strategies of staged driving and two-up driving were favoured by most industry groups, but only those drivers who had fairly recent experience of them believed that they were superior to single driving. This was especially true of two-up driving which attracted the least support from drivers. There is considerable evidence from this study, however, that neither of these strategies in themselves are particularly successful methods of dealing with fatigue, at least as they are currently used in the industry. Staged drivers undoubtedly were amongst the lowest reporters of fatigue, however this may be due to their shorter trips rather than to staged driving per se. Staged drivers, however, experienced a number of pressures which are most likely to be the reason for drivers disliking it as a type of driving.

Two-up driving, on the other hand, involved extremely long trips compared to all other types of driving and,

consequently, two-up drivers reported amongst the highest levels of fatigue. It is not surprising therefore, that most drivers did not favour two-up over single driving. It may be that drivers do not like two-up because of factors to do with the greater length of their trips, rather than anything to do with shared driving. It is impossible therefore, to truly assess the benefits of this form of driving since the results suggest that any benefits that might accrue from having another driver with whom to share the driving are outweighed by the greater length of the trips that they do.

The present research was the first stage of a two stage study. Stage 1 attempted to obtain the industry's views about the most effective and practical ways of reducing levels of fatigue in long distance drivers. The results shed considerable light on the most likely ways of reducing driver fatigue. Shorter trips and greater flexibility to organise the trip, reducing driving in the early hours of the morning, improving roads, easing of schedules and improving loading and unloading were all factors that were either related to lower levels of fatigue in drivers or were favoured by them as ways of managing their fatigue.

In Stage 2 a small number of strategies will be selected from Stage 1 and will be evaluated to determine to what extent they are useful and how they could fit into the industry. The strategies selected will be from those that were judged as most effective and acceptable by the different industry sectors since these are essential prerequisites for their success. Some strategies, such as road improvements, which are outside the scope of the industry to implement, will not be considered further. Specific details of the strategies to be evaluated in Stage 2 will be decided upon following further consultation with the industry.

**AUSTRALIAN TRUCK DRIVER SURVEY:  
SUMMARY OF MAIN FINDINGS**

**Characteristics of the sample**

960 drivers participated in the study.

About three quarters of the sample were employee drivers and the remainder were owner-drivers.

**Characteristics of the last trip**

*Length*

Overall, the mean length of the last trip was 1259.8 kms.

Employee drivers of large companies drove the shortest trips (mean: 889 kms).

Owner-drivers working for medium companies drove the longest trips (mean: 1659 kms).

Two-up operations involved the longest trips (mean: 2519 kms).

Staged operations involved the shortest trips (mean: 600.5 kms).

*Scheduling*

Overall, most drivers (80.3%) had an Estimated Time of Arrival [ETA], which in most cases (86.1%) was set by another party.

More independent owner-drivers scheduled their own start time than did any other type of driver (86.0%).

*Breaks*

Overall, the mean percentage of trip time spent in breaks was 20.7%.

Two-up drivers spent proportionally more of their trip time in breaks than did any other group (mean percentage: 31.7%).

Staged drivers spent proportionally less of their trip time in breaks than did any other group (mean percentage: one-way<sup>1</sup> drivers 14.1%; two-way drivers 16.8%).

### *Loading and unloading*

The majority of drivers did at least some of their own loading or unloading on their last trip (77.5%), and this did not vary substantially with employment status.

For those drivers involved in loading/unloading activities, the mean time spent loading/unloading on the last trip was 3.5 hours.

Fewer one-way staged drivers were involved in loading/unloading than any other driving operation (16.7%).

### **Characteristics of work during the last week**

Overall, the mean number of hours worked in the last week was 62.6 hours.

Overall, 30.1% of the sample worked more than 72 hours in the last week, with at least one quarter of each employment group working these hours.

More employees of medium and large companies worked "office hours" of 38 hours or less during the last week (34.9% and 30.8% respectively).

More two-up drivers worked more than 72 hours in the last week than any other group (56.5%).

<sup>1</sup> For discussion of one-way and two-way trips see pp. 54-56.

## **Breaking the rules**

Overall, approximately half the drivers reported breaking the work hour regulations on at least half their trips (56.6%).

Fewer employees of large companies reported breaking the work hour regulations on at least half their trips than any other group (37.2%).

## **Fatigue**

### *Size of the problem*

Approximately three quarters of the drivers rated fatigue as at least a substantial problem in the industry (77.5%).

Approximately one third of the drivers rated fatigue as at least a substantial problem for them personally (34.9%).

More employees of medium companies and owner-drivers working for small companies rated fatigue as at least a substantial problem for them personally (46.9% and 46.6% respectively).

Fewer independent owner-drivers rated fatigue as at least a substantial problem for them personally (26.0%).

Drivers of staged one-way operations were least likely to rate fatigue as at least a substantial problem for them personally (15.1%).

### *Experience of fatigue*

The majority of drivers reported experiencing fatigue at least occasionally while driving (84.6%).

About half the drivers reported feeling fatigued on their last trip (50.6%).

More single one-way drivers experienced fatigue on the last trip (59.3%).

Fewer staged one-way drivers reported fatigue on the last trip than any other group (34.4%).

#### *Contributors to and effects of fatigue*

The most common contributors to driver fatigue were:

- \* Poor roads (58.2%)
- \* Dawn driving (56.0%)
- \* Long driving hours (48.6%)
- \* Poor weather (47.5%)
- \* Loading/unloading (47.2%)

The majority of drivers reported that their driving is worse when they are fatigued (74.5%).

The most common effects of fatigue on driving were:

- \* Slower to react (49.2%)
- \* Poorer gear changes (40.4%)
- \* Driving too slowly (38.5%)
- \* Poorer steering (37.2%)

#### *Dealing with driver fatigue*

Close to one third of the drivers reported using stay awake drugs to reduce driver fatigue (31.7%).

Of the fatigue reduction strategies that could be used, the ones most often rated by drivers as very helpful in dealing with driver fatigue were:

- \* Improving roads (84.2%)
- \* Easing tight schedules (75.0%)
- \* Greater flexibility in hours (74.6%)
- \* More efficient loading/unloading (74.2%)

#### *Two-up and staged driving*

Of drivers with experience of two-up, far fewer preferred two-up (10.6%) than preferred single driving (77.3%).

Of drivers with experience of two-up, far more rated two-up as more fatiguing (45.1%) than rated single driving as more fatiguing (23.9%).

Of drivers with experience of staged driving, slightly more drivers preferred staged driving (47.6%) than preferred single driving (38.6%).

Of drivers with experience of staged driving, far fewer rated staged driving as more fatiguing (18.6%) than rated single driving as more fatiguing (44.7%).

## BACKGROUND

The main impetus for this study came from the increasing pressure from within the community to improve the safety standards of the long distance road transport industry. Recently there have been a number of initiatives directed towards this aim. These include the Special Task Group on Driving Hours, the Austroads Project on Management of Heavy Vehicle Driver Safety, a study considering the economic pressures within the industry (Hensher, Battellino, Gee and Daniels 1991), a study of truck driver behaviour and attitudes (Haworth, Vulcan, Schulze and Foddy, 1991) and the Road Transport Industry Forum's tackling of the process of self-regulation for the industry.

Given the distances that have to be travelled in Australia, and therefore the amount of driving that has to be done, perhaps one of the most prominent safety issues for the industry has been driver fatigue. Fatigue is certainly viewed as a principal contributing factor to road crashes (Haworth, Triggs and Grey, 1988). Yet, fatigue is still considered to be a major unresolved problem in driver safety, with one of the main impediments to management of the problem being the lack of practical consideration of its nature in the industry. The main aim of this project, therefore, was to take up the issue of driver fatigue, and, in particular, to examine the relationship between work practices and driver fatigue.



## INTRODUCTION

The contribution of fatigue to heavy vehicle accidents is by no means clearcut (Hamelin, 1987; US Department of Transportation, Federal Highways Administration, 1990; MacDonald, 1984). Much of the evidence implicating driver fatigue in crashes, for example, is indirect and circumstantial. Crashes which are thought to be caused by driver fatigue have been identified as those in which there is no evidence of mechanical failure, no evidence of alcohol or drugs, and no evidence of evasive action on the part of the driver (Moore-Ede, Campbell and Baker, 1988). In other words, loss of alertness is inferred when all other possible accounts of the accident have been ruled out.

On the other hand, what we know about human performance leaves little doubt about the nature of the difficulties that must be part of the long distance driving task. Tasks which require long hours of constant attention, prolonged inactivity and/or stamina in a monotonous or repetitive environment, so-called vigilance tasks, are known to demand more effort of the worker (see Krueger, 1989 for a review). Jobs like driving are, therefore, by their very nature, more tiring.

Time of day also affects worker performance. Alertness is reduced during nightwork, both as a function of inadequate daytime sleep and of reduced physiological arousal due to circadian influences (see Rosa, Bonnet, Bootzin, Eastman, Monk, Penn, Tepas and Walsh, 1990 for a review). In particular, tasks involving vigilance, like driving, become more difficult to continue performing during these times of the day because the naturally occurring reductions in alertness have to be overcome (Folkard and Monk, 1985). Simply exerting the effort necessary to sustain performance within acceptable limits at such times of reduced alertness, is likely to cause additional fatigue. There are times of the day, therefore, when, again by their very nature, jobs like driving are both more likely to produce fatigue and to be more tiring.

A review of the vast literature examining aspects of human operator performance during driving and similar vigilance tasks, and the impact of shiftwork and night work on such performance, is beyond the scope of this report. Several excellent reviews of this area are available (Dotto, 1990; Folkard and Monk, 1985; Haworth, Triggs and Grey, 1988; Hockey, 1983; Krueger, 1989; MacDonald, 1984; Mackie and Miller, 1978; Rosa et al, 1990; Warm, 1984). From these reviews, it can be seen that many of the fundamental patterns of increased human error seen in a wide variety of occupational settings are particularly relevant to long distance driving. Jobs such as driving which require performance over long periods of sustained alertness are known to be prone to increases in error with increases in time on the job. Similarly, jobs performed in the early hours of the morning, as is long distance truck driving, are also known to be more prone to error at that time of the day.

These effects can be seen clearly in the results presented by Moore-Ede, Campbell and Baker (1988). The probability of a single vehicle accident increases very gradually over about eight hours and then climbs so that by ten hours of driving there is a threefold increase in risk. When the data are corrected for the number of trucks at risk by time of day, there is also a considerable increase in risk during the early hours of the morning, peaking with a fivefold increase in risk at about 4.00 a.m. (Moore-Ede et al, 1988). Moreover, examination of the combined effects of time of day and duration of driving revealed that the probabilities of having an accident multiply so that there are very different effects at different times of the day. During day-time driving over ten hours, the risk of an accident never exceeds the average, that is there is no increased risk by duration of driving time. In contrast, during a ten hour drive spanning the early hours of the morning, the risk of a single vehicle accident is increased fourteen-fold by the end of a ten hour drive at 5.00 a.m. (Moore-Ede et al, 1988).

Thus, the distribution of work across the day and across the week has become a very important focus for attention. One way that management of this distribution has been approached has been through regulations and collective agreements

controlling drivers' hours of driving, work and rest. As Table 1 shows, the form that regulations take varies substantially from country to country.

**Table 1: Summary of current driving hours regulations**

	EC	USA	CANADA	AUS <sup>*</sup>
Maximum daily driving	9	10	13	11/12
Maximum driving time without a break	4.5	-	-	5.0/5.5
Minimum break length	0.5	-	-	0.5
Maximum working day	-	15	15	11/12
Minimum daily rest period	11 <sup>a</sup>	8	8	5/10 <sup>b</sup>
Maximum driving hours/week	56	-	-	72
Maximum working hours/week	-	60	60	-
Maximum driving hours/2 weeks	90	-	120	-

\* ranges across states are given

<sup>a</sup> average over two weeks

<sup>b</sup> minimum continuous rest in 24 hours

(adapted from MacDonald, 1984, Table 2.1 and  
ASW Associates, 1991)

Yet, despite the considerable variation in hours of service requirements, driver fatigue remains a serious problem universally and the impact of hours of service on fatigue remains unresolved (Hamelin, 1987; US Department of Transportation, Federal Highways Administration, 1990; MacDonald, 1984). Clearly, consensus about the real limits of duration of driving and duration of work is lacking.

What is becoming increasingly clear, however, is that driver fatigue needs to be viewed not only in terms of long hours of driving, but rather as part of the whole pattern of work and rest (Hamelin, 1987; Moore-Ede et al, 1988). Obviously, the amount of rest relative to the amount of work is an important factor but other factors are likely to be of equal importance. The effects of the nature of the rest obtained, including its quality and timing, needs to be considered, as does the impact of recovery time between trips. It also seems likely that non-driving activities such as loading and unloading will influence the level of fatigue experienced by drivers. These are all factors which have been shown to be relevant to worker performance in other industrial settings (Rosa et al, 1990) and even in truck driving (Mackie and Miller, 1978).

One of the major impediments to better understanding of the impact of patterns of work and rest on driver fatigue has been the lack of practical assessment of either the nature of the problem in the industry or of the pressures operating within the industry that might cause fatigue (Hamelin, 1987; MacDonald, 1984). The working conditions which actually exist in the industry, and how drivers themselves understand and respond to these conditions, will determine the constraints under which they operate and thereby the ways in which they plan and organise their driving. For example, various practices, already operational in the industry, reflect consideration of work and rest patterns. Single, two-up and staged driving, by definition, involve very different work and rest patterns, but all aim to assist in doing the same job of long distance truck driving. The provision of a relief driver, either as part of a team in two-up operations or at a changeover point in staged operations, provides ways of doing the job to try to overcome the limitations of a single driver doing the same job. The main questions are whether these practices are

indeed of benefit, and why a particular practice does or does not benefit drivers in managing driver fatigue.

More generally, this study was designed to examine what strategies could be used to better manage driver fatigue among long distance drivers. In particular, the study was directed towards investigating the relationship between work practices, both existing and potential, and fatigue. The two main questions being tackled were first, how aspects of current conditions and practice relate to driver fatigue and, second, which work practices would be likely to be most successful in managing driver fatigue. To address these questions, the study was divided into two stages. In the first stage, attitudes to fatigue and its management, as well as current work practices relating to fatigue were investigated in the main sectors of the industry. The second stage will be an investigation of how successful the strategies considered effective or favoured by the industry actually are in reducing fatigue. By basing judgements about what could be done on information obtained from the industry, the strategies which emerge are much more likely to be those which will be acceptable to the industry. While a given strategy must be useful in reducing fatigue in an objective sense, it is at least as important that it be acceptable to the industry. Without such acceptance, a strategy would not be used and its effectiveness would become a moot point. Thus, finding out what the industry currently does and thinks was considered an essential starting point. The present report describes the findings of this essential first stage.

## **AIMS**

The aim of Stage 1 of the study was to identify possible countermeasures to driver fatigue in the long distance road transport industry in Australia. To identify such possible countermeasures, data were collected from three main sources: worldwide correspondence and consultation; consultations with Australian industry groups; and a survey of Australian truck drivers. The aims for each source of data collection are outlined below.

### **1. WORLDWIDE CORRESPONDENCE/CONSULTATION**

The aim here was to obtain information about fatigue countermeasures being used or being considered for use in road transport industries overseas or in similar industries in Australia. It was important to determine whether the Australian road transport industry could benefit from innovations elsewhere.

### **2. AUSTRALIAN INDUSTRY GROUP CONSULTATION**

The aim of these consultations was to obtain the views of Australian industry groups on fatigue and potential fatigue countermeasures so that our recommendations for fatigue countermeasures could be based not only on the actual effectiveness of various countermeasures but also on their likely acceptance and adoption by the Australian road transport industry.

### **3. AUSTRALIAN TRUCK DRIVER SURVEY**

To draft useful recommendations for countermeasures to fatigue in the Australian road transport industry, it was considered necessary to first establish the following: the

extent to which fatigue is currently a problem for Australian truck drivers; the strategies that Australian truck drivers currently use to combat fatigue; and the likely acceptance by Australian truck drivers of any recommended strategies.

## METHOD

An advisory committee was convened by the Federal Office of Road Safety to assist the study team on the three facets of the research outlined in the Aims section. More specifically, the purpose of the Advisory Committee was to assist the study team in:

- (i) ensuring that the relevant issues were covered by the project;  
and
- (ii) pinpointing, and suggesting solutions to, any problems that might arise with the practical execution of the project.

A list of the members of the Advisory Committee is presented in Appendix A. A meeting with the Advisory Committee took place at Worksafe Australia on 7 March, 1991. The study team outlined the three facets of the study as planned and received feedback on these facets from the Advisory Committee.

### 1. WORLDWIDE CORRESPONDENCE/CONSULTATION

#### CORRESPONDENCE

One hundred and twenty-six letters were sent to various government, research, industry, library and training organizations around the world. A listing of these organizations by country is presented in Appendix B.

The letters used a standard format and asked for information on hours of service regulations, recommended codes of practice, research initiatives and training initiatives pertaining to driver fatigue and long distance driving. The letters also asked for the names of persons and/or organizations that may be worthwhile contacting.

A database was compiled to document where letters were sent and what responses were received. Appendix B outlines which



organizations responded from each country and presents a bibliography of the references received.

## **CONSULTATION**

On the basis of the responses to the letters, a list was compiled of individuals with whom it would be particularly worthwhile to conduct personal consultations. A number of Australian researchers and industry representatives were added to this list. Table 2 lists the individuals around the world with whom personal consultations were held.

The personal consultations involved obtaining further information on the consultee's particular area of expertise with respect to driver fatigue and/or the long distance road transport industry. Appendix B includes references obtained through the personal consultations.

### **2. AUSTRALIAN INDUSTRY GROUP CONSULTATION**

Discussion groups were held with major employer and employee industry organizations in Australia. Table 3 outlines these Australian industry organizations. The views of these organizations on the nature and extent of driver fatigue and on the effectiveness and acceptability of potential countermeasures were canvassed.

The only organization that declined our invitation to participate in a discussion group was the National Transport Federation (NTF). The NTF preferred that their views on fatigue be obtained from (i) their policy statements, and (ii) the discussion group with the RTIF, a body that represents the major road transport organizations in Australia including the NTF.

A standardized format and agenda was used for each discussion group. The agenda for the discussion groups was developed from a review of the current literature, the feedback from the Advisory Committee and the early stages of the worldwide correspondence and consultation. All organizations were approached by phone and were asked if they would like to take part. Each organization was asked to

**Table 2: Outline of consultations with researchers and industry operators worldwide**

<b>COUNTRY</b>	<b>NAME</b>	<b>AFFILIATION</b>	<b>DATE</b>
<b>AUSTRALIA</b>	Dr D Carseldine & Ms D Fell	Roads and Traffic Authority, Sydney	4/2/91
	Dr L Hartley	Department of Psychology, Murdoch University, Perth	11/4/91
	Prof D Hensher & Ms H Battellino	Research Centre, Graduate School of Management & Public Policy, University of Sydney, Sydney	30/4/91
	Dr N Haworth	Accident Research Centre, Monash University, Melbourne	21/5/91
	Mr R Finemore	Finemore Holdings Ltd, Wagga	27/3/91
	Mr O Jones	Gascoyne Trading Pty, Perth	11/4/91
<b>USA</b>	Dr D Wylie & Dr R Mackie	Human Factors Research, Essex Corporation, California	24/6/91
	Dr R Hertz	Batelle Statistics & Data Analysis Systems, California	26/6/91
	Dr R Pain	Transportation Research Board, National Research Council, Washington DC	26/6/91
	Dr S Green	American Trucking Associations Foundation, Virginia	27/6/91
	Dr T Brown & Mr G Page	Research & Test Dept., Association of American Railroads, Washington DC	27/6/91
	Mr J Grimm	Office of Motor Carrier Information, Federal Highway Administration, Washington DC	28/6/91

**Table 2: Outline of consultations with researchers  
and industry operators worldwide (cont)**

<b>COUNTRY</b>	<b>NAME</b>	<b>AFFILIATION</b>	<b>DATE</b>
<b>USA</b>	Mr J Scapellato & Ms D Freund	Office of Motor Carrier Standards, Federal Highway Administration, Washington DC	28/6/91
	Mr M House	Motor Carriers Policy & Programs, Transport Canada, Ottawa	2/7/91
<b>CANADA</b>	Mr S Vespa	Transportation Development Centre, Transport Canada, Montreal	3/7/91
	Mr P Hamelin	National Institute for Research on Transport Safety, Paris	17/7/91
<b>FRANCE</b>	Mr C Morin	Road Transport Research Programme, OECD, Paris	18/7/91
	Mr F van Ouwkerk	Foundation for Traffic Safety & Science, Rotterdam	22/7/91
<b>HOLLAND</b>	Mr W Clough	Transport & Road Research Laboratory, Crowthorne	24/7/91
<b>ENGLAND</b>	Dr I Brown	MRC Applied Psychology Unit, Cambridge	25/7/91
	Mr G Brothers	International Transport Workers' Federation,  London	26/7/91

**Table 3: Outline of discussion groups with  
Australian industry organizations**

ORGANIZATION	DATE	VENUE	NO. OF PARTI- CIPANTS
Australian Bus and Coach Association (ABCA)	3/4/91	Melbourne	5
Transport Workers Union: Melbourne	3/4/91	Melbourne	3
Australian Road Transport Federation (ARTF)	4/4/91	Melbourne	7
Transport Workers Union: Perth (TWUP)	10/4/91	Perth	17
Transport Workers Union: Adelaide (TWUA)	12/4/91	Adelaide	8
Transport Workers Union: Sydney (TWUS)	15/4/91	Sydney	3
Long Distance Road Transport Association (LDRTA)	13/5/91	Sydney	11
Australian Livestock Transporters Association (LTA)	16/5/91	Brisbane	12
Transport Workers Union: Brisbane (TWUB)	17/5/91	Brisbane	12
Road Transport Industry Forum (RTIF)	6/8/91	Melbourne	6

provide approximately 10 members who would represent a cross-section of the organization's main interests with respect to long distance road transport. Each discussion group was led by one of the study team members and ran for

about two to three hours. The same questions were raised for discussion by the discussion leader in the same order to each group. A copy of the questions posed is presented in Appendix C. The questions addressed four issues:

- (1) The extent to which driver fatigue is a problem in the long distance road transport industry in Australia.
- (2) The effects of fatigue on driving.
- (3) The factors which contribute to driver fatigue (eg, work/rest schedule factors, driving conditions, truck conditions, personal factors and organizational job features).
- (4) The effectiveness and acceptability of possible strategies that could be used to reduce driver fatigue in the long distance road transport industry in Australia (eg, changes to drug taking, work hour regulations, loading/unloading, pay and scheduling; use of fatigue training, two-up driving, staged driving and fatigue monitors; and improvements to truck design, rest facilities and roads).

The consensus views expressed by each group were noted by the discussion leader in a standard results booklet. The discussions were also taped enabling the written notes to be checked against the tapes and, if appropriate, amended or expanded at some later point.

### **3. AUSTRALIAN TRUCK DRIVER SURVEY**

#### **DESIGN**

A survey method was used to obtain information from long distance truck drivers on fatigue. The survey was structured so that it could be either self-administered by the drivers or administered as an interview. The survey was similar in content to the discussion format used for Australian industry organizations in that it asked about:

- (1) the extent to which driver fatigue is a problem in the long distance road transport industry in Australia;
- (2) the effects of fatigue on driving;
- (3) the factors which contribute to driver fatigue; and

(4) attitudes to possible strategies that could be used to reduce driver fatigue in the long distance road transport industry.

In addition, the survey included questions on driver characteristics and current work practices.

### **PILOT SURVEY**

A pilot version of the survey was tested in order to develop the final version for the full-scale study. The pilot version of the survey was used primarily to detect any difficulties associated with specific questions or with the two forms of administration.

The interview form for the pilot survey was slightly longer than the self-administered form because it contained more detailed questions about drivers' work/rest schedules over the last week. Specifically, while the self-administered form asked drivers to report how much time they spent working over the last week, the interview form asked drivers to break down this working time into time spent on each of the following activities: driving, loading/unloading, sleeping and resting.

Forty-two male drivers participated in the pilot, 22 completing the self-administered form and 20 completing the interview. All 42 drivers were volunteers who took part in the survey at the Southern Cross Truck Terminal at Chipping Norton, Sydney, in June and July, 1991.

The pilot indicated that both the self-administered and interview forms were quite well understood by the drivers but that the interview form was somewhat lengthy. As a result, a major change made to the pilot survey involved shortening the interview form by shortening the section on drivers' work/rest schedules over the last week. The change to the interview form effectively meant that the interview form became identical to the self-administered form. A change was also made to the section on possible strategies that could be introduced to reduce fatigue across the industry. This section was altered so that drivers were only asked about the effectiveness of these strategies rather than about both effectiveness and acceptability. This alteration was made because it appeared from the pilot that

drivers did not readily distinguish the effectiveness of these strategies from their acceptability. In addition to these changes, some minor wording changes were made and, for a few questions, additions or deletions were made to the alternatives from which drivers could choose. (N.B. The most notable of these remaining changes are detailed in the materials section below.)

## **SUBJECTS**

Nine-hundred and sixty drivers participated in the full-scale study, 950 being male and 6 being female (4 subjects failed to report their gender). Of the 960 subjects, 658 (68.5%) subjects completed the self-administered form and 302 (31.5%) subjects were interviewed.

## **MATERIALS**

The final version of the survey is presented in Appendix D. A definition of fatigue was provided in the survey (at the beginning of Section 2) to minimize the likelihood of drivers interpreting the term "fatigue" in different ways. The definition of fatigue was as follows: "By fatigue we don't only mean feeling drowsy or sleepy. We also mean being tired, lethargic, bored, unable to concentrate, unable to sustain attention and being mentally slowed." A summary of the final version of the survey is outlined below, section by section.

Section 1: Driver and vehicle information. The purpose of Section 1 was to obtain information about the composition of the sample.

This section gathered personal details about the driver (eg, age, sex, marital status, number of dependents and home base) and details about the driver's employment (eg, owner or employee driver, size of company worked for, heavy vehicle driving experience, type of freight carried, type of payment, payment rate and type of vehicle driven).

Section 2: Fatigue. The purpose of this section was to obtain information about drivers' experience of fatigue and their attitudes to fatigue and to potential fatigue countermeasures.

Firstly, this section asked for attitudes to fatigue (eg, extent to which fatigue is a problem). Secondly, this section obtained details about the occurrence of fatigue (eg, latency and typical onset time), the perceived effects of fatigue on driving (eg, on reaction time, on driving tasks and on attention) and the perceived contributors to fatigue (eg, work/rest schedule, driving conditions, truck conditions and personal factors). Thirdly, Section 2 obtained information on the strategies that drivers may use currently to deal with fatigue (eg, sleep, rest, eating, drug taking, ventilation). Finally, drivers were asked to rate the effectiveness of a number of strategies that COULD be used to deal with driver fatigue across the industry (eg, changes to drug taking, work hour regulations, loading/unloading, pay and scheduling; use of fatigue training, two-up driving, staged driving and fatigue monitors; and improvements to truck design, rest facilities and roads).

The questions in Section 2 were similar to those posed to the Australian industry groups with the following notable exceptions.

Firstly, the questions on the occurrence of fatigue were omitted from the industry group agenda since it was thought that drivers would be best placed to report on their own experience of fatigue.

Secondly, a number of changes were made to the questions on the possible strategies that could be used to deal with fatigue across the industry. It should be noted that these questions on possible strategies were identical for the industry groups and the pilot survey. Consequently, the differences outlined below on these questions between the industry groups and the final survey are identical to the differences on these questions between the pilot survey and the final survey. These differences are as follows.

(a) Because (as noted earlier) the pilot suggested that drivers did not adequately distinguish effectiveness and acceptability, drivers taking part in the final survey were only asked to rate the strategies on effectiveness rather than on both effectiveness and acceptability.



(b) As a result of comments made by the industry groups and by drivers taking part in the pilot, the following wording changes appeared in the final survey: "self-regulation of driving hours and accreditation of drivers" became "having driving and/or work regulations set by industry people not be government people"; "reduction of economic pressures on drivers (eg, easing unreasonably tight schedules imposed by employers and/or freight forwarders)" was divided into two separate strategies, namely "increasing rates of pay for drivers" and "easing unreasonably tight schedules imposed by employers and freight forwarders".

(c) As a result of the overseas consultations, the following strategy was added to the list of strategies in the final survey: "regulation of work time not just driving hours (eg, including loading time)".

Section 3: Last trip. The purpose of this section was to obtain an accurate record of drivers' work so the occurrence of fatigue could be related to the wider circumstances of driving.

Drivers were asked about their last long distance one-way trip. Firstly, this section obtained descriptive information about the trip (eg, place and time of the start and finish, length, arranger of the load, freight carried, type of driving operation, information on scheduling, information on rest breaks, details about loading and unloading, and average speed on the open road). Secondly, information was gathered on the amount of rest/sleep the driver obtained in the 10 hours immediately before commencing the trip. Finally, information was gathered on the driver's experience of fatigue during the trip (eg, when the driver felt fatigue).

Section 4: Comparison of last trip with usual trips. The purpose of this section was to assess the representativeness of the data collected on trips in Section 3.

This section asked whether the driver's last trip was similar to the trips he usually makes.

Section 5: Details of work/rest schedule. The purpose of this section was to determine whether the circumstances of

the last working week affected the experience of fatigue on the last trip.

Section 5 asked for a record of the driver's work over the week immediately before his last trip (eg, typicality of last week, number of long distance trips made, and place and time of each trip start and finish).

Section 6: Comparison of trip rates. The purpose here was to obtain information about the effects of trip payment rates on driving.

Drivers were asked whether carrying a lower paid load influences average speed on the road, the number of rest breaks and/or the length of rest breaks.

Section 7: Breaking the rules. The purpose of this section was to ascertain the extent to which pressures in the industry may influence drivers to break rules, and hence, may increase the risk of driver fatigue.

Drivers were asked about the frequency with which they breach (i) the work hour regulations and (ii) the road rules. Information was also obtained on the reasons for any breaches (eg, tight schedules, rewards or penalties, getting in for the next load, doing enough trips to earn a living, returning home, reaching adequate rest facilities).

Sections 8 and 9: Two-up driving and staged driving. The purpose of each of these sections was, respectively, to obtain attitudes on two-up driving from drivers who had driven two-up and to obtain attitudes to staged driving from drivers who had driven in staged operations.

Drivers were asked whether they preferred driving in two-up and staged operations rather than in single operations; whether they found driving in two-up and staged operations more or less fatiguing than driving in single operations; how often and how recently they had driven in two-up and staged operations; and details about a typical two-up trip and a typical staged trip.

## **PROCEDURE**

Initially, it was aimed to obtain a sample of drivers that would accurately reflect the distribution of different types of truck drivers across the Australian long distance road transport industry. For instance, it was intended that the ratio of owner-drivers to employee drivers in the sample would mirror the corresponding ratio in the industry. Similarly, it was intended that the break down of owner-drivers (eg, prime contractors, subcontractors, freelance owner-drivers) and of employee drivers (eg, employees working for small, medium-sized and large companies) in the sample would be the same as the corresponding break down in the Australian industry.

A thorough investigation revealed that up-to-date statistics were not available on the distribution of different types of long distance truck drivers in Australia. This investigation involved a literature search as well as consultations with staff from the Federal Office of Road Safety, the NSW Road Transport Association, the Bureau of Transport and Communications Economics (BTCE) and the Australian Bureau of Statistics. The most recent document was a BTCE document entitled "Survey of trucking operations" which was based on the makeup of the industry in 1982-1983.

Given that up-to-date statistics on the makeup of the industry were not available, it was decided that the most useful sampling approach was to ensure that different types of drivers were all represented in the sample by sampling from as many sources as possible in the time available.

### **Procedure for self-administered survey**

The self-administered form of the survey was distributed by two different methods. Firstly, self-administered surveys were handed to drivers directly by one of the study team at truckstops or truck terminals in all states nationally except for Tasmania. A list of truckstops/terminals used is presented in Table 44 in Appendix E. It should be noted that these same truckstops/terminals were used for interviewing drivers (see part (b) of procedure below).

Permission was obtained from the manager of each truckstop/terminal to approach drivers at the site in order to ask them if they would take part in the survey either by completing a self-administered survey or an interview. Each driver who agreed to complete the self-administered survey was told about the purpose of the survey and about its confidential and anonymous nature, and was given a survey to complete and mail back in his own time. A postage-paid envelope was attached to each self-administered survey to increase the ease with which the driver could return the completed survey.

The second distribution method for the self-administered surveys involved having companies distribute them to their drivers. Table 45 in Appendix E outlines the companies involved in the this distribution process, broken down by Australian state and by size of company. The number of self-administered surveys distributed via companies, broken down by state and size of company, is presented in Table 46 in Appendix E. The largest numbers of self-administered surveys were distributed to large companies (ie, those having more than 50 trucks) in New South Wales and Victoria, and the smallest numbers were generally distributed to small companies (ie, those having no more than 10 trucks) in all states. This distribution pattern reflects (i) that large companies require more questionnaires than small and medium-sized companies because they have more drivers, and (ii) that more large companies are based in New South Wales and Victoria than in the other states in accordance with the greater freight volumes in New South Wales and Victoria.

For this second, company distribution method, one member of the study team arranged a meeting with the management of companies that had agreed to take part. The study team member explained the purpose of the study, the details of the administration and left the self-administered surveys with management for distribution. Again a postage-paid envelope was attached to each self-administered survey so that drivers could easily mail back the completed surveys. In addition, a sheet explaining the purpose of the study and the confidential and anonymous nature of the study was also attached to each survey.

### **Response Rate**

A record was kept of the number of self-administered surveys returned from each state by each distribution method.

The number of self-administered surveys returned from the distributions to truckstops/terminals in each state is presented in Table 44 in Appendix E. The overall response rate for self-administered surveys at truckstops was 18.7% (122 returned from 654 distributed). The largest number of surveys (50) was returned from the truckstop distribution in New South Wales, with roughly equal numbers (7 - 17) being returned from the truckstop distributions in other states.

An outline of the response rate for self-administered surveys distributed via companies is presented in Table 47 in Appendix E. The overall response rate for distribution via companies was 15.6% (536 returned from 3432 distributed). As can be seen from Table 47, the response rate was higher for companies having more than 50 trucks (18.6%) than it was for small and medium-sized companies (9.9% and 9.5%, respectively) and higher for New South Wales and Victorian distributions (17.8% and 18.2%, respectively) than for distributions in the other states (7.1% - 15.4%).

### **Procedure for interview survey**

The interviews were conducted by the four members of the study team and one other qualified interviewer at truckstops or truck terminals nationally. As already noted, interviews took place at each of the truckstops/terminals where self-administered surveys were distributed (see Table 44 in Appendix E). In addition, 10 interviews took place on the premises of Gascoyne Trading, Perth.

As was the case for drivers at truckstops/terminals who agreed to complete the self-administered survey, those agreeing to an interview were told about the purpose of the survey and about the confidential and anonymous nature of the survey. In addition, drivers agreeing to an interview were told that the interview would take about 30 minutes.

A break down of the interviews conducted by state is presented in Table 44 in Appendix E. Of the 302 interviewed

subjects, 156 were interviewed in New South Wales, 36 in Victoria, 36 in Queensland, 37 in South Australia, 21 in Western Australia and 16 in the Northern Territory.

#### *Refusal rate*

The refusal rate for interviews was quite small, with 81.4% of drivers who were approached for an interview agreeing to take part (302 interviews from 371 approaches).

#### **Procedure for reporting results to Australian industry**

Meetings were organized with major organizations representing the Australian road transport industry to both apprise these organizations of our major findings from the truck driver survey and to give these organizations the opportunity to comment on our findings before these findings were made public.

Meetings were held with the Transport Workers Union (TWU: 9th December, 1991), the Road Transport Industry Forum (RTIF: 10th December, 1991) and the Australian Road Transport Industrial Organization (ARTIO: 11th December, 1991). We requested that officials from as many of the organizations represented by each of the TWU, RTIF and ARTIO were present at each meeting.

All three meetings involved a presentation of our main findings followed by an open discussion about the findings. The comments made by the industry representatives were noted down by the discussion leader. All three groups agreed to later send us a formal written comment on our results, with the TWU agreeing to send a separate written comment from each of their state branches. At the time of preparing this manuscript, only one written statement (from the South Australian TWU) had been received.

## RESULTS

### 1. WORLDWIDE CORRESPONDENCE/CONSULTATION

#### GENERAL OVERVIEW

The main purpose of this part of the project was to ascertain the current state of knowledge and activity around the world related to fatigue and driving. Of the 126 various government, research, industry, library and training organisations contacted around the world, 67 (53.2%) replied. The complete listing of responses appears in Appendix B. In addition, 21 personal consultations were undertaken. The materials obtained through all consultations are listed in Appendix B. Although several of the organisations contacted also provided or recommended references in the published scientific literature, these are generally available, and are, therefore, not included in the list.

In reviewing the information received, it was clear that, internationally, the issues in the area of driver fatigue and the efforts to grapple with them, in the main parallel the focus in Australia. Further, there appear to be no strategies currently being adopted or researched outside Australia that are not already being used or at least have not already been considered for use here.

Overall, the activities described by overseas contacts addressed four broad issues. First, the issue of determining the extent of the problem of driver fatigue is fairly prominent. Clearly, this is important information to have when trying to determine the priority to be given to investigating solutions. Second, the phenomenon of fatigue itself, how and why it occurs, is being addressed. In particular, the influence of time, both time of day and time on the job, on the occurrence of fatigue is a major focus of these activities. Third, various ways of alleviating or at least dealing with the problem are being considered.

Finally, fatigue in other areas of transport, including rail and air transport, are being considered.

The main activities in each of these four areas will be briefly discussed in turn. Publications referred to in this section appear in Appendix B.

#### **DETERMINING THE EXTENT TO WHICH DRIVER FATIGUE IS A PROBLEM**

Analysis of crash statistics is one of the most prominent ways of attempting to assess the extent of the problem of driver fatigue (e.g. National Transportation Safety Board, 1990; Transport Canada Motor Carrier Branch. Report to Parliament for the year 1988;). All countries contacted referred to such statistics. To a large extent the prominence of the use of crash statistics reflects the impact of actual injury and its effects on public safety on determining priorities for government and research activity. As discussed earlier, the relationship between fatigue and crashes is difficult to establish retrospectively, and there is general agreement that the relationship is far from being accurately described, either in terms of the nature of the relationship or in terms of the extent of the relationship (US Department of Transportation: Federal Highway Administration. Hours-of-Service Study: Report to Congress).

Although less prominent, examining the experience of fatigue among drivers is another way in which the extent of the problem is being approached (see van Ouwerkerk, 1987 for a review of such surveys). Evaluation of the subjective experience of fatigue is also being planned as part of a large study currently being undertaken in the USA (Wylie, Mackie, Schultz, Kennedy and Miller, 1990). It appears to be recognised internationally that such surveys are likely to provide sensitive assessment of the problem of driver fatigue as it actually occurs in the work of truck drivers. Making inferences about the problem from crashes, which are relatively rare events, is likely underestimate the extent of the problem. For example, of 650 international drivers questioned at Dutch border crossings, 60% of drivers reported having at least sometimes actually or almost fallen asleep at the wheel (van Ouwerkerk, 1986).



Several symposia have also been held recently to discuss issues related to fatigue in long distance transport (Commission of the European Communities Discussion Group, 1988; Federal Highway Administration Symposium on Truck and Bus driver Fatigue, 1988). The government sponsorship of such high profile meetings reflects the increased importance of driver fatigue on the agenda internationally.

The only exception to this appears to be the UK. Very little information was received from Britain, and there does not appear to be a great deal of attention being focussed on commercial driver fatigue there. From meetings with staff at the Transport and Road Research Laboratory in England, the prevailing view on driver fatigue appeared to be that it was not a problem in Britain because drivers do not have the problem of long distance driving. This situation may well change as a consequence of development of freer trade in the EC.

#### **INVESTIGATION OF THE INFLUENCE OF TIME ON FATIGUE**

International interest in the influence of time, both time of day and time on duty, on accident occurrence reflects the need to have a scientific basis for regulating hours of service of truck drivers. Accordingly, there is considerable research activity in regard to this area.

The Federal Highway Administration and the American Trucking Associations are sponsoring a very large study on driver fatigue (Wylie et al, 1990) in the USA. The main focus of this study is a comparison of 10 hour and 13 hour driving shifts in the context of regular and irregular schedules. Driving performance, behavioural, physiological and subjective information will be collected from drivers operating commercial routes. This study, the largest of this nature so far undertaken, is currently at the pilot stage, with results being expected in late 1993. The results are very clearly seen as providing a basis for re-evaluating the current hours of service regulations, both in the US and also in Canada (US Department of Transportation: Federal Highway Administration. Hours-of-Service Study: Report to Congress). The study involves collaboration with the Canadians, in part because 13 hour driving shifts are driven in Canada but not in the US Hours-of-service regulations are

relatively new in Canada, having only been introduced as part of the deregulation of the Canadian commercial road transport industry in 1987. Prior to that time, truck drivers' working hours were only limited by the Canadian Labour Code. The evaluation of the impact of the new National Safety Code, which includes hours-of-service, on the industry is seen as an integral part of formalising attention to safety in road transport in Canada.

Recent research in Europe also reflects interest in the influence of time on fatigue. The International Transport Workers' Federation, for example, has commissioned research recently on the effects of night driving on fatigue (Kecklund and Akerstedt, 1991). Similarly, the French group at INRETS has also had considerable interest in the area (Hamelin, 1990).

Time, both working hours and time of day has also been major focus of accident analysis (e.g. Mackie and Miller, 1978). Although not a new area of interest, time factors continue to be used to calculate accident risk (e.g. Moore-Ede, Campbell and Baker, 1988; Hamelin, 1987; Reyes, 1990; see van Ouwerkerk, 1987 for a review).

#### **STRATEGIES TO BETTER DEAL WITH THE PROBLEM**

The lack of centralised and uniform licensing systems has been a common problem in other parts of the world. As in Australia, the absence of centralised licensing systems has made it difficult to attain uniform standards of driver qualifications. Without such licensing systems, it is also difficult to keep track of drivers and their work routines through logbooks, the universal mainstay of enforcement of hours-of-service. Presently, national licensing schemes are being implemented in both the USA and Canada.

Coupled with national licensing there has been recognition internationally of the need to ensure that certain standards are met in the qualification and training of drivers. The advent of the European Economic market will result in a greater density of truck traffic, with many truck drivers who have obtained licenses outside the jurisdiction in which they are driving. With increased cross boundary travel in the future, there is concern in Europe that drivers in

coming from all jurisdictions should be equally qualified. Consequently, content and standardisation of training is presently a priority topic for investigation in Europe (OECD, 1991). It also seems inevitable that centralised licensing of some sort, similar to national licensing in countries with a federal system, will have to accompany standards for driver training in Europe.

To some extent, moves towards standardisation of driver training have been attempted in the USA, with the development of the "Model Curriculum for Training Tractor-Trailer Drivers" in 1985 by the Department of Transportation. However, the model is specifically described as not being a standard, specification or regulation. More recently, the need for development of formal standardised driver training programs has been re-emphasised in the USA (Moore-Ede et al, 1988).

The single most common strategy used to manage commercial driver fatigue appears to be the specification of working/driving hours. As discussed in the introduction to this report, there is, as yet, no consensus regarding what the hours of work and rest should be for drivers. The principle of regulatory control seems, nevertheless, to have universal acceptance.

The influence of other activities besides driving on driver fatigue have long been known. Since Mackie and Miller (1978) described the exacerbation of driver fatigue by loading/unloading activities involved in the work of long distance drivers, there has been increasing interest in the working hours, as opposed to the driving hours, of drivers (e.g. Commission of European Communities Discussion Group, 1989; US Department of Transportation: Federal Highway Administration. Hours-of-Service Study: Report to Congress, 1990). In several cases, hours-of-service regulations already reflect the importance of time on duty, rather than only time spent driving (e.g. US and Canada). Given the current interest in this issue, it is likely that attention to non-driving tasks as part of work will be part of the solution to better dealing with the problem of driver fatigue in most countries.

## **FATIGUE IN OTHER AREAS OF TRANSPORT**

Given that many of the issues in driver fatigue involve consideration of fundamental characteristics of human operators, other areas of transport were also contacted. There appears to be an increasing realisation that knowledge about fatigue in other areas of transport, including rail and aviation sectors, can be highly relevant to the road transport industry. Perhaps the most outstanding example of this is a report by the US Department of Transportation on fatigue in transportation (Report to the Senate Committee on Appropriations and the House Committee on Appropriations, 1989). The report reviews research and discusses issues involved within the various branches of transportation. The recurring themes are strikingly similar, for example, the need for many transportation workers to perform their jobs at times that are inappropriate due to circadian influences, the long hours of service involved in many transportation jobs, and the need for vigilance performance over extended periods of time in many transport settings.

As part of the information gathering for the present project, information was also obtained about relevant initiatives in other areas of transport. Scheduling in locomotive crews (Pollard, 1991; Tepas, Popkin and Dekker, 1989) and in shipboard crews (Pollard, Sussman and Steams, 1990) are among the current areas of activity. The most extensively studied area of transport beside road transport, however, is aviation. Clearly, this is because while the risk of disaster is relatively low, the potential impact is so likely to be high. While a review of the vast literature on human factors in aviation is well beyond the scope of the present report, one particular international initiative warrants mention because of its relevance. An international study is presently being planned to evaluate the impact of in-flight bunk rest on fatigue experienced by cockpit crew on long haul tours of duty. The participants are yet to be finalised, but it seems likely that at least the USA, the UK, Europe and Japan will be represented. This effort is likely to yield highly pertinent information about bunk rest in round-the-clock jobs in general, and be very useful in the evaluation of the practice of two-up driving in the road transport industry in Australia.

## 2. AUSTRALIAN INDUSTRY GROUP CONSULTATION

As described in the Method section, the views of industry groups were sought on four issues. These were:

1. The extent to which driver fatigue is a problem in the long distance road transport industry;
2. The effects of fatigue on driving;
3. Factors currently contributing to driver fatigue; and
4. The acceptability and effectiveness of potential solutions to driver fatigue.

Ten groups took part in all, one representing each of the five mainland state Transport Workers' Union (TWU) branches, the remaining five groups comprising a selection of prominent employer organisations (see Table 3, Method, for details).

In the summary and analysis of the discussion group proceedings which follows, only issues 1 and 4 will be addressed. The exclusion of issues 2 and 3 has partly to do with the drivers themselves being better placed to provide the required information, but perhaps more importantly with the relative importance of the issues given the overall objective of this research. If influential industry groups do not regard driver fatigue as problematic or perceive potential countermeasures as unacceptable, then the value of the research or the likelihood of the countermeasures being a success is diminished.

The first step then was to ascertain the groups' opinions on how serious a problem driver fatigue posed to the long distance transport industry.

### EXTENT TO WHICH DRIVER FATIGUE IS A PROBLEM

Of the ten groups, seven thought driver fatigue was a problem. The three groups that did not were ABCA, LTA and the LDRTA (see Table 3, Method, for abbreviations). Certain qualifications were applied by some of the groups regarding driver fatigue as a problem, with owner-drivers being singled out by TWUP as being at particular risk and Northern Territory drivers by the RTIF as being somewhat protected from driver fatigue.

Those groups who thought driver fatigue to be a problem were unanimous in nominating it as a major problem in the industry. Opinions differed, however, on whether driver fatigue was itself a symptom of some more basic malaise (TWUA), or indeed whether driver fatigue can genuinely be separated from other problems affecting the industry (TWUP).

#### **POSSIBLE SOLUTIONS TO DRIVER FATIGUE**

Group members were asked to comment on both the effectiveness and acceptability of 16 possible strategies that could be introduced to reduce driver fatigue. The reasoning behind asking about both effectiveness and acceptability was that a strategy, however effective, may be of little practical value if it is not adopted. Allowing drivers to use stay-awake drugs, for example, may be a telling way to ameliorate fatigue but may be unacceptable to people for a variety of reasons. Conversely, an agreeable strategy might be widely perceived as ineffective in reducing driver fatigue.

A discrepancy of two votes or greater on rated effectiveness versus acceptability was obtained for only two of the 16 strategies. As a result of the acceptability and effectiveness dimensions being largely parallel, the description and analysis will be restricted to "effectiveness" scores. It should be noted that in both discrepant cases the strategy was rated more effective than acceptable, and in neither case was the strategy among those strongly favoured or disfavoured (see below).

Strongly favoured strategies were those which were rated effective by eight or more of the ten groups. Seven strategies were in this category. Similarly strongly disfavoured strategies were rated ineffective by eight or more groups. There were two of these. Only those nine strategies strongly favoured or disfavoured will be discussed. The remaining strategies appear bracketed under the heading of "Other", the group ratings for which are summarised with the other two classes of strategy in Table 4.

**Table 4: Summary of industry groups' responses to strategies for reducing driver fatigue**

Strategy		
Strongly in favour	Information/training	Groups opposed
	Improving roads	
	Better off-road rest facilities	
	Greater flexibility in hours	
	More efficient un/loading	
	Staged driving	
	Reducing economic pressures	
Strongly Opposed	Banning driving 2am - 6am	Groups in favour
	Stricter driving hours	

**Table 4: Summary of industry groups' responses to strategies for reducing driver fatigue (cont)**

Strategy		Groups in favour	No group consensus or group could not offer opinion
Neither strongly in favour nor strongly opposed	Preventing drugs	ABCA TWUA TWUP TWUB	
	Regulating drugs *	ABCA LTA LDRTA TWUA TWUM	RTIF
	Proper enforcement of current hours *	ARTF ABCA TWUS TWUM TWUA TWUB	LDRTA
	Self regulation/ accreditation	RTIF ABCA LTA TWUS TWUM TWUP	ARTF
	Two-up driving	RTIF ARTF ABCA LTA TWUP TWUM TWUS	TWUA
	Fatigue monitors	ABCA ARTF LDRTA	TWUA TWUS RTIF TWUM TWUB
	Better vehicle design	RTIF ABCA ARTF LDRTA TWUA TWUM TWUP	

\* These strategies were rated more effective than acceptable by two or more votes



## **Strongly favoured strategies**

### *Information/training*

All groups considered information and training to be an effective countermeasure to driver fatigue. Among points that were stressed was the need to ensure the targeting of schedulers and freight forwarders (TWUP, RTIF), the desirability of training continuing beyond the prelicensing stage (TWUA) and the value of including in any training programmes information on the relevance of diet (LDRTA).

### *Improving roads*

There was unanimous agreement that levels of driver fatigue would be reduced by improving road design and upkeep, perhaps via reducing stress (ABCA). Some changes advocated were: divided highways (TWUS), more overtaking lanes (RTIF) and improved road signs (ABCA) and surfacing (LTA). Particular trouble spots were identified, and the claim was made that roads in West Australia are better than those in the east (TWUP).

### *Greater flexibility in driving hours*

Increasing the flexibility of the driving hours had appeal to most groups. Only two groups (TWUA, TWUB) opposed the concept, both voicing concern that companies rather than drivers would be the beneficiaries of such a move. However, some advantages in reducing driver fatigue were highlighted. Allowing a short extension of time for a driver to legally reach home and get proper sleep (ie, in a bed) was one attractive possibility (TWUP).

### *More efficient loading/unloading*

The physical strain caused by loading and unloading a heavy vehicle was identified as a major contributor to driver fatigue and an important target for attention. TWUS and TWUP were both of the opinion that ideally drivers should not have to load and that improvements in the current situation will necessarily involve educating customers on matters of scheduling (eg, on setting ETAs that allow for loading delays). Two groups, ABCA and LTA, did not think driver

fatigue could be reduced via changes to loading/unloading practices, probably owing to the type of freight (people and livestock) with which they were concerned .

### *Staged driving*

Staged driving, where one driver drives for part of the trip before getting out and handing over the truck to a fresh driver who has been waiting, was considered a worthwhile countermeasure to driver fatigue by eight of the 10 groups. No group had any objection in principle to this strategy but several pointed to some logistic impediments. For both ABCA and the LTA the problems associated with conducting staged operations in remote areas were sufficient to render the strategy unworkable. The other groups, while emphasising the need for routes with sufficient facilities and freight volumes, pointed to the desirability of sleeping away from the vehicle (TWUB) and to the relative advantage staged driving enjoys over two-up of a driver not being stressed by having another (sometimes incompatible) individual in close proximity (ARTF).

### *Reducing economic pressures on drivers*

Most groups were in agreement that economic pressures could be a source of stress to drivers and contribute to fatigue on the road, the exceptions being ABCA and the LTA. Unrealistic schedules were nominated by the RTIF and the LDRTA as compounding financial worries for drivers in certain industry sectors. Also, various TWUs (eg, TWUS, TWUA) emphasised the intractable position of many drivers, who, forced to seek extra work because of dwindling freight rates, are also allotted ETAs that cannot possibly be met. Calling for uniform award rates and an end to the practice of rate undercutting, TWUB also drew attention to the need to make accountable those who breach award conditions and who set unrealistic ETAs. The RTIF, on the other hand, promoted policed speed-limiters as a means of ridding the roads of speeding drivers, including those doing so because of irresponsibly imposed ETAs.

Because of the groups' view that unrealistic scheduling interacts with economic pressure on drivers, it was decided

to include "easing tight schedules" as a separate strategy in the survey of drivers.

### **Strongly opposed strategies**

#### *Banning driving between 2am and 6am*

No group thought a ban on driving between 2am and 6am would be an effective remedy to driver fatigue. Common objections to this strategy were that it was impractical (ARTF, TWUB, RTIF) and would serve only to clog the roads during the day, extending loading delays at depots and causing frustration for the ordinary motorist. Two groups (TWUS, ABCA) claimed that the professional driver has adapted to night driving and that a ban of the type proposed would be pointless. Others (eg, LTA, LDRTA) queried the value of an across the board ban given the substantial individual differences which exist between drivers.

#### *Stricter driving hours*

The concept of stricter driving hours had little attraction either for employer or union groups. The ARTF thought any such change in driving hours would be unenforceable, uneconomical and inefficient for receiving goods. The overall feeling was that drivers need not benefit from stricter hours, especially if these meant they had to spend more time away from home (RTIF) or if these were not enforced (TWUA). Some groups expressed satisfaction with the current number of hours (TWUB); others (eg, LTA), while happy with the number of hours, welcomed greater flexibility. TWUP was the only group in favour of stricter hours.

### **SUMMARY**

The purpose of holding the discussion groups was to establish not just what measures were thought likely to be effective in reducing fatigue but also to determine which were most likely to be acceptable. Because the group ratings of effectiveness and acceptability closely corresponded, the picture is less complicated than it might have been.

The groups' responses suggested that improved roads, more information and training about driver fatigue, improved off-road rest facilities, greater flexibility in hours, reducing economic pressures on drivers, staged driving and more efficient loading/unloading would all be effective in reducing reduce driver fatigue. Most emphatic was the call for improved roads and more training. (Interestingly enough, information and training received little support from drivers themselves, while improving roads was their most favoured strategy (see Results section on Australian truck driver survey).)

Clearly, of those strategies advocated by the industry organisations, not all can be quickly and easily introduced. They depend variously on the availability of resources, on the co-operation of drivers and on a measure of political will. This point is taken up in more detail in the Discussion.

### 3. AUSTRALIAN TRUCK DRIVER SURVEY

#### OVERALL RESULTS

The overall results revealed that virtually all of the drivers who participated in the survey were male with a mean age of 37.9 years (s.d.=8.9). More than three-quarters were married or living in a de facto relationship. Most had children with the average number of children being between 2 and 3, but one-quarter of drivers had more than 4 children.

Most drivers were extremely experienced. The mean number of years of experience in driving heavy vehicles was 15.6 (s.d. = 8.9). Only a relatively small percentage had less than 9 years experience. This finding is consistent with that found by Hensher, Battellino, Gee and Daniels (1991) who found that most drivers in their sample of Australian truck drivers had more than 10 years experience driving large trucks on a regular basis.

### *Working conditions*

About three-quarters of the sample were employee drivers, most working for medium to large companies of more than 10 trucks (See Figure 1). Amongst the owner-drivers, most were subcontractors (64.7%), but there were also smaller groups of prime contractors (9.9%) and freelance or independent owner-drivers (17.0%). The greater majority of owner-drivers had only one truck, with less than 1% having more than four. The largest group of owner-drivers worked for a single, large company (more than 50 trucks), with the remainder fairly evenly divided between those working for medium-sized companies (11 to 50 trucks), those working for small companies (less than 10 trucks) and those not working for one main company (independent owner drivers).

#### (a) Type of vehicle and type of freight

Approximately three-quarters of the sample usually drove an articulated vehicle with a gross combined mass greater than 22.4 tonnes (See Figure 2). About 10% usually drove road trains or B-doubles. Small percentages of the long distance drivers in the sample drove light articulated trucks, light rigid trucks or heavy rigid trucks.

Table 5 shows the distribution of types of freight that drivers usually carried. Drivers could use multiple responses on this question so the percentages summed to more than 100% and any interpretation of the results must take this into account. Nevertheless, the largest single category of freight carried by drivers was general freight. The least common type of freight reported was livestock. All other freight types were reported by roughly equal percentages of drivers. About one-fifth of drivers used the "other" category to describe the type of freight that they carried. Further examination of these questionnaires showed that a considerable percentage of drivers carrying overnight parcel express freight were included in this group.

### *Payment arrangements*

About one-third of the sample had an on-going contract for all of their loads and less than 10% had on-going contracts for only some of their loads (See Figure 3). On the other

Figure 1: Distribution of drivers by employment status

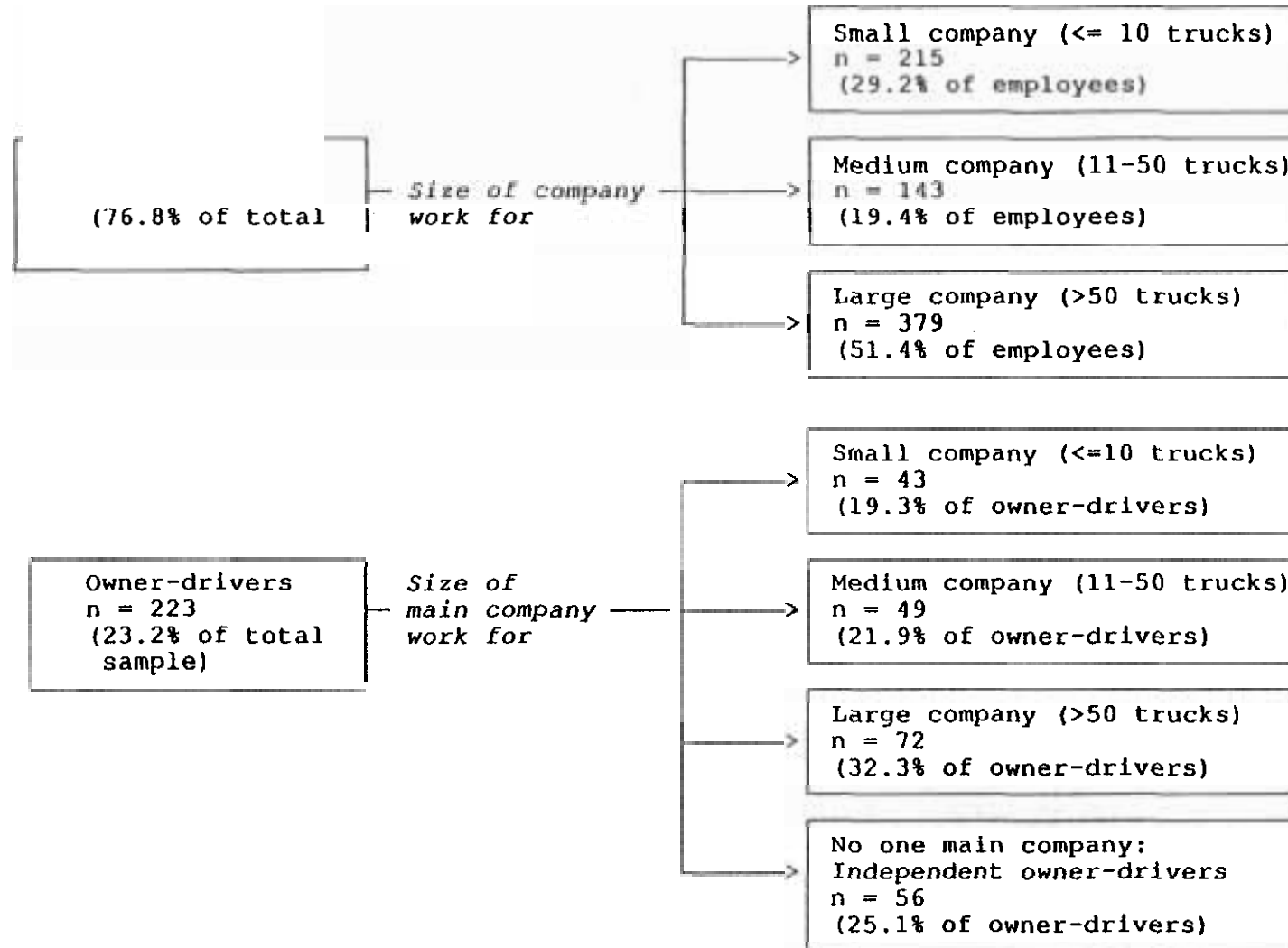


Figure 2: Type of vehicle usually driven

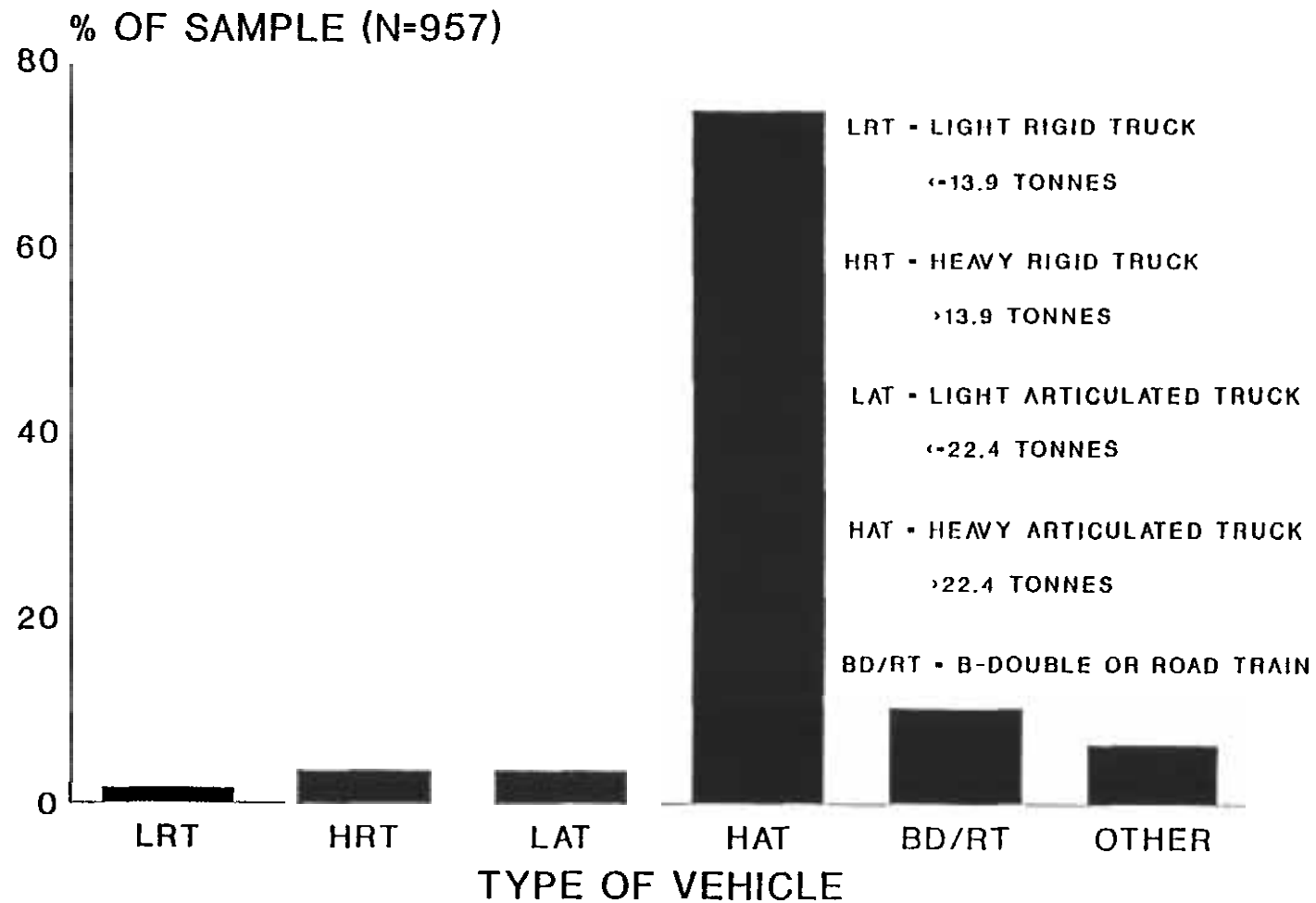


Table 5: Freight type usually carried and freight type carried on last trip

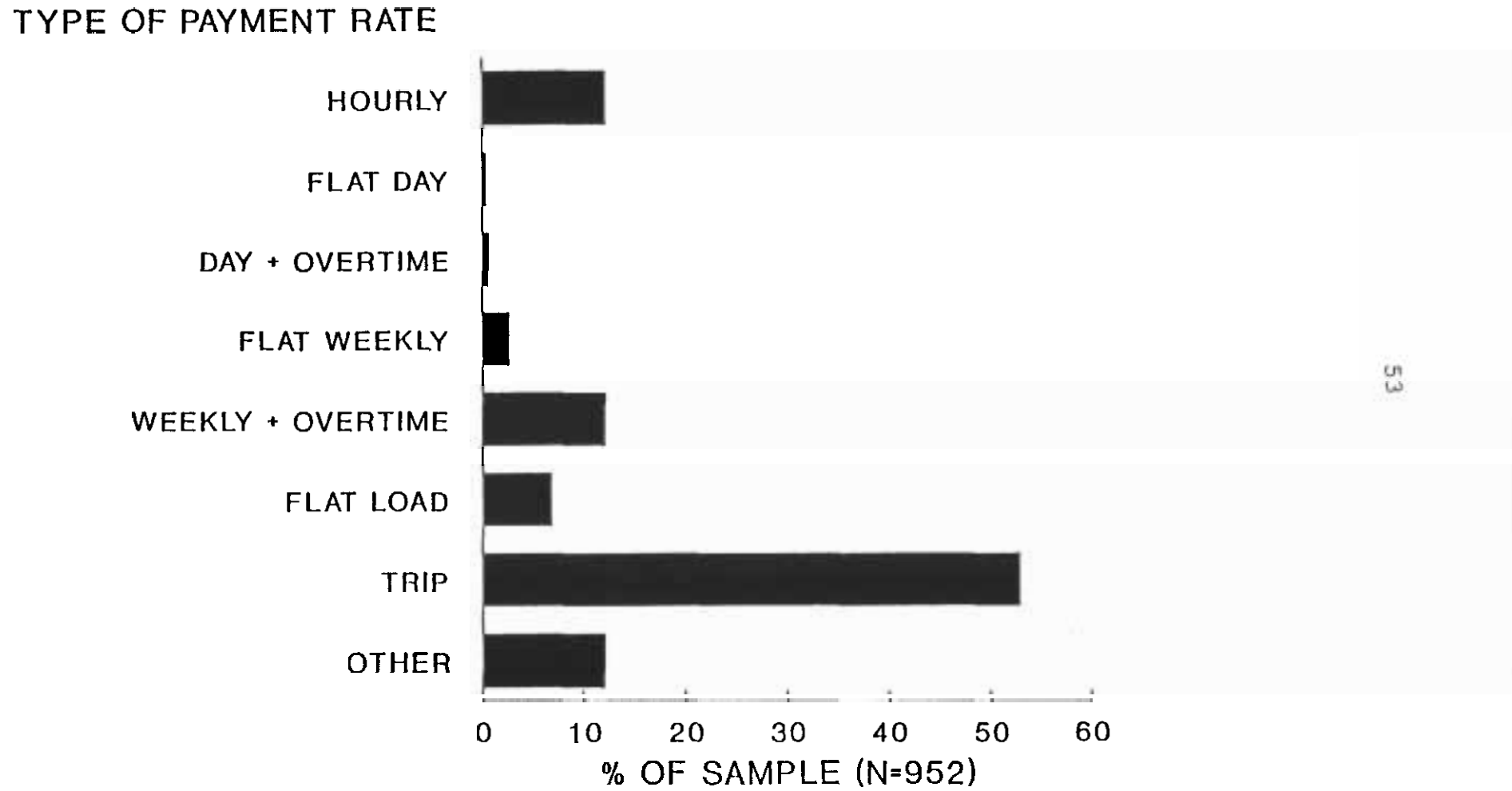
Freight type	Freight usually carried * (% of drivers; N = 957)	Freight carried on last trip ** (% of drivers; N = 920)
Livestock	4.4	2.5
Refrigerated or temperature controlled	20.3	9.6
Dangerous materials	23.7	8.5
Bulk	21.7	10.3
Machinery	12.5	2.5
Building materials	15.2	4.1
Farm produce	17.5	5.2
Groceries	21.3	5.4
Manufactured goods (eg clothing)	16.1	6.0
General	48.5	22.7
Other	18.7	23.2

• Drivers were permitted to choose more than one freight type

\*\* Drivers were asked to choose one freight type



Figure 3: Type of payment



hand, a small percentage of drivers had to negotiate their rate of pay for each load. More than half of drivers were paid at a rate based on the distance travelled and/or the weight carried for each trip. Significantly fewer were paid on the basis of a weekly rate with or without overtime or for hours worked. Other forms of payment were reported by very small numbers of drivers. Hensher et al. (1991) also found that the greater majority of drivers were paid directly in relation to the earnings of the truck. The majority of drivers reported receiving payment at the award rate or greater, however a reasonable percentage reported receiving below the award rate. A significant percentage of drivers did not know how their pay rates measured up against award conditions.

#### *Last trip*

##### (a) Trip length

Drivers were asked a number of details about their last long distance one-way trip. For more than three-quarters of drivers their last trip was similar to those that they usually do. The mean trip distance was 1259.8 kilometres (s.d. = 986) and the mean duration was 27.0 hours (s.d. = 23.7) (See Table 6). As can be seen from the standard deviations, there was considerable variation amongst drivers on these measures. A significant percentage of drivers did only relatively short trips, with 25.1% of drivers doing less than 700kms on the last trip, but an equivalent number, 24.9% did more than 1500 km. Similarly, for about one in five drivers the trip was quite brief, lasting less than 12 hours, but for more than a quarter of drivers the trip duration was thirty hours or more.

##### (b) Type of driving operation

Table 7 shows the distribution of drivers in the survey who do various forms of driving operation. The results show that most of the trips involved a single driver doing a one-way trip. A considerably smaller percentage reported that their last one-way trip involved two-up driving or staged driving. A not insubstantial percentage of drivers made it clear that they did not do one-way trips; 13.4% of drivers

Table 6: Length of last trip

Distance for last trip (kms)	Mean distance (SD)	1259.8 (986)
	% whose trip was < 700kms	25.1
	% whose trip was > 1500kms	24.9
Duration of last trip (hours)	Mean duration (SD)	27.0 (23.7)
	% working < 12 hours	19.2
	% working >= 30 hours	26.5

Table 7: Type of driving operation on last trip

Type of driving operation on last trip	% of drivers (N = 921)
Single one-way	75.6
Single two-way	13.4
Two-up	4.7
Staged One-way	3.6
Staged Two-way	2.8

reported doing two way or round-trips with a single driver and 2.8% reported doing two-way staged driving.

(c) Distribution of drivers across states

As shown in Table 8, all states were represented in the sample. Most drivers started or finished their trips in NSW, followed by Victoria, Queensland and South Australia. More than three-quarters of the trips described either started or finished in the eastern states. This reflects the pattern of distribution of questionnaires to a certain extent. As described in the method section, more questionnaires were distributed to drivers in NSW and Victoria, however these states also carry the greatest freight volumes.

(d) Timing and scheduling of trip

Table 9 shows details of how trips were scheduled by or for drivers. About half of the drivers started their trips at night, between 1800 and 0600 hours and just under half finished their trips between those hours. Only 40% of drivers scheduled their own start time for the trip whereas the remainder had their start time scheduled by another party such as their employer, freight forwarder or customer. Most drivers made the start time.

Most drivers had some type of estimated time of arrival (ETA). Only 19.7% did not have any ETA. For 37.1% of drivers the ETA was scheduled for within a specified hour. Compared to start times, considerably fewer drivers were able to schedule their own finish time. Only 15.9% of drivers could set their own ETA, the remainder had ETAs imposed by another party. Nevertheless, almost all drivers kept to the ETA (93.6%).

A variety of reasons were reported for wanting to keep to the ETA. Penalties for not meeting the ETA were reported by 13.4% of drivers, compared to only 2.7% reporting receiving a bonus for keeping to time. Nearly half of the drivers (47%) reported having reasons beside an ETA for wanting to arrive at their destination by a particular time. Most commonly the reasons were the need to unload or to reload (36.4%), to avoid traffic (23.4%) and for social considerations such as to return to their family (17.1%).

Table 8: Start and finish states for last trip

State	Start state (% of drivers; N = 917)	Finish state (% of drivers; N = 915)
NSW	33.8	43.7
Vic	26.6	17.4
Qld	16.8	13.7
SA	10.8	12.2
WA	7.7	7.0
NT	3.2	4.9
Tas	1.1	1.1

Table 9: Timing and scheduling of last trip

Start time	% starting 0000-0559	19.5
	% starting 0600-1159	34.0
	% starting 1200-1759	25.5
	% starting 1800-2359	21.1
	% setting own start time	40.0
Estimated time of arrival (ETA)	% not having ETA	19.7
	% having ETA scheduled within an hour	37.1
	% having ETA scheduled within part of a day	30.6
	% having ETA scheduled within a day	12.6
	% setting own ETA	15.9
most common reasons for meeting ETA (%)		<i>unload/reload</i> (36.4)
		<i>avoid traffic</i> (23.4)
		<i>social reason</i> (17.1)
Cruising speed	% travelling at or below speed limit	75.6
	% travelling above speed limit	24.5

These results were different to those obtained by Hensher et al. (1991) such that only about 35% of their drivers had a given time of arrival for their last trip. This was much lower than that reported by drivers in this study. More than half of the drivers in the Hensher study, however, reported that they had a self-imposed time of arrival, rather than one imposed by another party. The most common reason reported for this self-imposed arrival time was to get unloaded in order to get the next load.

In relation to this, most drivers in this study reported that their cruising speed on the open road was at the speed limit or below (75.6%). A significant number reported driving over the speed limit (24.5%), with 5.2% admitting to driving more than 15kph above the limit.

(e) Type of freight and driver involvement in loading and unloading

The types of freight drivers reported they carried on the last trip showed similar distribution to the types of freight they reported they usually carried (See Table 5). For this question, drivers were asked to choose only one category to describe the type of freight they carried on the last trip, whereas when reporting the type of freight they usually carried, drivers could choose more than one category. As for the types of freight usually carried, there was a wide variation in the types of freight reported by drivers. Again, general freight was the largest single category, but the "other" category was just as large. As before, the "other" category was mainly composed of overnight parcel express freight. There was a fairly even spread of drivers across the remaining categories of freight and, again, the smallest percentage of drivers fell into the livestock category.

Most drivers did at least some of the loading or unloading on their last trip (77.5%). The mean time spent loading and unloading for drivers who were involved in loading or unloading was 3.5 hours (s.d.=5.2). About half of the drivers (52%) experienced some sort of delay in loading or unloading. The average length of these delays was 3.45 hours (s.d.=5.3), and the most common reasons for such delays were waiting for other trucks to be loaded or unloaded (58%), the

depot not being open (18%) and the unavailability of machinery (16%).

(f) Breaks in last trip

Almost all drivers had at least one break on their last trip (92%). The mean number of hours that drivers spent in breaks was 8.2 (s.d. = 12.2). Table 10 shows the distribution of the length of and reason for breaks that drivers took on their last trip. The results showed that the duration of breaks increased as the number of breaks increased. Most of the first few breaks were no longer than 30 minutes. In contrast, for the 5th and 6th breaks, the most common length of break was between 1 and 5 hours. The reasons for breaks also differed according to their position in the trip. Sleep became an increasingly common reason for having a break as the trip progressed. For the first break, only 14.0% of breaks were for sleep or rest, compared to 29.1% for the sixth break. Taking breaks to sleep is probably one reason for the finding of longer breaks later in the trip, since sleep usually requires longer periods to be effective in reducing fatigue.

About half of the drivers (50.6%) reported feeling fatigued on their last trip, and of these, most experienced fatigue only once, about one-quarter reported experiencing it twice and the remainder experienced it three or more times (See Table 11). Table 12 shows when the fatigue periods occurred. Fatigue was most likely to be experienced in the period 0000 to 0559 no matter how many times it had occurred. Drivers clearly felt freshest during the period 0600 to 1159 as there were very few reports of fatigue during this period.

Drivers appeared to be reasonably well rested before the trip started. Almost half of the drivers (47.2%) reported spending all of the 10 hours before the last trip sleeping or resting and more than three-quarters of them (83.1%) reported spending at least half of this time sleeping or resting. The average hours spent sleeping and resting in the 10 hours before the last trip was 7.7 hours (s.d.=3.0).



Table 10: Length of break and reason for break on last trip

Break number	N	Length of break				Reason for break				
		% breaks 15-30 minutes	% breaks 31-60 minutes	% breaks 61-300 minutes	% breaks > 300 minutes	% breaks spent on sleep/rest	% breaks spent on work	% breaks spent on body function	% breaks mixed without work	% breaks mixed with work
Break 1	798	40.2	29.4	22.3	8.0	14.0	15.5	31.6	13.2	25.7
Break 2	651	37.8	25.3	27.6	9.3	22.0	22.0	27.0	12.6	16.4
Break 3	427	35.6	24.1	24.6	15.7	20.7	18.6	24.7	13.7	22.3
Break 4	260	32.7	25.4	28.1	13.5	20.7	22.6	25.3	13.6	17.7
Break 5	167	25.1	22.2	29.9	22.2	25.8	20.4	18.0	11.4	24.6
Break 6	102	23.5	20.6	36.3	19.6	29.4	21.6	19.6	14.7	14.7
Break 7	60	33.3	15.0	33.3	18.3	25.0	11.7	25.0	10.0	28.3

**Table 11: Number of fatigue periods for drivers reporting fatigue on last trip (N = 486)**

	Number of fatigue periods					
	1	2	3	4	5	6
% of drivers	57.2	28.2	7.8	2.5	1.2	1.0

**Table 12: Onset time of fatigue periods for drivers who reported experiencing fatigue on last trip (N = 482)**

Fatigue period on last trip	N = 482	Onset during 0000-0559	Onset during 0600-1159	Onset during 1200-1759	Onset during 1800-2359
1st fatigue period	n = 482	46.1	9.5	16.8	27.6
2nd fatigue period	n = 207	39.6	10.1	24.2	26.1
3rd fatigue period	n = 63	52.4	9.5	19.0	19.0

### *Work/rest schedule in past week*

Drivers were asked for details of their work schedule for the last week. Most drivers reported doing some long-distance trips in the last week (73.7%) and for most drivers this was a typical week for them (78.9%). This section on work schedule in the last week was clearly somewhat difficult for some drivers to complete as they were asked to recall some details of all their trips in the past week. Consequently, of the drivers who reported doing some long distance trips in the last week 16.3% failed to complete any of these details.

For drivers who did complete details of their trips in the last week, the average hours worked in the last week was 62.6 (s.d. = 32.5). This involved working an average of 2.9 nights (s.d. = 2.0). In contrast Hensher et al. (1991) reported considerably higher average driving hours of 105 hours per week for their sample of drivers. This difference can be accounted for by the fact that weekly working hours in the present study included only time spent working during trips taken during that time (e.g.: driving, loading and unloading), whereas in the Hensher et al. study, drivers were asked to include all activities that are involved in earning their living, so including time for activities like organising loads and doing repairs and maintenance to their trucks.

Most of the journeys undertaken by drivers in the past week started or finished in NSW or Victoria, but all states were covered. (See Table 13) As for the results of the last trip, this concentration of trips in NSW and Victoria probably reflects the distribution of questionnaires around the country rather than the actual distribution of trips made by long distance drivers. Most trips involved drivers travelling in 2 states (57.7% of trips), compared to 34.3% of trips involving travel within a state. A small percentage of trips involved travel in three states and less than 1% involved travel in 4 states (0.2%).

### *Breaking the rules*

A number of questions were asked about drivers' experience of breaking work hour regulations and road rules in order to

**Table 13: Distribution of starting and finishing states  
for trips made in the last week**

<b>State</b>	<b>Start state for one or more trips last week (% of drivers; N = 593)</b>	<b>Finish state for one or more trips last week (% of drivers; N = 593)</b>
<b>NSW</b>	60.1	62.4
<b>Vic</b>	48.2	47.7
<b>Qld</b>	29.8	29.8
<b>SA</b>	25.0	24.2
<b>WA</b>	9.8	9.6
<b>NT</b>	3.9	4.0
<b>Tas</b>	0.3	0.3

establish whether factors to do with fatigue play a role. The results showed that more than half of the drivers work contrary to the working hours regulations on at least half of their trips (See Table 14). The most common reasons for doing so were: in order to earn a living (49.5%), to return home (48.4%) and due to tight schedules (31.6%).

Fewer drivers reported breaking road rules compared to breaking work hour regulations. Only 30.7% reported breaking road rules on at least half of their trips, however, the reasons given were very similar to those given for breaking working hours regulations. As before, 35% of drivers reported the need to earn a living as the reason for breaking road rules and tight schedules were reported by 30.5% of drivers.

#### *Experience of driver fatigue*

Most drivers reported feeling fatigued at least occasionally while driving (See Table 15). Relatively few reported very rarely feeling driver fatigue. For the drivers who reported fatigue at least occasionally while driving, 59.7% experienced it before the 14th hour of driving. The early hours of the morning, between midnight and 6 a.m., was the period when most drivers experienced fatigue (75.3%). While most drivers reported only one specific block of time during which they felt tired, when drivers reported a second, it occurred most often between 1 p.m. and 6 p.m (49.1%).

Drivers were asked to indicate what factors contribute to fatigue while they are driving (See Table 16). The most common contributors to driver fatigue were judged to be poor roads, dawn driving, long driving hours, loading and unloading and poor weather. In addition, drivers were asked to choose the most important contributing factors from the factors they reported as contributing to their driver fatigue. The list of most important contributors was slightly different to the list of most common contributors. Having to load and unload showed the highest number of reports as the most important factor contributing to fatigue, followed by poor roads, inadequate sleep before trips and long driving hours.

Table 14: Frequency of breaking work hour regulations

Frequency	Breaking work hour regulations (% of drivers; N = 904)
Every trip	30.0
Most trips	18.4
On half the trips	8.2
Occasionally	16.7
Very rarely	23.9
Never	2.9

Table 15: Frequency of fatigue while driving

Frequency of feeling fatigue	Every trip	Most trips	On half the trips	Occasionally	Very Rarely
% of drivers (N = 951)	10.7	17.9	17.4	38.6	15.3

Table 16: Contributors to driver fatigue

Factor	% of drivers reporting factor as contributor (N = 947)	Of drivers reporting factor as contributor, % rating it as important contributor
Long driving hours	48.6	32.5
Insufficient rest breaks	24.8	17.3
Loading/unloading	47.2	42.6
Checking load	2.1	4.8
Driving two-up	8.1	28.4
Insufficient sleep during trips	40.1	26.9
Insufficient sleep before trips	38.9	34.2
Night driving	16.8	19.6
Dawn driving	56.0	24.5
Dusk driving	19.0	23.2
Poor roads	58.2	37.5
Monotonous routes	37.2	27.7
Heavy highway traffic	13.8	15.2
Heavy city traffic	25.3	17.8
Poor weather	47.5	28.0
Poor truck ventilation	18.9	19.6
Truck vibration	8.8	12.5
Family problems	13.8	18.8
Poor diet/ irregular eating	30.2	18.9

Table 16: Contributors to driver fatigue (cont)

Factor	% of drivers reporting factor as contributor (N = 947)	Of drivers reporting factor as contributor, % rating it as important contributor
After effects of drugs	7.7	10.4
Use of alcohol	6.2	16.1
Other	15.1	15.2



About three-quarters of the drivers (74.5%) reported that their driving is worse when they are tired. Table 17 shows the percentages of drivers reporting specific effects of fatigue on driving. The most common signs of poor driving that drivers related to their fatigue were being slower to react, poorer gear changing, slower driving and poorer steering. There is obviously a close relationship between being tired and poorer driving. The driver's experience of fatigue therefore should be seen as an indicator of increased risk of poor driving.

The solutions drivers indicated they use to overcome driver fatigue are shown in Table 18. Drivers were asked to indicate which of a list of strategies they use to deal with their driver fatigue and then to indicate which of these they regard as most helpful. The results revealed that there was considerable consistency between drivers in that a number of solutions were reported by more than three-quarters of the sample. These were listening to music or radio, adjusting the ventilation, having a drink containing caffeine, stopping to sleep and kicking the tyres or walking around. In contrast only two solutions were consistently reported as most helpful in reducing fatigue by the drivers who used them. These were taking stay-awake drugs and stopping to sleep. It is noteworthy that relatively few drivers reported using stay-awake drugs in an attempt to reduce driver fatigue (31.7%), but of these drivers, more than half reported this solution as amongst the most helpful of the strategies they use. Hensher et al. (1991) found that 46% of drivers admitted to taking drugs on at least some trips which is slightly more than the number of drivers who reported taking drugs in the current study.

#### *Attitudes and solutions to driver fatigue*

Drivers were asked to rate their estimation of the extent to which fatigue is an industry problem and a personal problem. Table 19 shows that there were clear differences in drivers' views of the two. The largest percentage of drivers reported fatigue as at least a substantial problem in the long distance transport industry and only a very small percentage reported that there is no problem for the industry. As a personal problem, however, the majority of drivers rated fatigue as a minor problem with only about 35% reporting it

Table 17: Effects of fatigue on driving

Effects of fatigue on driving (for drivers reporting fatigue)	% of drivers (n = 740)
Slower to react	49.2
Poorer steering	37.2
Poorer braking	11.3
Poorer gear changes	40.4
Poorer overtaking	5.8
Speeding	7.7
Driving too slowly	38.5
Poorer signalling	9.2
Less attention to traffic signs	22.7
Less awareness of other traffic	27.5
Other	6.9

Table 18: Strategies currently used by drivers to deal with fatigue (N = 953)

Strategy currently used by drivers	% of drivers using strategy at least sometimes	Of drivers who use strategy at least sometimes, % rating it as among most helpful
Sleep	78.2	45.9
Rest	70.2	21.9
Stopping for meal	63.2	14.8
Eating while driving	49.2	14.2
Caffeine drink	78.4	20.7
Non-Caffeine drink	38.5	6.0
Smoking	47.0	20.0
Drugs	31.7	53.3
Kicking tyres/ walking around	77.4	21.7
Shower	54.0	15.2
Music/radio	80.7	20.0
CB radio	70.3	22.9
Singing	36.1	6.6
Using ventilation	79.9	17.5
Other	10.6	

**Table 19: Drivers' ratings of extent to which fatigue is a problem for the industry and for themselves**

<b>Extent of problem</b>	<b>Major problem</b>	<b>Substantial problem</b>	<b>Minor problem</b>	<b>No problem</b>
<b>For industry (% of drivers; N = 949)</b>	37.5	40.0	20.1	2.3
<b>For driver personally (% of drivers; N = 951)</b>	8.6	26.3	50.1	15.0

as at least a substantial problem for them and 15% reporting it as no problem.

Table 20 shows the results from the section in which drivers were asked to make judgements about a number of existing or potential strategies to reduce driver fatigue. Drivers were asked to rate each of a list of possible strategies that could be used to reduce fatigue in terms of how helpful they believe each to be and then to select the most helpful ones from those which they judged to be very helpful. The results showed that the strategies reported most often as very helpful in reducing fatigue were better roads, easing of unreasonably tight schedules, greater flexibility in driving hours regulations and more efficient loading and unloading.

Of the strategies selected by drivers as very helpful, the following were selected by drivers as most helpful: better roads, more flexible driving hours regulations, allowing stay awake drugs by prescription, more efficient loading and unloading and easing of unreasonably tight schedules. Clearly there is considerable overlap between strategies that are thought to be very helpful by most drivers and those judged to be most helpful. Apart from the order of strategies in these two lists, the only other difference was that the strategy of allowing stay awake drugs by prescription was included in the list of most helpful strategies. This difference indicates that while a relatively smaller number of drivers rate allowing drugs as very helpful in reducing driver fatigue (41.7%), a significant percentage of those doing so rated this strategy as one of the most helpful for them (22.5%).

The strategies judged by drivers least often as very helpful were banning driving between 0200 and 0600 hours, introducing stricter driving hours and two-up driving. Similarly, those judged as most helpful by the least number of drivers were introducing stricter driving hours, using fatigue monitors and providing drivers with more information and training of drivers about driver fatigue.

Drivers were also asked to suggest any other strategies not included in the questionnaire that they thought would help to reduce fatigue. A significant number of drivers suggested other strategies (41.2%, see Table 21). A wide range of

Table 20: Strategies that could be used to deal with driver fatigue in the industry

Strategy	% of drivers rating strategy as very helpful (N = 957)	Of drivers rating strategy as very helpful, % rating it as among most helpful
Information/training	31.2	4.8
Preventing drugs	22.0	5.0
Drugs by prescription *	41.7	22.5
Stricter driving hours	11.9	3.4
Stricter enforcement of current hours *	15.2	7.2
Regulation of work time *	30.3	5.9
Regulation by industry *	59.4	7.4
Banning driving 2am - 6am	5.9	13.5
More efficient un/loading	74.2	21.7
Two-up driving	13.8	10.1
Staged driving	29.3	10.2
Pay increase *	49.0	16.3
Easing tight schedules *	75.0	21.5
Better vehicle design	39.9	7.3
Fatigue monitors	32.3	4.0
Better off-road rest facilities	54.7	14.6
Greater flexibility in hours	74.6	33.4
Improving roads	84.2	40.4

\* These strategies had a somewhat different wording to that used for discussions with industry groups

**Table 21: Additional strategies to deal with  
driver fatigue suggested by drivers**

Strategy	% of drivers suggesting strategy (N = 957)
Less police/RTA harrassment	9.6
Change to speed regulations	9.7
Change to logbook procedures	0.9
Abolish logbooks	4.2
Slow vehicle lanes	0.2
Depot to depot driving	1.1
Uniform driving hours and road rules nationally	5.6
Making freight schedulers accountable	6.4
Educating public about trucks	4.4
Other	19.6

suggestions were made such that there was a relatively large percentage that could not be classified (19.6% of drivers). Nevertheless, the strategies of removing speed limiters and reducing police and RTA harassment were each spontaneously suggested by about 10 percent of drivers. If these had been included in the list provided for drivers it is likely that these strategies would have been judged as very helpful by a considerably larger percentage of drivers.

### **THE INFLUENCE OF SECTORIAL DIFFERENCES WITHIN THE TRANSPORT INDUSTRY**

While the overall results are useful for describing the working situations of long distance heavy vehicle drivers as a group, it is likely that there are subgroups of drivers who experience different pressures and influences. These may consequently influence both the way drivers do their work, the way they view their work and therefore how they respond to questions in this survey.

For these reasons, the effect of two main types of influences were investigated: the driver's employment status and type of driving operation. These will be described in the following sections. In addition, the results for drivers with experience of staged driving and for drivers with experience of two-up will be examined separately in this section.

#### **The influence of employment status**

For the purposes of this analysis, the sample was divided into employee drivers and owner-drivers and within these groups they were further divided according to their relationship with particular sized companies. Small companies were defined as those with fewer than 10 trucks, medium-sized companies as having between 11 and 50 trucks and large companies as those with more than 50 trucks. From Figure 1, it can be seen that most drivers were company employees mostly of large companies. The owner-drivers in the sample were fairly evenly divided into 4 groups: those working mainly for a small company, those working mainly for a medium-sized company, those working mainly for a large company and those who were independent or did not work for a particular company.



### *Description of drivers of different employment status*

Table 22 contrasts the characteristics of drivers from different employment groups. There is very little difference in age between the employment groups apart from a slight tendency for younger drivers to be employed by or working mainly with small companies. The groups tend to be very similar also in marital status and the percentage who have children. Employee drivers working for small companies, owner-drivers working for small companies and independent owner-drivers were less likely to be married or to have children. In addition, there are hardly any differences between the groups in terms of the average number of children they each have.

Employee drivers working for small companies and owner-drivers working for small companies had the least driving experience, although overall owner-drivers had more driving experience than employee drivers. This can also be seen in the percentage of drivers who had less than 8 years experience of driving heavy vehicles.

### *Payment arrangements and employment status*

The employment groups could be distinguished by the payment arrangement that they had (See Table 23). Independent owner-drivers were the only group in which most drivers had to negotiate their pay rate for each load. In contrast, all other groups, with the exception of employees of large companies, had on-going contracts for some or all of their loads. Only employee drivers were paid on the basis of an hourly rate and they far out-numbered owner-drivers in terms of being paid a weekly rate with or without overtime. The most common method of payment for employee drivers was a trip rate based on kilometres covered and/or tonnage carried. Owner-drivers on the other hand, were paid almost exclusively on a trip rate, or on a flat rate per load.

These results are not unexpected. By definition independent owner-drivers do not work mainly for one company and so would be expected to have to negotiate both to get each load and for rates of payment for each load. Similarly, it would be expected that a substantial number of owner-drivers

Table 22: Demographics of employment groups

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
<b>Age</b>	Mean age (SD)	34.8 (8.7)	37.7 (8.7)	39.0 (8.5)	39.4 (9.9)	35.6 (7.9)	38.3 (8.4)	40.8 (8.4)
<b>Marital status</b>	% married or in defacto	66.2	76.8	84.6	70.0	67.5	83.7	88.8
<b>Children</b>	% with children	71.0	81.7	81.4	68.6	72.1	85.4	87.5
	Mean no. of children (SD)	2.0 (1.7)	2.1 (1.4)	2.2 (1.5)	1.9 (1.5)	2.0 (1.7)	2.5 (1.7)	2.2 (1.3)
<b>Driving experience</b>	Median years experience (range)	12.0 (44)	15.0 (52)	15.0 (42)	16.0 (46)	14.0 (32)	15.0 (33)	18.0 (36)
	% with < 8 years experience	28.6	18.2	20.1	17.6	23.3	24.5	12.5
<b>Truck type</b>	% driving articulated truck > 22.4 tonnes	76.7	77.5	70.8	72.5	76.7	79.6	81.9
	% driving B-double or road train	14.3	10.6	6.4	17.6	11.6	10.2	11.1
	% driving other	9.1	11.9	22.8	9.9	11.7	10.1	7.0

Table 23: Payment details of employment groups

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Contractual arrangements	% negotiating pay rate for each load	9.1	7.4	3.0	52.9	19.0	12.2	7.0
	% with ongoing contract for some or all loads	43.4	42.9	27.9	23.5	40.5	55.1	61.8
Payment type	% paid hourly rate	7.2	16.3	20.0	0.0	0.0	0.0	0.0
	% paid weekly rate	15.3	14.9	22.4	2.0	0.0	2.0	1.4
	% paid flat rate per load	8.6	5.7	0.3	17.6	27.9	10.2	16.7
	% paid trip rate	57.4	50.4	41.3	68.6	62.8	81.6	70.8
	% paid other	11.4	12.8	16.0	11.8	9.3	6.1	8.3
Payment rate	% paid award rate or	65.4	72.5	89.4	33.4	40.5	68.1	66.7
	% paid less than award	19.2	18.3	5.3	50.0	40.5	12.8	24.6
	% not knowing	15.4	9.2	5.3	16.7	19.0	19.1	8.7

working mainly for one company would have contracts for their loads, but that they might still be paid trip rates or flat rates in terms of their loads. What is surprising, however, is that relatively few employee drivers were paid a weekly wage and that so many were paid trip money.

There were also apparent differences in the amount of payment received by different employment groups. All types of employee drivers and owner-drivers working for medium and large companies were paid mainly at the award rate or greater. On the other hand half of the independent owner-drivers and a large percentage of owner-drivers working for small companies received less than award rates. It is noteworthy that a reasonable number of drivers, particularly from the owner-driver groups and employees of small companies, did not know how their pay rate compared to the award rate. This finding suggests that information about pay entitlements may not be reaching some driver groups.

#### *Working conditions and employment status*

The majority of drivers from all employment groups drove articulated vehicles of greater than 22.4 tonnes weight (See Table 22). The largest percentage of drivers of road trains or B-doubles were from the independent owner-driver group, but they were fairly evenly spread across the other groups. It is not clear whether this finding reflects the actual state of the industry or simply the survey's sampling methods.

The findings for drivers' weekly working hours were similar to those for payment rates in that employees of medium and large companies were different to the other groups (See Table 24). Considerably more employees of medium and large companies worked "office hours" of 38 hour per week or less. There were no differences between the groups though in the percentages of drivers working very long hours per week. At least one-quarter of the drivers in each group worked more than 72 hours in the last week. Similarly, the mean number of nights worked by drivers in the last week showed very little variation across the employment groups.

Table 24: Details of work last week for employment groups

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Work last week	% of drivers with no long-distance trips	21.2	18.4	27.4	25.5	19.0	18.8	13.0
Work last week for drivers who made long distance trips (n = 708)	Mean hours worked (SD)	71.7 (35.0)	55.6 (31.2)	55.6 (28.7)	62.5 (30.6)	64.8 (34.4)	58.2 (29.5)	75.4 (34.4)
	% working <= 38 hours	16.7	34.9	30.8	19.4	20.0	22.6	12.5
	% working > 72 hours	42.8	25.6	25.0	38.7	44.0	25.8	45.8
	Mean number of nights worked (SD)	3.0 (2.1)	2.3 (2.0)	2.0 (2.2)	2.3 (1.8)	2.2 (1.9)	2.5 (1.7)	3.2 (2.2)

### *Last trip and employment status*

Details of the last trip for all drivers in each employment group are shown in Tables 25 and 26.

#### *(a) Trip length and employment status*

Table 25 shows how the employment groups differed in terms of the details of their last trip. Across groups the distances covered and the time taken for the last trip were quite similar. The one outstanding group, however, was large company employees who did fewer kilometres and, as a result, took considerably shorter time to complete their trip compared to all other groups. In addition, independent owner-drivers show results for trip length that require comment. Although their mean hours driven and mean kilometres covered were not the highest overall, more independent owner-drivers did trips of 30 hours or more and greater than 1500 kilometres in length than any other group. This indicates that while independent owner-drivers were not doing the longest trips, more owner-drivers were doing long trips than any of the other groups.

The cruising speed reported by drivers when on the open road was at or lower than the speed limit for the majority of drivers in each employment group. About one-third of drivers reported mainly travelling above the speed limit. Again, employees of large companies were different from the other groups in that a greater percentage of them reported that they complied with the speed limit. This difference is probably due to the shorter trips that large company employees tended to do.

#### *(b) Type of driving operation and employment status*

No matter what the drivers' employment status, the most common type of driving operation by far was single driving (See Table 25). The other two types of driving operation, namely two-up and staged driving, were not so evenly spread across the groups. Both types were restricted predominantly to company employees, especially employees of large companies in the case of staged driving. Two-up operations occurred most often for employees and owner-drivers working for small and medium companies. These findings are not

Table 25: Details of last trip for employment groups

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Trip length and duration	Mean trip length in kms (SD)	1476.9 (1083.4)	1383.4 (987.6)	888.7 (674.4)	1607.6 (1132.9)	1537.4 (1015.2)	1658.6 (1399.6)	1407.2 (930.4)
	% driving > 1500 kms	32.5	32.1	11.0	41.2	34.9	31.9	31.9
	Mean trip duration in hours (SD)	31.2 (24.9)	29.2 (23.2)	18.2 (15.2)	38.2 (27.9)	40.5 (38.0)	33.6 (25.2)	33.2 (25.4)
	% whose trip was ≥ 12 hours	87.0	85.0	70.4	91.8	87.5	97.6	87.0
	% whose trip was ≥ 30 hours	34.7	29.3	13.1	46.9	37.5	33.3	37.7
Cruising speed	% travelling at or below speed limit	66.3	66.9	86.5	70.0	73.2	70.8	72.5
	% travelling above speed limit	33.7	33.1	13.5	30.0	26.8	29.2	27.5

Table 25: Details of last trip for employment groups (cont)

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Type of operation	% driving Single one-way	85.6	81.2	60.3	96.1	83.7	85.1	88.7
	% driving Single two-way	5.8	8.0	24.9	2.0	2.3	6.4	5.6
	% driving Two-up	6.3	7.2	2.3	2.0	14.0	6.4	1.4
	% driving Staged one-way	1.4	1.4	7.1	0.0	0.0	0.0	4.2
	% driving Staged two-way	1.0	2.2	5.4	0.0	0.0	2.1	0.0
Start time	% starting trip between 0000-0559	2.1	17.6	31.6	6.0	7.1	10.6	7.0
	% starting trip between 0600-1159	43.2	33.8	22.3	38.0	52.4	42.6	43.7
	% starting trip between 1200-1759	28.6	26.5	19.1	40.0	33.3	31.9	28.2
	% starting trip between 1800-2359	16.0	22.1	27.0	16.0	7.1	14.9	21.1
	% whose start time was set by another party	48.6	63.5	74.1	24.0	48.8	48.9	55.7



Table 25: Details of last trip for employment groups (cont)

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
<b>Arrival time</b>	% whose ETA was set by another party	90.3	89.7	82.7	82.0	92.7	91.3	92.8
<b>Reasons for meeting ETA</b>	% with contingent bonus	2.9	2.2	2.3	0.0	0.0	0.0	4.3
	% with contingent fine	16.1	13.0	4.7	18.4	17.5	12.5	12.9
	% with other reasons	52.4	51.1	37.1	58.8	55.8	55.3	55.7

surprising as independent owner-drivers would find any type of operation other than single driving expensive and difficult to organise.

(c) Timing and scheduling of trip and employment status

The results showed that employee drivers were more likely than owner-drivers to start their trip in the night hours between 1800 and 0600 hours, particularly so for large company employees (See Table 25). Owner-drivers were more likely to start their trip during the daylight hours. For roughly half of drivers in all groups except the independent owner-driver group, the start time for their last trip was scheduled by someone other than themselves. Less than one-quarter of independent owner-drivers had their start time scheduled by someone else such as the customer or freight forwarder. The scheduled time of arrival (ETA), however, had been specified by another party for almost all drivers in all groups. When asked about factors which motivated drivers to keep to the ETA, drivers reported that fines and penalties rather than bonuses were used by a number of employers, freight forwarders and customers. Employees of large companies reported less experience of fines and penalties than the other groups. Nevertheless, most drivers had other reasons for wanting to keep to their ETA. All groups reported loading or unloading most often as a reason for needing to keep to their ETA. To avoid traffic and social reasons like wanting to get home were also cited by considerable numbers of drivers in each group as reasons for keeping to their ETA.

(d) Breaks in last trip and employment status

The number of breaks of greater than 15 minutes that drivers reported taking on their last trip mirrors the length of their trips quite closely (See Table 26). Large company employees drove the shortest trips and took the least number of breaks, whereas more independent owner-drivers drove the longest trips and had the greatest number of breaks. Owner-drivers tended to spend a slightly greater proportion of their trip time in breaks. Again, it is likely that this finding is related to trip length, with longer trips requiring proportionately longer breaks for rest as the trip progresses. Certainly the length of breaks would be expected

**Table 26: Breaks, fatigue, and pretrip activities on last trip by employment group**

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
<b>Number of breaks</b>	Mean number of breaks $\geq$ 15mins (SD)	3.1 (2.2)	3.0 (2.2)	2.5 (1.9)	3.8 (2.6)	3.6 (2.8)	3.7 (1.9)	3.0 (2.1)
<b>Time spent in breaks</b>	Mean time spent in breaks as a % of trip duration (SD)	20.5 (14.7)	20.4 (15.4)	18.3 (13.1)	26.7 (17.1)	28.4 (17.6)	22.1 (12.8)	24.7 (19.1)
<b>Fatigue</b>	% reporting fatigue on last trip	57.0	56.2	53.7	54.9	66.7	66.0	56.3
<b>Rest/Sleep before last trip</b>	Mean hours spent sleeping/resting in 10 hours before last trip	7.7	7.8	7.4	7.9	6.9	7.0	7.5
<b>Activity during breaks</b>	% of breaks not involving work	65.8	63.9	57.2	72.5	69.1	64.1	63.3
	% of breaks involving work only	15.1	15.8	20.5	12.7	9.4	17.6	12.1
	% of breaks involving some work	19.0	20.3	22.3	14.8	21.4	18.3	24.6

Table 26: Breaks, fatigue, and pretrip activities on last trip by employment group (cont.)

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Loading/ unloading	% required to load/unload	81.5	71.8	74.0	87.8	92.5	89.1	70.1
	Mean time spent un/loading by drivers who un/loaded	4.4 (8.2)	3.3 (3.4)	2.6 (2.5)	3.8 (4.3)	5.6 (6.7)	3.3 (4.2)	3.7 (3.1)
	% required to wait to un/load	53.7	59.7	51.1	64.0	57.5	68.8	61.8

to increase as the average trip length increases beyond 18 to 24 hours since people generally need a long period of sleep after 18 to 24 hours of wakefulness.

The percentage of drivers reporting fatigue on the last trip were quite similar across all groups. Large company employee drivers and independent owner-drivers were the lowest reporters of fatigue on the last trip. It is perhaps surprising that these two groups were so similar in this respect since the lengths of their trips differed so much. Employees of large companies made the shortest trips while independent owner-drivers typically made very long trips. A number of characteristics of independent owner-drivers may protect them against feeling fatigue. First, if the amount of rest that drivers reported getting in the 10 hours before the last trip is examined, it can be seen that independent owner-drivers spent more of this time sleeping or resting than other drivers. Thus independent owner-drivers may be better prepared for the long trips that they do. Second, as has been seen already, independent owner-drivers were less subjected to starts in the early hours of the morning and start times being set by other parties like customers and freight forwarders and to some extent to ETA's being set by these groups. Therefore, independent owner-drivers may get less fatigued as they are better able to plan their trip according to their own needs and rhythms.

Clearly resting and sleeping are not the only reasons for taking breaks during trips. While most drivers in all groups spent their break time having a meal, resting or sleeping, a significant percentage of drivers spent at least part of their break working. When the reasons for taking breaks were collapsed across all breaks, it can be seen that the independent owner-drivers were the least likely to work during their breaks while large company employees were the most likely to do so. (See Table 26)

(e) Driver involvement in loading and unloading and employment status

With the exception of owner-drivers working with large companies, virtually all owner-drivers had to load and unload their own freight (See Table 26). While the percentages of employee drivers who had to load and unload

were lower than those for owner-drivers, they were still very high. Roughly three-quarters of all employee drivers had to load and/or unload themselves. The same pattern was found for the percentage of drivers needing to wait to load or unload. Overall, more owner-drivers had to wait for loading or unloading, but the percentage for employee drivers was still relatively high.

The amount of time spent loading and unloading was similar across all groups and corresponded to about 10% of the entire trip time for all groups. Large company drivers spent the least time in loading and unloading, but it still corresponded to about the same proportion of the entire trip time.

#### *Breaking the rules and employment status*

The majority of drivers in all groups, except large company employees, reported that they break the working hours regulations on at least half of their trips (See Table 27). The reasons given by all drivers for needing to break working hours regulations were the same for all owner-driver groups; to earn a living, to get the next load and to return home. Employee drivers also reported returning home and the need to earn a living, but not the need to get the next load. Instead they included tight schedules as an imperative for breaking the working hours rules. This difference is clearly due to the fact that more owner-drivers had to negotiate for each load, but fewer had schedules that were set by some other party compared to employee drivers. Considerably fewer employees of large companies reported that they needed to drive contrary to these regulations, most likely because as was discussed above they do considerably shorter trips than all other groups.

The reporting of breaking road rules was much less common than reporting of work hours breaches across all groups. As before, large company employees reported least often, but for road rule breaking, small company employees reported most often, with close to half of them reporting the need to do so. Again, the reasons were very similar between the groups and they were similar to those given for contravening working rules. The need to earn a living, to get the next

Table 27: Adherence to work hour regulations and road rules by employment group

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
<b>Work hour regulations</b>	% breaking work hour regulations on > half trips	65.5	58.9	37.2	58.9	66.6	63.9	54.0
<b>Most common reasons for breaking work hour regulations</b>	% giving each reason	<i>Return Home</i>	<i>Return Home</i>	<i>Return Home</i>	<i>Earn Living</i>	<i>Earn Living</i>	<i>Earn Living</i>	<i>Earn Living</i>
		48.7	55.1	49.3	80.4	61.9	72.7	62.9
		<i>Earn Living</i>	<i>Earn Living</i>	<i>Earn Living</i>	<i>Next Load</i>	<i>Next Load</i>	<i>Return Home</i>	<i>Return Home</i>
		45.6	48.8	38.9	52.9	45.2	50.0	43.5
		<i>Tight Schedule</i>	<i>Tight Schedule</i>	<i>Rest Facility</i>	<i>Return Home</i>	<i>Return Home</i>	<i>Next Load</i>	<i>Next Load</i>
		39.9	38.6	29.9	41.2	42.9	45.5	37.1
<b>Road rules</b>	% breaking road rules on > half trips	46.7	38.5	19.5	26.5	33.3	32.4	30.3
<b>Most common reasons for breaking road rules</b>		<i>Tight Schedule</i>	<i>Tight Schedule</i>	<i>Fatigue</i>	<i>Earn Living</i>	<i>Earn Living</i>	<i>Earn Living</i>	<i>Earn Living</i>
		35.4	38.3	29.1	41.7	54.1	55.8	55.6
		<i>Earn Living</i>	<i>Earn Living</i>	<i>Earn Living</i>	<i>Next Load</i>	<i>Next Load</i>	<i>Tight Schedule</i>	<i>Next Load</i>
		27.6	33.3	27.2	33.3	40.5	39.5	31.7
		<i>Next Load</i>	<i>Next Load</i>	<i>Tight Schedule</i>	<i>Tight Schedule</i>	<i>Tight Schedule</i>	<i>Next Load</i>	<i>Tight Schedule</i>
		19.9	27.5	25.4	25.0	29.7	37.2	22.2

load and tight schedules motivated all types of drivers to break road rules.

*Attitudes and solutions to driver fatigue and employment status*

(a) Attitudes to and effects of driver fatigue and employment status

Table 28 shows the results of the reported attitudes and effects of fatigue for each employment group. The employment groups did not vary a great deal in the percentage who believe fatigue to be at least a substantial problem for the industry. There was, however, variation amongst them for ratings of personal fatigue. As before, overall the numbers of drivers rating personal fatigue as at least a substantial problem were much lower than their ratings for industry. The smallest number of drivers reporting fatigue as a major or substantial problem for them came from the independent owner-driver group followed by the group of large company employees. This is consistent with reporting of fatigue on the last trip since fewer drivers in these two groups reported it.

Although the percentage of drivers in each group reporting fatigue on at least half of their trips showed a similar pattern to the percentage reporting fatigue as at least a substantial personal problem, more drivers in each group reported fatigue on at least half their trips. Large company employees were less likely to report fatigue as a personal problem and this group showed the least reporting of experience of fatigue on at least half of their trips. Only independent owner-drivers departed from this pattern. Very few reported fatigue as a major or substantial personal problem, but more than half reported fatigue on at least half of their trips. This apparent anomaly may be due, again, to factors in the way independent owner-drivers organise their work. While they may experience as much fatigue or more than other drivers, their greater flexibility in organising themselves may allow them to deal with it more effectively.

These results could reflect simply different perceptions about what is meant by fatigue. It is possible that drivers,



Table 28: Details of fatigue experience and management for each employment group

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
The problem of fatigue	% rating fatigue as at least a substantial problem for the industry	79.7	72.5	78.4	78.0	81.4	83.6	77.5
	% rating fatigue as at least a substantial problem for them personally	36.8	46.9	32.5	26.0	46.6	40.9	35.2
Frequency of fatigue	% reporting fatigue on at least half of trips	48.4	56.5	38.2	56.9	67.4	48.9	42.3
Onset of fatigue	Mean no. of hours after starting work that driver begins to feel fatigued (SD)	14.7 (13.4)	12.6 (10.7)	10.4 (6.0)	16.2 (14.6)	15.3 (8.1)	14.6 (15.7)	11.9 (5.7)
Distribution of fatigue occurrence	% reporting fatigue 0000-0559	74.3	79.0	70.6	78.4	79.1	85.7	76.4
	% reporting fatigue 0600-1159	23.8	22.4	24.3	21.6	18.6	20.4	20.8
	% reporting fatigue 1200-1759	36.2	23.8	31.7	23.5	32.6	34.7	27.8
	% reporting fatigue 1800-2359	24.8	17.5	24.3	15.7	20.9	20.4	25.0

Table 28: Details of fatigue experience and management for each employment group (cont)

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
The effects of fatigue on driving	% reporting adverse effects of fatigue on driving	81.3	79.6	75.6	68.0	81.0	89.8	86.8
	Three most common adverse effects reported (%)	Slower reaction	Slower reaction	Slower reaction	Slower reaction	Slower reaction	Slow driving	Poorer gear
		57.1	51.7	45.8	52.9	48.8	55.1	change
		Poorer gear	Slow driving	Poorer gear	Poorer steering	Poorer gear	Poorer gear	47.2
		change	42.0	change	47.1	change	change	Slower reaction
		50.0	Poorer gear	33.6	Poorer gear	44.2	49.0	44.4
		Poorer steering	change	Poorer steering	change	Slow driving	Slow reaction	Slow driving
Contributors to fatigue	Three most common contributors reported (%)	Un/loading	Poor roads	Dawn driving	Dawn driving	Poor roads	Poor roads	Dawn driving
		77.9	62.4	49.9	66.7	76.7	77.6	55.7
		Poor roads	Dawn driving	Poor roads	Poor roads	Un/loading	Dawn driving	Un/loading
		66.0	62.4	46.9	62.7	69.8	55.1	55.7
		Dawn driving	Long hours	Poor roads	Un/loading	Long hours	Un/loading	Poor roads
		62.2	53.9	45.3	62.7	62.8	55.1	54.3

Table 28: Details of fatigue experience and management for each employment group (cont)

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Current fatigue reduction strategies	Three most common strategies currently used (%)	<i>Sleep</i>	<i>Kick</i>	<i>Music/</i>	<i>Sleep</i>	<i>Sleep</i>	<i>Kick</i>	<i>Sleep</i>
		76.7	tyres	radio	94.0	87.7	tyres	80.7
		<i>Kick</i>	79.2	90.6	<i>Rest</i>	<i>Music/</i>	91.1	<i>Music/</i>
		tyres	<i>Sleep</i>	<i>Ventil-</i>	69.3	radio	<i>Caffeine</i>	radio
		76.7	78.8	ation	<i>Caffeine</i>	81.0	91.1	78.2
	Current strategies rated as most most helpful (%)	<i>Ventil-</i>	<i>Ventil-</i>	86.4	68.8	<i>Caffeine</i>	<i>Sleep</i>	<i>Caffeine</i>
		ation	ation	<i>Caffeine</i>		69.2	88.4	78.0
		76.4	77.6	84.9				
		<i>Drugs</i>	<i>Drugs</i>	<i>Drugs</i>	<i>Drugs</i>	<i>Sleep</i>	<i>Drugs</i>	<i>Drugs</i>
		52.3	61.1	50.0	62.7	52.8	57.1	53.4
		<i>Sleep</i>	<i>Sleep</i>	<i>Sleep</i>	<i>Sleep</i>	<i>Drugs</i>	<i>Sleep</i>	<i>Sleep</i>
		52.0	40.6	44.7	48.9	43.7	44.8	38.9
		<i>Kick</i>	<i>Rest</i>	<i>Rest</i>	<i>Smoking</i>	<i>Caffeine</i>	<i>Kick</i>	<i>Shower</i>
		tyres	22.2	27.1	28.5	22.3	22.0	21.2
		20.6						

Table 28: Details of fatigue experience and management for each employment group (cont)

		Employees			Owner-drivers			
		Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
<b>Fatigue reduction strategies that could be used</b>	Three strategies most commonly selected as very helpful (%)	Improve roads 83.0	Improve roads 83.9	Improve roads 82.9	Improve roads 86.2	Improve roads 88.4	Improve roads 89.3	Improve roads 84.3
		Easing tight schedules 76.0	Greater flexibility 79.9	Easing tight schedules 79.9	Easing tight schedules 68.0	Greater flexibility 81.4	Greater flexibility 81.3	Greater flexibility 80.3
		Greater flexibility 74.8	More efficient loading 77.0	Greater flexibility 72.2	Pay increase 64.0	More efficient loading 79.1	More efficient loading 73.5	Easing tight schedules 65.3
	Three strategies most commonly selected as most helpful (%)	Improve roads 50.0	Greater flexibility 36.0	Greater flexibility 32.7	Improve roads 50.0	Improve roads 57.9	Improve roads 61.9	Greater flexibility 43.8
		Drugs by prescription 39.4	in hours Two-up 31.3	in hours Improve roads 32.4	Stricter enforcing of hours 33.9	Greater flexibility 34.3	Drugs by prescription 31.8	in hours Improve roads 35.6
		Greater flexibility in hours 32.9	Improve roads 30.4	Easing tight schedules 17.6	Pay increase 31.2	Drugs by prescription 27.3	Pay increase 31.8	Stricter driving hours 25.2

like independent owner-drivers, who have to cover long distances only recognise fatigue as the feelings that occur after long periods without consolidated sleep, while large company employees, who do shorter distances recognise it as the earlier, and to some extent, more easily overcome feelings of tiredness after a period of driving. If drivers doing very long distances do, in fact, ignore the early stages of fatigue, this could be seen as a compensatory or protective attitude which may help them to keep going. Alternatively, it is possible that independent owner-drivers, because of their somewhat freer schedules, can organise their trip more to suit their own needs, thereby increasing the time that they can drive before they feel fatigue. It is possible, of course, that both explanations are correct.

Independent owner-drivers reported the longest period before fatigue started, again possibly because they were more able to organise themselves to avoid fatigue up until this time. In contrast, both employee and owner-drivers working for large companies reported becoming fatigued soonest in a trip.

The greater majority of drivers in all groups report that their driving is adversely affected when they feel fatigued, with the most common effects of fatigue also the same across all groups. Consistent with the findings discussed above, independent owner-drivers and large company employees showed the lowest reporting of effects on driving, but the way that driving was affected was the same as for the other groups. Type of employment would not be expected to affect the way that fatigue disrupts driving only the extent to which fatigue is experienced.

An examination of the factors that drivers report contribute to their fatigue showed that the groups were in agreement on the main factors. All groups listed poor roads, dawn driving, loading and unloading, and/or long driving hours as the factors most likely to make them fatigued while driving. Clearly differences between the types of employment are not sufficient to eliminate some of these universal contributors to driver fatigue. These, therefore, may provide important targets on which employers, owner-drivers and employees alike can act to reduce fatigue.

(b) Solutions currently used to combat driver fatigue and employment status

The strategies that drivers use to reduce the amount of fatigue they experience while driving appeared at least partly to be related to the distances they cover and their work practices (See Table 28). Independent owner-drivers, for example, were more likely to use sleep or rest to reduce their fatigue whereas large company employees used more passive, "on the road" methods such as the radio or CB radio, improving ventilation in the truck and using caffeine drinks to stay alert. The greater use by independent owner-drivers of the strategies like sleep and rest, which are much more likely to actually solve the fatigue problem at the time, may be due to their greater need to use these strategies because they do longer trips than the other groups. Longer trips mean that drivers' work periods overlap with normal sleep periods, so that any fatigue due to the job becomes overlaid with normal sleep requirements. Under these circumstances, drivers need to use more direct types of strategies to overcome fatigue. The greater use of sleep or rest is also likely to be due to independent owner-drivers having better access to the strategies like sleep and rest due to their apparently more flexible work practices than the other groups. This may also explain why independent owner-drivers reported fatigue as a personal problem least often.

The drivers' views about which were the most helpful of the strategies they used to reduce fatigue were not influenced by their employment status. The use of stay awake drugs were judged most often by drivers in virtually all groups to be the most helpful way of combating on-road fatigue, with sleep a fairly close second. Only owner-drivers working for small companies showed any deviation from this in that for them the order of drug-use and sleep was reversed. It should be pointed out that unlike sleep, drug-use was far from the most common strategy that drivers used, however, for the majority of those who used this strategy, it was seen to be most helpful in combating fatigue. Again, the differences between types of employment were not enough to reduce the perceived need in at least some drivers in every group for stay awake drugs to complete their trips.

(c) Possible solutions to driver fatigue and employment status

Tables 28 and 29 show the results for each employment group of the questions on possible strategies that could be introduced to reduce driver fatigue. Employment status appeared to have very little influence on drivers' views. For all groups improving the roads was the most common strategy that was seen to be very helpful for reducing fatigue. The strategies of allowing flexible driving hours, easing tight schedules and/or more efficient loading and unloading were also seen by a majority of drivers in all employment groups as very helpful in reducing driver fatigue.

There were more differences between the groups though, in terms of the strategies that were rated by the drivers as the most helpful for reducing fatigue from those that they selected as very helpful. It is likely that these differences reflect, to some extent, the different pressures that each group of drivers experience. While road improvement and more flexible driving hours were the strategies rated generally as most helpful by the greatest number of drivers in each group, three groups, small company employees, owner-drivers working with small companies and owner-drivers working with medium-sized companies, reported allowing drugs by prescription most often as most helpful. Independent owner-drivers also commonly reported stricter enforcement of current driving hours as most helpful, whereas about one-quarter of owner-drivers working for large companies who reported stricter driving hours as very helpful, also viewed it as most helpful for reducing fatigue. It should be recognised that both these groups were making comments about reducing or controlling the number of hours that drivers work. In addition, although just over 10% of employee drivers from medium-sized companies rated two-up driving as very helpful, nearly one-third of this smaller group chose this strategy as most helpful for reducing their fatigue.

**Table 29: The influence of employment group on attitudes to possible strategies to reduce driver fatigue showing percentage of drivers in each group rating each strategy as very helpful and percentage rating each as among most helpful (brackets).**

Strategy	Employees			Owner-drivers			
	Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
Information/training	26.9 (5.2)	28.5 (4.9)	40.5 (4.2)	17.7 (11.3)	14.3 (0.0)	32.0 (13.4)	23.6 (0.0)
Preventing drugs	14.9 (9.4)	18.8 (15.4)	29.6 (1.0)	15.7 (0.0)	9.3 (0.0)	25.6 (16.8)	18.3 (0.0)
Drugs by prescription	39.1 (39.4)	50.4 (27.6)	32.3 (14.2)	39.2 (15.1)	51.2 (27.3)	46.8 (31.8)	47.8 (9.0)
Stricter driving hours	10.2 (4.9)	11.6 (6.0)	16.3 (0.0)	5.9 (0.0)	2.4 (0.0)	4.2 (0.0)	11.5 (25.2)
Stricter enforcement of current hours	8.7 (5.7)	15.2 (0.0)	23.5 (8.1)	5.9 (33.9)	2.3 (0.0)	2.1 (0.0)	15.5 (9.0)
Regulation of work time	25.0 (7.6)	31.6 (9.2)	34.6 (6.4)	23.5 (0.0)	19.0 (0.0)	26.5 (7.5)	37.1 (0.0)
Regulation by industry	54.5 (7.9)	63.5 (13.9)	62.1 (5.8)	50.0 (8.0)	52.4 (4.6)	63.8 (3.3)	60.8 (7.1)
Banning driving 2am-6am	4.3 (0.0)	7.2 (0.0)	6.5 (1.6)	5.9 (0.0)	0.0 (0.0)	0.0 (0.0)	1.4 (100)



**Table 29: The Influence of employment group on attitudes to possible strategies to reduce driver fatigue showing percentage of drivers in each group rating each strategy as very helpful and percentage rating each as most helpful (brackets) (cont).**

Strategy	Employees			Owner-drivers			
	Small company	Medium company	Large company	Independent	Small company	Medium company	Large company
<b>More efficient un/loading</b>	74.6 (28.4)	77.0 (29.9)	69.8 (16.6)	74.5 (15.8)	79.1 (20.6)	73.5 (25.0)	91.7 (16.7)
<b>Two-up driving</b>	17.0 (5.9)	13.7 (31.3)	12.1 (9.1)	9.8 (0.0)	19.1 (12.6)	20.4 (0.0)	9.7 (0.0)
<b>Staged driving</b>	25.2 (9.5)	31.9 (11.0)	38.3 (12.3)	10.0 (0.0)	9.5 (0.0)	19.1 (11.0)	23.4 (0.0)
<b>Pay increase</b>	43.7 (20.8)	45.6 (16.2)	47.5 (7.6)	64.0 (31.2)	65.1 (14.3)	46.8 (31.8)	61.1 (22.7)
<b>Easing tight schedules</b>	76.0 (25.6)	73.4 (23.6)	79.9 (17.6)	68.0 (20.6)	72.1 (16.1)	68.7 (30.3)	65.3 (21.3)
<b>Better vehicle design</b>	28.1 (10.3)	39.0 (3.6)	57.3 (8.2)	14.0 (0.0)	14.0 (0.0)	22.4 (0.0)	35.2 (7.9)
<b>Fatigue monitors</b>	20.5 (7.3)	29.5 (4.7)	44.9 (4.2)	32.0 (0.0)	17.1 (0.0)	25.0 (8.4)	24.3 (0.0)
<b>Better off-road rest facilities</b>	47.8 (17.2)	52.6 (18.1)	61.8 (13.6)	39.2 (15.1)	53.5 (13.1)	45.8 (18.1)	63.3 (8.8)
<b>Greater flexibility in hours</b>	74.8 (32.9)	79.9 (36.0)	72.2 (32.7)	56.9 (20.7)	81.4 (34.3)	81.3 (30.8)	80.3 (43.8)
<b>Improving roads</b>	83.0 (50.0)	83.9 (30.4)	82.9 (32.4)	86.2 (50.0)	88.4 (57.9)	89.3 (61.9)	84.3 (35.6)

### **The influence of type of driving operation**

Another of the more important possible influences on drivers' experiences and attitudes is the type of driving that they do, single, two-up or staged. Drivers were asked about their driving operation during their last one-way trip. Table 7 shows the results for types of driving operation that drivers reported they did on their last trip. As described earlier a small percentage of single and staged drivers reported that they did not do one-way trips, so for this analysis they were treated separately.

#### *Description of drivers undertaking different types of driving operations*

These results are shown in Table 30. Drivers doing all types of driving were approximately the same age. They were different, however, on marital status and the number with children. Fewer two-up drivers were married or in a defacto relationship and fewer had children. There were no differences, however, on the number of children that each group had.

There was a relationship between age and years of driving experience such that the younger two-up group had considerably less driving experience compared to the other groups and the older staged drivers who also had the most experience. This could be seen in terms of both the median number of years of driving experience and the percentage of drivers in the each group who had less than 8 years experience.

A comparison of the employment status of drivers doing various types of driving operation shows that single drivers reporting one-way trips were fairly evenly distributed across all the employee groups, and across all the owner-driver groups, but in much smaller proportions for the latter. Almost all single drivers who reported two-way trips were employee drivers, mainly from large companies. Two-up was done mainly by employee drivers and by owner-drivers working for small companies. Staged driving was done virtually exclusively by employee drivers with the exception of a small group of owner-drivers working for large or medium-sized companies. These results reflect to a large

**Table 30: Demographics by type of driving operation**

		<b>Single one-way</b>	<b>Single two-way</b>	<b>Two-Up</b>	<b>Staged one-way</b>	<b>Staged two-way</b>
<b>Age</b>	Mean Age (SD)	37.4 (8.7)	39.8 (9.1)	36.1 (10.7)	39.6 (9.1)	39.2 (6.8)
<b>Marital status</b>	% married or defacto	85.5	91.9	72.1	96.9	96.1
<b>Children</b>	% with children	78.2	80.3	67.4	84.8	80.8
	mean no. of children	2.1	2.2	2.0	2.5	2.2
<b>Driving experience</b>	Median years experience (range)	14.0 (52)	15.5 (43)	11.0 (49)	20.0 (27)	16.5 (35)
	% with < 8 years experience	21.8	19.7	37.2	6.1	23.1
<b>Employment status</b>	Employee Small <= 10 trucks	25.8	10.1	31.0	9.1	8.0
	Employee Medium 11-50 trucks	16.3	9.2	23.8	6.1	12.0
	Employee Large > 50 trucks	30.6	73.1	19.0	75.8	76.0

**Table 30: Demographics by type of driving operation (cont)**

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
<b>Employment status</b>	Owner driver Independent	7.1	0.8	2.4	0.0	0.0
	Owner driver Small <= 10 trucks	5.2	0.8	14.3	0.0	0.0
	Owner driver Medium 11-50 trucks	5.8	2.5	7.1	0.0	4.0
	Owner driver Large > 50 trucks	9.1	3.4	2.4	9.1	0.0
<b>Truck type</b>	% driving articulated < 22.4 tonne	78.0	75.6	27.9	90.9	73.1
	% driving B-double or road train	8.8	8.9	51.2	0.0	11.5
	% driving other	13.2	15.4	21.0	9.1	15.3

extent the possible distribution of staged and two-up driving within the industry. For organisational and cost reasons, independent owner-drivers would not be expected to do two-up driving and fewer owner-drivers overall would be expected to do two-up driving.

#### *Payment arrangements and type of driving operation*

Only single drivers reporting one-way trips and two-up drivers had to negotiate their rates of pay for each load, but this only involved small percentages of drivers in these two groups (See Table 31). Larger percentages of drivers in each group had on-going contracts for at least some loads, with the exception of staged drivers reporting two-way trips for whom this only applied to a small group.

The groups were distinguished by different pay rates (See Table 31). Single drivers who described one-way trips were paid mainly at a trip rate per kilometre and/or tonnage carried, whereas single drivers describing two-way trips were mainly paid a weekly wage, with or without overtime. Two-up and staged drivers also mainly received trip rates, but a significant number of two-up drivers were paid on an hourly rate. All groups also reported a wide assortment of other types of pay rates, with more than one-third of two-up, staged two-way and single two-way drivers reporting rates that could not be classified using the categories provided.

Staged drivers and two-way single drivers were most likely to be paid at the award rate or greater, whereas nearly 1 in 5 one-way single drivers and two-up drivers reported receiving under the award rate of pay. A significant number of one-way single drivers and two-up drivers also did not know how their pay rate compared to the award rate, again suggesting that these two groups of drivers are not being made aware of some important information.

#### *Working conditions and type of driving operation*

Articulated trucks of more than 22.4 tonnes capacity were driven by most drivers in single and staged driving operations. More than half of the two-up group, however, drove B-doubles or road trains (See Table 30).

**Table 31: Payment details for different types of driving operation**

		<b>Single one-way</b>	<b>Single two-way</b>	<b>Two-Up</b>	<b>Staged one-way</b>	<b>Staged two-way</b>
<b>Contractual arrangements</b>	% negotiating pay rate for each load	11.7	0.0	14.3	0.0	0.0
	% with ongoing contract for some or all loads	39.5	35.9	43.6	40.0	15.8
<b>Payment type</b>	% paid hourly rate	9.2	23.6	20.9	6.5	4.0
	% paid weekly rate	11.2	34.1	9.3	3.2	4.0
	% paid flat rate per load	8.4	2.4	4.7	0.0	12.0
	% paid trip rate	59.6	24.4	48.8	71.0	48.0
	% paid other	20.5	39.0	37.2	25.9	36.0
<b>Payment rate</b>	% paid award rate or greater	68.9	90.1	64.3	87.9	88.5
	% paid less than award rate	19.8	4.1	19.0	3.0	3.8
	% not knowing	11.3	5.8	16.7	9.1	5.8

There were clear differences between the groups also for the weekly working hours they reported (See Table 32). Drivers doing two-up reported the longest weekly working hours, followed by single one-way drivers. Both groups of staged drivers reported only about half as many hours as worked by the two-up drivers. Again, all groups except staged one-way drivers worked considerably more than the usual 38 or 40 hour week. Most staged drivers who described one-way trips reported weekly working hours of no more than 38 hours. Twice as many one-way staged drivers did shorter hours than did one-way single drivers, two-up drivers and even staged two-way drivers. The single two-way group had intermediate numbers of drivers doing shorter weekly hours. The single two-way group also reported the lowest average number of nights worked in a week, with only a single night being worked on average. All other groups reported between 2 and 3 nights worked per week on average.

It appears that the two single driver groups were different in terms of their working hours, including work at night. The two-way single drivers seemed to have a much less arduous driving task compared to the one-way single drivers. The two staged groups also differed with one-way drivers appearing to have less work than two-way drivers, although both involved similar amounts of night driving on average. Considering that most staged drivers were also employees of large companies, which the analysis described above showed to do the shortest trips, these findings are not surprising.

#### *Last trip and type of driving operation*

##### *(a) Trip length and type of driving operation*

The details for the length of the last trip for drivers doing different types of operation are shown in Table 33. The duration and length of the last trip differed markedly between types of driving operation. Staged drivers took the shortest trips in terms of all measures of hours taken and of distance travelled. Staged drivers reporting two-way trips, not surprisingly, did longer journeys than those reporting only one-way trips. For single driving, however, this pattern was not evident. Single drivers who reported two-way trips did shorter journeys than those reporting one-way trips. This surprising result is probably due to the

**Table 32: Details of work last week by type of driving operation**

		<b>Single one-way</b>	<b>Single two-way</b>	<b>Two-Up</b>	<b>Staged one-way</b>	<b>Staged two-way</b>
<b>Work last week</b>	% of drivers with no long- distance trips	20.3	35.3	27.9	6.5	13.0
<b>Work last week for drivers who made long- distance trips (n = 708)</b>	Mean hours worked (SD)	65.1 (32.1)	50.9 (30.0)	81.0 (44.7)	39.1 (19.0)	49.8 (15.9)
	% working <= 38 hours	21.2	37.0	21.7	52.0	25.0
	% working > 72 hours	37.2	19.6	56.5	4.2	0.0
	Mean no. of nights worked (SD)	2.6 (2.1)	1.0 (1.6)	2.8 (2.3)	2.8 (2.5)	2.4 (2.0)



Table 33: Type of driving operation: Details of last trip

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
Trip length and duration	Mean trip length (SD)	1280.3 (956.1)	937.0 (748.0)	2519.1 (1456.3)	600.5 (239.4)	921.3 (249.8)
	% driving > 1500kms	26.7	68.3	3.2	3.8	12.6
	Mean trip duration in hours (SD)	28.5 (23.7)	21.1 (21.5)	44.4 (30.1)	8.5 (3.2)	15.5 (6.6)
	% working >= 12 hours	82.9	86.0	94.3	9.1	80.0
	% working >= 30 hours	29.2	14.9	51.4	0.0	8.0
Cruising speed	% travelling at or below speed limit	71.7	89.0	73.9	90.3	96.2
	% travelling above speed limit	28.3	11.0	26.1	9.7	3.8
Start time	% starting trip between 0000-0559	13.9	48.8	7.1	30.3	34.6
	% starting trip between 0600-1159	38.2	21.5	42.9	6.1	7.7
	% starting trip between 1200-1759	28.2	13.2	28.6	12.1	23.1
	% starting trip between 1800-2359	19.7	16.5	21.4	51.5	34.6
	% whose start time was set by another party	53.4	77.5	73.8	87.8	88.5

**Table 33: Type of driving operation: Details of last trip (cont)**

		Single one-way	Single two-way	Two-up	Staged one-way	Staged two-way
<b>Arrival time</b>	% whose ETA was set by another party	88.2	84.2	95.1	81.2	73.1
<b>Reasons for meeting ETA</b>	% with contingent bonus	2.2	1.7	4.8	0.0	0.0
	% with contingent fine	12.3	3.4	16.7	3.0	4.0
	% with other reasons	50.4	33.3	44.2	38.7	41.7

fact that some single two-way trip drivers did trips which started and ended in the same place, but often involved a number of pick ups and deliveries in a number of locations along the way. The length and time taken for such trips was considerably shorter than that done by drivers who drove from point of origin to point of destination. Finally, two-up drivers, as might be expected, did trips which were twice as long as those of the next longest type of operation. One of the main perceived advantages of two-up driving is that it allows the truck to be driven further by doubling the number of drivers and promoting continuous driving. It is clear that this advantage is taken to an extreme extent since two-up drivers do so many more kilometres and hours than the other types of operation.

(b) Trip timing and scheduling and type of driving operation

Table 33 shows the timing and scheduling of the last trip for drivers doing different types of operation. The results showed that start time was also a distinguishing feature of the different types of driving operation. Single one-way drivers mainly started their trip during the daylight hours, but a significant number of two-way single drivers started their trips during the hours of darkness, particularly in the early morning. Two-up drivers also mainly started in the daylight hours whereas the greater majority of both types of staged groups started their trip in the darkness hours of early morning or evening.

Most drivers doing all types of driving operation had the start time scheduled by someone else, but more single one-way drivers were able to schedule themselves than for any other group. This may be one reason why so many drivers in this group were able to start their trips during the day-time and, in fact, why most other groups did so many starts in the early morning hours. Two-up drivers are clearly an exception to this, but the start time may not be as important for them since their trips were so long. The majority of all drivers in all groups had their time of arrival also specified by another party. Nearly all of the two-up group had a finish time to stick to, whereas only about three-quarters of staged two-way drivers reported that they had an ETA. Two-up drivers and one-way single drivers were most likely to incur fines as motivators to comply with

their finish time but there were many other reasons given. These included social reasons such as wanting to get home, time pressures on loading or unloading and to avoid traffic problems. For most groups social reasons were the most common, but single one-way drivers reported loading and/or unloading most often as the reason for time pressures on the end of their trip.

(c) Breaks in last trip and type of driving operation

Details of the breaks taken by drivers doing different types of operation are shown in Table 34. The results showed that the number of breaks longer than 15 minutes taken in the last trip varied across different types of driving, but they were very much related to the length of the trip. Drivers doing two-up took the most breaks, but as discussed earlier, they also did the longest trips. Staged drivers took the fewest breaks, but they typically did the shortest trips. Examination of the percentage of the trip time that drivers spent taking breaks for each of the groups shows that staged drivers spent proportionally least time in breaks and drivers doing two-up the most time in breaks. In fact, the two-up drivers spent more than twice as much of their trip time in breaks as did the staged drivers. This difference is most likely due to the fact that two-up drivers do much longer trips which require them to incorporate their sleeping time into their trips. As shown in the earlier analysis for all drivers, there was a relationship between the length of the trip and the length of the break such that longer breaks were taken later in the trip. This is clearly the case for two-up driving.

Since sleep and rest is not the only reason for taking a break, it is important to look at the main reasons why each of the groups took breaks in their trip. Some drivers in all groups combined rest with work during their breaks. This was most common for staged two-way drivers, and overall, least common for single one-way drivers and staged one-way drivers. This difference between the two types of staged drivers is probably because the two-way drivers were reporting the combined loading/unloading and rest activities that occurred at their turn around point.

**Table 34: Breaks, fatigue and pre-trip activities by type of driving operation**

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
<b>Number of breaks</b>	Mean no. of breaks ≥ 15 mins (SD)	2.9 (2.0)	3.1 (2.0)	4.8 (3.6)	1.2 (1.0)	2.4 (1.0)
<b>Time spent in breaks</b>	Mean time spent in breaks as a % of trip duration (SD)	21.1	19.1	31.7	14.1	16.8
<b>Activity during breaks</b>	% of breaks not involving work	67.2	49.4	50.1	52.7	30.0
	% of breaks involving work only	13.3	33.3	16.2	14.0	35.6
	% of breaks involving some work	19.6	17.3	33.7	33.3	34.4
<b>Fatigue</b>	% reporting fatigue on last trip	59.3	49.6	50.0	34.4	44.0
<b>Rest/sleep before last trip</b>	Mean time spent sleeping/resting in 10 hours before last trip	7.5	8.6	7.1	9.0	9.2

**Table 34 (Continued): Breaks, fatigue and pre-trip activities by type of driving operation**

		<b>Single one-way</b>	<b>Single two-way</b>	<b>Two-Up</b>	<b>Staged one-way</b>	<b>Staged two-way</b>
<b>Loading/ unloading</b>	% required to load/unload	79.8	84.2	76.3	16.7	60.9
<b>Time spent loading/ unloading</b>	Mean time(hrs) un/loading by drivers who un/loaded (SD)	3.4 (3.4)	2.2 (2.2)	11.3 (18.3)	1.0 (0.0)	2.5 (1.6)
<b>Waiting to load/unload</b>	% required to wait to un/load	59.7	49.1	33.3	33.3	33.3

(d) Driver involvement in loading and unloading and type of driving operation

The majority of drivers in each of the driving operations were involved in the loading and/or unloading of their own trucks on their last trip (See Table 34). The exception to this was staged drivers, with relatively few staged drivers reporting one-way trips being involved in loading or unloading. In contrast, slightly more than half of the staged two-way drivers reported being involved in loading or unloading, however, this was considerably fewer than for the other driving groups.

The same pattern of results were found for the time drivers spent in the loading and unloading process. Staged drivers doing one-way trips were only involved for a very short time, whereas two-up drivers spent many hours in the loading and unloading process. Again, two-up drivers were distinguished by the extent to which their time was taken up in this aspect of the transportation task. The average time for loading and unloading for them was more than three times that for the next highest group, single one-way drivers.

The results for the percentage of drivers who had to wait for their loads showed that most of the single drivers were inconvenienced in this way. Even so, one-third of drivers in the staged and two-up groups also had to wait to be loaded or unloaded on their last trip.

(e) Experience of driver fatigue and type of driving operation

The results of drivers' experiences of fatigue for drivers from different types of driving operation are shown in Table 34. Not surprisingly, the lowest percentage of drivers reporting fatigue on their last trip was in the group of staged one-way drivers. About half of the single drivers and the two-up drivers reported fatigue, compared to only about one-third of the staged one-way group. These results should be viewed in conjunction with the amount of rest that each group of drivers reported getting in the 10 hours before their last trip. Staged drivers spent almost all of the time sleeping or resting, whereas single and two-up drivers spent about three-quarters. This shows that staged drivers were

better rested prior to their last trip than the other two groups and this may account for their lower rates of feeling fatigue. It must be remembered, however, that fatigue for single and two-up drivers would also be due to the longer trips that they did and their longer weekly working hours, plus the fact that they were more likely to have to be involved in loading and unloading.

*Breaking the rules and type of driving operation*

The results for drivers breaking the work hours regulations and road rules are shown in Table 35. They indicate that the majority of the single one-way and two-up drivers reported breaking work hours regulations on at least half of their trips compared to relatively few drivers from the other groups. The reasons given for breaking work hours regulations, however, were very similar across the groups; earning a living, returning home and tight schedules. Only the staged one-way driver group which also had the lowest level of reporting of working hours breaches showed any different reason. This group did not report needing to earn a living amongst the main reasons for breaking working hours regulations, instead they substituted needing to reach rest facilities. These results appear to reflect the different pressures that each group faces. More two-up and single one-way drivers appeared to find it difficult to work to the working hours regulations compared to the other groups. In addition, it seems that staged one-way drivers were relieved of the pressure to drive contrary to working hours regulations due to the need to earn a living. This is consistent with the finding that staged drivers were more likely to be paid above the award wages.

Considerably fewer drivers in all groups except both types of staged driver reported breaking road rules on most of their trips. Even though across the groups the pattern of results was the same as for working hours regulations, there was less difference between the groups with the highest and lowest percentages of drivers reporting breaches. More staged drivers reported breaking road rules than breaking working hours regulations, suggesting that for road rules staged drivers were more like the other driving groups. It is interesting, however, that the reasons for breaking road rules for the three lowest reporting groups, staged drivers,



Table 35: Adherence to work hour regulations and road rules by type of driving operation

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
Work hour regulations	% breaking work hour regulations on > half the trips	55.7	22.3	56.4	9.7	20.9
Most common reasons for breaking work hour regulations	% giving each reason	Earn living 54.0 Return home 48.8 Tight schedule 33.6	Return home 47.3 Earn living 37.4 Tight schedule 20.9 Rest facilities 20.9	Earn living 43.6 Tight schedule 43.6 Return home 33.3	Return home 56.0 Rest facilities 28.0 Tight Schedule 12.0	Return home 66.7 Earn living 44.4 Tight schedule 22.2 Rest Facilities 22.2
Road rules	% breaking road rules on > half the trips	31.5	11.0	35.7	18.8	21.7
Most common reasons for breaking road rules	% giving each reason	Earn living 37.7 Tight schedule 31.3 Next load 25.2	Fatigue 32.8 Earn living 27.9 Tight Schedule 19.7	Tight schedule 37.8 Earn living 27.0 Next load 16.2	Tight schedule 23.1 Fatigue 23.1 Earn living 15.4	Fatigue 35.7 Tight schedule 35.7 Earn living 7.1

both one and two-way and single two-way drivers, included fatigue along with the other, more externally generated reasons. This suggests that the combined pressures for breaking road rules in the three lowest reporting groups are again, overall much less and more likely to be due to the effects of fatigue on driving compared to the other groups.

*Attitudes and solutions to driver fatigue and type of driving operation*

The details of fatigue experience and management for drivers from different types of driving operation can be seen in Table 36.

(a) Attitudes to and effects of driver fatigue and type of operation

The majority of drivers in every driving operation group reported fatigue as at least a substantial problem for industry and there was very little variation between the groups. Nevertheless, they all reported it as a personal problem far less often and there was considerable variation among the groups. Single drivers reported fatigue as at least a substantial problem for them most often, but relatively few staged drivers did so.

When asked about the frequency of feeling fatigue, twice as many single and two-up drivers reported feeling fatigue on at least half of their trips as did staged drivers. This pattern of results for fatigue as a personal problem and frequency of fatigue is very similar to that discussed in the previous section for the percentage of drivers experiencing fatigue on their last trip and is likely to be due to the same influences.

Even though more two-up and single one-way drivers reported fatigue as a commonly experienced personal problem, they reported being able to work for longer periods before they felt fatigue. Surprisingly, considering their relatively shorter trips, one-way staged drivers reported becoming fatigued far earlier into the period of work than drivers in the other driving operations. As described in the section on the influence of employment type, these results could reflect simply different perceptions about what is meant by

**Table 36: Details of fatigue experience and management by type of driving operation**

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
<b>The problem of fatigue</b>	% rating fatigue as at least a substantial problem for the industry	77.9	76.9	72.1	78.8	84.6
	% rating fatigue as at least a substantial problem for them personally	38.5	32.8	28.6	15.1	19.2
<b>Frequency of fatigue</b>	% reporting fatigue on at least half of trips	50.8	37.4	49.9	24.3	19.2
<b>Onset of fatigue</b>	Mean no. of hours after starting work that driver begins to feel fatigued (SD)	13.0 (10.7)	10.7 (5.5)	18.6 (18.1)	7.8 (2.8)	11.1 (3.2)
<b>Distribution of fatigue occurrence</b>	% reporting fatigue 0000-0559	75.9	69.1	79.1	87.9	73.1
	% reporting fatigue 0600-1159	32.2	30.1	30.2	6.1	15.4
	% reporting fatigue 1200-1759	23.1	22.8	20.9	21.2	11.5
	% reporting fatigue 1800-2359	15.9	13.8	14.0	21.2	7.7

Table 36: Details of fatigue experience and management by type of driving operation (cont)

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
<b>The effects of fatigue on driving</b>	% reporting adverse effects of fatigue on driving	77.4	74.2	81.0	75.8	76.0
	Three most common adverse effects reported (%)	<i>Slower reaction</i> 51.0 <i>Poorer gear change</i> 43.0 <i>Slower driving</i> 41.4	<i>Slower reaction</i> 47.2 <i>Poorer gear change</i> 34.1 <i>Poorer steering</i> 31.7	<i>Slower reaction</i> 53.5 <i>Poorer gear change</i> 48.8 <i>Poorer steering</i> 48.8	<i>Slower reaction</i> 39.4 <i>Poorer gear change</i> 36.4 <i>Poorer steering</i> 27.3	<i>Poorer steering</i> 46.2 <i>Slower reaction</i> 38.5 <i>Poorer gear change</i> 30.8
<b>Contributors to fatigue</b>	Three most common contributors reported (%)	<i>Poor roads</i> 60.9 <i>Dawn driving</i> 58.4 <i>Un/loading</i> 54.2	<i>[Dawn driving</i> <i>[Poor roads</i> 49.1 <i>[Poor weather</i> <i>[Long hours</i> 44.2	<i>Poor roads</i> 59.5 <i>Long hours</i> 54.7 <i>[Dawn driving</i> <i>[Un/loading</i> <i>[Poor weather</i> 50.0	<i>Dawn driving</i> 65.7 <i>Poor weather</i> 53.2 <i>[Inadequate sleep before trips</i> <i>[Poor roads</i> 43.8	<i>Dawn driving</i> 57.7 <i>Poor weather</i> 53.2 <i>Poor roads</i> 42.3
<b>Fatigue reduction strategies currently used</b>	Three most common strategies currently used (%)	<i>Sleep</i> 74.9 <i>Music/radio</i> 69.5 <i>Ventilation</i> 68.2	<i>Shower</i> 72.4 <i>Kick tyres</i> 69.9 <i>Caffeine</i> 68.3	<i>Caffeine</i> 69.8 <i>Music/radio</i> 67.4 <i>Sleep</i> 65.1	<i>Ventilation</i> 78.8 <i>Music/radio</i> 72.7 <i>Caffeine</i> 69.7	<i>Music/radio</i> 92.3 <i>Ventilation</i> 88.5 <i>Caffeine</i> 73.1

Table 36: Details of fatigue experience and management by type of driving operation (cont)

		Single one-way	Single two-way	Two-Up	Staged one-way	Staged two-way
<b>Fatigue reduction strategies currently used</b>	Three strategies rated "most helpful"	CB radio 74.1 Sleep 47.4 Drugs by prescription 42.3	Sleep 30.2 CB radio 28.8 Drugs by prescription 28.6	Drugs by prescription 66.7 [Sleep [Meal 28.6 Caffeine 26.7	Drugs by prescription 50.0 Kick tyres 45.5 Sleep 36.4	Drugs by prescription 100.0 Sleep 42.5 Caffeine 36.8
<b>Fatigue reduction strategies that could be used</b>	Three strategies most commonly selected as very helpful (%)	Improving roads 84.1 More efficient un/loading 76.8 Greater flexibility in hours 74.7	Improving roads 86.7 Easing tight schedules 86.0 Greater flexibility in hours 78.2	Greater flexibility in hours 72.1 Improving roads 66.7 [More efficient un/loading [Easing tight schedules 65.1	Improving roads 93.5 Staged driving 87.9 More efficient un/loading 87.1	Improving roads 92.0 Staged driving 88.0 Greater flexibility in hours 84.0
<b>Fatigue reduction strategies that could be used</b>	Three strategies rated "most helpful"	Improving roads 41.5 Greater flexibility in hours 35.2 Drugs by prescription 25.4	Improving roads 36.5 Greater flexibility in hours 33.3 Banning driving 2am - 6am 30.1	Improving roads 50.0 Easing tight schedules 28.6 More efficient un/loading 28.6	Improving roads 34.5 Greater flexib- ility in hours 28.0 Better vehicle design 19.0	Improving roads 34.0 More efficient un/loading 30.0 Drugs by prescription 28.6

fatigue. Drivers who have to cover long distances may only recognise fatigue as the feelings they experience after long periods without sustained sleep, while staged drivers recognise it as tiredness much earlier in a period of driving. It is feasible that drivers who have to cover long distances in a trip may attempt to ignore the early effects of fatigue, both in order to keep going, and because they are aware of the differences between the type of fatigue experienced after long periods of time without sleep and that experienced after shorter periods of time at the wheel. Alternatively, as discussed in the earlier section, the more flexible schedules of two-up and one-way single drivers may give them more liberty to organise their trips to suit themselves, rather than some other party, so increasing the time that they can drive before they feel fatigue. Both explanations may be correct, however.

Around three-quarters of drivers in all groups reported that their driving was worse when they are fatigued. This consistent finding is also seen in the drivers' reports of how their driving is affected. Slowed reactions, and poorer gear changing were reported by all groups as the most common effects of fatigue on driving and poorer steering was reported by all groups except one. Differences in the type of driving operation do not appear to buffer drivers from the effects of fatigue on driving performance.

Type of driving operation on the last trip was also unrelated to the factors that generally contribute to drivers feeling fatigued. Most drivers in all types of operation cited dawn driving as a contributor to their fatigue. Poor roads was also a commonly reported contributor, however it was reported by fewer staged drivers than any other group. Other commonly reported contributors included poor weather, long driving hours and inadequate sleep before their trips. In addition, single drivers reporting one-way trips and those doing two-up reported loading and unloading as fatigue contributors. This is consistent with the finding that these two groups spent the longest periods loading and unloading compared to the other groups.

(b) Solutions currently used to combat driver fatigue and type of driving operation

The strategies that drivers reported they use to reduce their experience of fatigue while driving were also very similar across driving types (See Table 36). The majority of drivers in all operations reported using music and the radio to help manage driver fatigue. Most single one-way drivers and two-up drivers also reported sleep as a strategy they used for fatigue reduction, but they were the only groups to do so. This is surprising since sleep is the best and most lasting solution to the fatigue problem, however it may be due to the longer distances that these two groups typically cover. Caffeine-containing drinks were also cited by all groups except one-way single drivers and improving ventilation by most drivers in all groups except two-up drivers and single two-way drivers. Both of these are temporary solutions to fatigue.

Drivers also indicated which of the strategies that they used to reduce their driver fatigue were most helpful to them. This produced a somewhat different pattern of strategies. In all groups sleep was regarded to be among the most helpful strategies that drivers used, even though as discussed above, relative to other strategies, fewer drivers in three of the groups reported using it as a strategy. Similarly, stay awake drugs were reported as among the most helpful of the strategies they use by large percentages of drivers in all types of operations, in spite of the fact that very small percentages of drivers reported using them in the first place. Both of these strategies were remarkable for the high levels of belief amongst drivers in all groups that they are most helpful. Other strategies such as listening to music or the radio or caffeine drinks were used by significantly greater numbers of drivers, but were rated by very low numbers of drivers as most helpful for reducing fatigue. It is clear that drivers judge strategies that usually have longer-lasting effects on their fatigue as most helpful.

(c) Possible solutions to driver fatigue and type of driving operation

The drivers' views about the helpfulness of the list of possible strategies for reducing fatigue were very similar across the groups (See Tables 36 and 37). Better roads, more flexible driving hours, more efficient loading and unloading, easing of tight schedules and having regulations set by industry were listed by most drivers in all groups as being very helpful. In addition, a high percentage of staged drivers (87.9% and 88.0% for one-way and two-way drivers respectively) reported staged driving as very helpful for reducing fatigue. A considerably smaller percentage (60.5%) of two-up drivers reported two-up as very helpful.

There were some similarities also on the strategies that were judged most helpful. Improving roads was the most common strategy for all groups. The other strategies judged as most helpful by the largest percentages of drivers were again flexible hours, easing tight schedules and improvements to the loading and unloading procedures.

The groups did differ, though, on some of the strategies that were judged to be most helpful. One-quarter of staged drivers reporting two-way trips judged preventing drug use as being most helpful for reducing driver fatigue and just over one-quarter of them judged allowing stay-awake drugs only by prescription as most helpful. This is an apparent inconsistency, but it is possible that the drivers in both groups were simply commenting on the need for control of the way that drugs are currently used.

A significant percentage of single two-way drivers also reported banning driving during the 2 am to 6 am time period as most important for reducing their fatigue. The reason for this discrepancy is most likely to be because this group had the highest number of drivers who started their trips during this period. Clearly they saw such early starts as a problem for them.

It is noteworthy that only staged drivers judged this form of driving as very helpful. Very few judged it as most helpful. In contrast, while a relatively smaller percentage



**Table 37: The influence of type of operation on attitudes to possible strategies that could be used to reduce driver fatigue showing percentage of drivers in each group rating each strategy as very helpful and percentage rating each as among most helpful (brackets)**

<b>Strategy</b>	<b>Single one-way</b>		<b>Single two-way</b>		<b>Two-up</b>		<b>Staged one-way</b>		<b>Staged two-way</b>	
<b>Information/ training</b>	28.1	(4.2)	41.7	(2.0)	18.6	(14.3)	32.3	(0.0)	39.1	(12.5)
<b>Preventing drugs</b>	18.6	(5.5)	38.3	(2.2)	25.6	(9.1)	12.1	(0.0)	18.2	(25.0)
<b>Drugs by prescription</b>	46.8	(25.4)	23.1	(7.1)	40.5	(5.9)	50.0	(12.5)	29.2	(28.6)
<b>Stricter driving hours</b>	10.2	(5.8)	17.6	(0.0)	7.0	(0.0)	12.9	(0.0)	16.7	(0.0)
<b>Stricter enforcement of current hours</b>	13.1	(5.6)	20.5	(16.0)	2.3	(0.0)	31.2	(0.0)	20.0	(0.0)
<b>Regulation of work time</b>	30.5	(7.2)	27.4	(6.3)	14.0	(0.0)	53.3	(0.0)	29.2	(0.0)
<b>Regulation by industry</b>	58.9	(4.3)	65.0	(3.8)	51.2	(22.7)	64.5	(5.0)	54.2	(7.7)
<b>Banning driving 2am - 6am</b>	5.7	(7.7)	8.3	(30.1)	0.0	(0.0)	3.2	(0.0)	0.0	(0.0)

**Table 37: The influence of type of operation on attitudes to possible strategies that could be used to reduce driver fatigue showing percentage of drivers in each group rating each strategy as very helpful and percentage rating each as among most helpful (brackets) (cont.)**

<b>Strategy</b>	<b>Single one-way</b>	<b>Single two-way</b>	<b>Two-up</b>	<b>Staged one-way</b>	<b>Staged two-way</b>
<b>More efficient un/loading</b>	76.8 (23.7)	60.7 (14.1)	65.1 (28.6)	87.1 (3.7)	80.0 (30.0)
<b>Two-up driving</b>	11.8 (7.4)	10.4 (0.0)	60.5 (23.1)	3.0 (0.0)	8.0 (0.0)
<b>Staged driving</b>	23.9 (9.2)	32.5 (10.5)	18.6 (12.5)	87.9 (13.8)	88.0 (18.2)
<b>Pay increase</b>	48.7 (18.4)	49.2 (5.1)	41.9 (27.8)	45.2 (7.1)	48.0 (8.3)
<b>Easing tight schedules</b>	73.4 (22.9)	85.7 (13.7)	65.1 (28.6)	72.7 (4.2)	76.0 (25.0)
<b>Better vehicle design</b>	34.0 (6.9)	61.9 (6.8)	23.3 (0.0)	63.6 (19.0)	65.4 (11.8)
<b>Fatigue monitors</b>	29.7 (2.0)	52.1 (8.1)	19.1 (0.0)	18.8 (16.7)	16.0 (0.0)
<b>Better off-road rest facilities</b>	54.4 (13.7)	58.3 (21.4)	44.2 (10.5)	57.8 (10.5)	60.0 (13.3)
<b>Greater flexibility in hours</b>	74.7 (35.2)	78.2 (33.3)	72.1 (22.6)	75.8 (28.0)	84.0 (19.1)
<b>Improving roads</b>	84.1 (41.5)	86.7 (36.5)	66.7 (50.0)	93.5 (34.5)	92.0 (34.8)

**Table 37: The influence of type of operation on attitudes to possible strategies that could be used to reduce driver fatigue showing percentage of drivers in each group rating each strategy as very helpful and percentage rating each as among most helpful (brackets) (cont.)**

<b>Additional Strategy</b>	<b>Single one-way</b>	<b>Single two-way</b>	<b>Two-up</b>	<b>Staged one-way</b>	<b>Staged two-way</b>
<b>Less Police/RTA harrassment</b>	11.8	2.4	4.6	3.0	3.8
<b>Change to speed regulations</b>	10.9	4.1	2.3	15.1	19.2
<b>Change to logbook procedures</b>	1.0	1.0	0.0	0.0	0.0
<b>Abolish logbooks</b>	5.3	0.0	6.9	0.0	0.0
<b>Slow lane</b>	0.0	0.0	0.0	6.1	0.0
<b>Depot to depot</b>	1.1	0.0	3.0	0.0	0.0
<b>Other</b>	18.3	15.4	27.9	18.2	15.4
<b>Uniform hours and road rules nationally</b>	6.9	1.6	2.3	6.1	0.0
<b>Making freight schedulers accountable</b>	7.8	4.1	0.0	3.0	3.8
<b>Educate public</b>	4.2	7.3	2.3	3.3	7.7

of two-up drivers judged two-up to be very helpful, nearly one-quarter of them responded that it was a most helpful strategy.

Of the additional strategies that drivers volunteered as useful for dealing with driver fatigue, there were differences between the driving operations groups in those cited. The most commonly cited for staged drivers were removing speed limiters, whereas single one-way drivers cited reducing police and RTA harassment most often.

### **The influence of two-up and staged driving**

Two strategies in particular are currently in use in sections of the transport industry, staged driving and two-up. Additional questions were included on these strategies as they provided the opportunity to investigate what drivers who had experience of using them thought about their usefulness for reducing driver fatigue.

Drivers were asked to complete the two-up and staged driving sections only if they had ever driven with these methods. For two-up, 43.7% of drivers completed the section and for staged driving, 25.8% of drivers completed the section. These figures may underestimate to a certain extent the number of drivers who have used these methods as the additional questions on these methods were at the end of the questionnaire and a small number of drivers (3.3%) failed to complete the whole questionnaire (from Section 7 to the end). It is likely that at least some of the drivers who did not complete the questionnaire had experience of these driving methods.

### **Two-up driving**

The group of drivers responding to the questions on two-up was composed of about one-third (33.8%) with considerable experience of two-up, having driven it more than 50 times, and about one-quarter (26.4%) with very little experience, having driven it less than 5 times. Approximately half (54.1%) had driven two-up in the past year.

## (a) Preferences for two-up

Relatively few drivers with experience of two-up (10.6%) preferred it to working as a single driver (see Table 38) or judged the two methods as the same (12.0%). The most common reason for preferring two-up, given by 72.7% of drivers who preferred it, was that it provided better working conditions that resulted in less fatigue. In contrast, for the drivers who preferred single driving, there were a range of reasons. The most common, expressed by 24% of drivers preferring single driving, was problems with driver compatibility. In addition, 19.3% cited safety concerns when driving two-up and 14.0% that they had trouble sleeping in a moving vehicle.

When asked whether two-up or single driving was more fatiguing, 45.1% reported that they found two-up more fatiguing compared to 23.9% for single driving and 30.9% reporting that they were the same. The most common reasons for finding two-up more fatiguing were difficulty sleeping in a moving vehicle (42.5%), safety concerns with someone else driving (12.2%) and poorer working conditions (10.5%). For drivers who found single driving more fatiguing than two-up, the most common reason, given by 63.5% of these drivers, was that working conditions for single drivers were worse than when doing two-up.

## (b) Influence of recency of two-up experience

Preferences for two-up depended on how recently drivers had driven two-up such that drivers with the most recent two-up experience were most likely to prefer it to working as a single driver (See Table 39). About one-quarter of drivers who had done two-up trips in the last month preferred it, compared to less than 10% of those with less recent experience. The most common reason for preferring two-up for all drivers regardless of recency of experience was that it provided better working conditions. Preferences for single driving over two-up were reported to be due to driver incompatibility for all drivers with two-up experience but safety issues were also reported for drivers whose experience was more distant.

Table 38: Drivers' preferences for two-up driving

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Preference	% of drivers preferring two-up	10.6
	% of drivers single	77.3
	% of drivers with no preference	12.0
	most common reason for preferring two-up (%)	<i>superior working conditions</i> (72.7)
	most common reasons for preferring single (%)	<i>driver incompatibility</i> (24.0)
		<i>safety</i> (19.3)
		<i>sleep</i> (14.0)

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Degree of fatigue	% of drivers rating two-up more fatiguing	45.1
	% of drivers rating single more fatiguing	23.9
	% of drivers rating equally fatiguing	30.9
	most common reasons for rating two-up two-up fatiguing (%)	<i>sleep</i> (42.5)
		<i>safety</i> (12.2)
		<i>inferior working conditions</i> (10.5)
	most common reason for rating single more fatiguing (%)	<i>inferior working conditions</i> (63.5)

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Table 39: Influence of recency of two-up driving experience on attitudes to two-up driving.

		Length of time since last drove two-up			
		< 1 month	1 month - < 1 year	1 year - < 5 years	>= 5 years
<b>Preference</b>	% drivers preferring two-up	25.6	7.5	3.2	3.3
	% drivers preferring single	59.0	77.4	88.4	89.1
	most common reason for preferring two-up	<i>Better working conditions</i>	<i>Better working conditions</i>	<i>Better working conditions</i>	<i>Better working conditions</i>
	most common reason for preferring single	<i>Driver incompatibility</i>	<i>Driver incompatibility</i>	<i>Safety</i>	<i>Safety &amp; Driver incompatibility</i>
<b>Degree of fatigue</b>	% drivers rating two-up more fatiguing	43.1	45.7	46.8	45.2
	% drivers rating single more fatiguing	32.8	22.9	22.3	15.5
	% drivers rating two-up & single as equal	24.1	31.4	30.9	39.3
	most common reason for rating two-up more fatiguing	<i>sleep</i>	<i>sleep</i>	<i>sleep</i>	<i>sleep</i>
	most common reason for rating single more fatiguing	<i>inferior working conditions</i>	<i>inferior working conditions</i>	<i>inferior working conditions</i>	<i>inferior working conditions</i>

**Table 39 (cont.): Influence of recency of two-up driving experience on attitudes to two-up driving.**

		Length of time since last drove two-up			
		< 1 month	1 month - < 1 year	1 year - < 5 years	>= 5 years
Rating of two-up driving as a fatigue reduction strategy	% drivers rating two-up as very helpful	36.2	9.4	10.7	13.2
	% drivers rating two-up as most helpful	23.8	9.6	10.3	8.3



There was no relationship between the length of time since the driver last did two-up driving and the percentage who found it more fatiguing. Just under half of drivers found two-up more fatiguing than single driving no matter how recent their experience of two-up. There was, however a relationship between drivers reporting no difference between the two types of driving and experience of two-up driving. More drivers with less recent experience of two-up judged there to be no differences between two-up and single driving on the amount of fatigue they produce. The most common reason for finding two-up more tiring was the quality of sleep in a moving vehicle and this was the same for all drivers with experience of two-up. Where drivers found single driving more tiring than two-up, it was because they judged the working conditions for single as being worse than those for two-up driving.

Recency of experience with two-up driving also affected drivers' perceptions of the strategies proposed to reduce fatigue. More than one-third of drivers with experience of two-up in the last month judged it to be a very helpful strategy and of them, nearly one-quarter reported that it was one of the most helpful strategies. In contrast, for drivers with more remote experience with two-up, only about 10% judged it to be very helpful, and of them, only a very small percentage rated two-up as a most helpful strategy. The level of support for two-up as a fatigue management strategy given by drivers with less recent experience of two-up was only slightly higher than that given by drivers who had never experienced two-up driving.

In summary, these results show that only drivers who have current or very recent experience of two-up actually show a preference for it. There was very little support for two-up driving from all other drivers who had experienced it. This suggests that two-up drivers are self-selected. Those who prefer it remain in it because the working conditions suit them. However, two-up seems to suit only a relatively small group of drivers. The majority of drivers who have experienced two-up, prefer single driving.

### *Staged driving*

A similar analysis for staged driving showed a different pattern of results to that for two-up.

#### (a) Preferences for staged driving

Nearly half of the drivers with experience of staged driving preferred it to single driving (See Table 40) with the most common reason being that staged provided better working conditions which resulted in less fatigue (50.4%). A smaller percentage (16.2%) preferred staged driving because it allowed them better access to home and social life.

In comparison, reasons for preferring single driving to staged driving were that single provided better and less fatiguing working conditions (29.5%) or that there were safety concerns with staged driving such as not being aware of problems with the truck (18.9%) or that staged driving reduced the driver's independence (15.8%).

Only a small percentage of drivers found staged driving more fatiguing (See Table 40) although a reasonable percentage viewed the two methods as producing the same amount of fatigue. For drivers who found staged driving more fatiguing, it was mostly because they felt that working conditions were better for single drivers (61.4%). The most common reason for finding single more fatiguing was that drivers reported working conditions were worse for single drivers (56.6%)

#### (b) Influence of recency of experience of staged driving

Examination of the relationship between time since the last staged driving trip and preference for staged driving showed that more than half of the drivers who had done staged driving in the past month preferred it to single driving (See Table 41). A relatively high level of preference for staged driving could still be seen in drivers who had last done staged driving between a month and a year ago, with equal percentages of these drivers preferring staged and single driving. For drivers whose last experience of staged driving was more than one year ago, only about one-quarter preferred it to single driving. Working conditions was the

Table 40: Drivers' preferences for staged driving

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Preference	% drivers preferring staged	47.6
	% drivers preferring single	38.6
	% drivers with no preference	13.8
	Most common reason for preferring staged (%)	Better working conditions (50.4%)
	Most common reasons for preferring single (%)	Better working conditions (29.4%) Safety (18.9%) Less driver independence (15.8%)

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Degree of fatigue	% drivers rating staged more fatiguing	18.6
	% drivers rating single more fatiguing	44.7
	% drivers rating equally fatiguing	36.7
	Most common reason for rating staged more fatiguing (%)	Inferior working conditions (61.4%)
	Most common reasons for rating single more fatiguing (%)	Inferior working conditions (56.6%)

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**Table 41: Influence of recency of staged driving experience on attitudes to staged driving**

		Length of time since last drove staged			
		< 1 month	1 month - < 1 year	1 year - < 5 years	>= 5 years
<b>Preference</b>	% drivers preferring staged	63.0	40.6	26.3	21.6
	% drivers preferring single	24.4	40.6	52.6	70.3
	% drivers with no preference	12.6	18.8	21.1	8.1
	most common reason for preferring staged	<i>better working conditions</i>	<i>better working conditions</i>	<i>better working conditions</i>	<i>better working conditions</i>
	most common reason for preferring single	<i>better working conditions</i>	<i>better working conditions</i>	<i>better working conditions</i>	<i>better working conditions and safety</i>
<b>Degree of fatigue</b>	% drivers rating staged more fatiguing	11.9	22.6	29.7	30.3
	% drivers rating single more fatiguing	49.3	45.2	43.2	27.3
	% drivers rating staged & single as equal	38.8	32.3	27.0	42.4
	most common reason for rating staged more fatiguing	<i>inferior working conditions</i>	<i>inferior working conditions</i>	<i>inferior working conditions</i>	<i>inferior working conditions</i>
	most common reason for rating single more fatiguing	<i>inferior working conditions</i>	<i>inferior working conditions</i>	<i>inferior working conditions</i>	<i>inferior working conditions</i>

**Table 41 (Cont.): Influence of recency of staged driving experience on attitudes to staged driving**

		Length of time since last drove staged			
		< 1 month	1 month - < 1 year	1 year - < 5 years	>= 5 years
Rating of staged driving as a fatigue reduction strategy	% rating staged as very helpful	76.1	47.7	47.4	24.3
	% rating staged as most helpful	16.7	6.5	16.7	11.1

most commonly cited reason for preferring both staged and single driving.

These results were supported by drivers' reporting of the type of driving they found more fatiguing. Only about 10% of drivers with the most recent experience of staged driving reported it to be more fatiguing than single driving compared to nearly one-third of those with the most remote experience. For all levels of recency, however, around one-third of drivers reported that they found no difference in the level of fatigue induced by either type of driving. Again, where drivers cited staged or single driving as most fatiguing, it was due to working conditions.

More than three-quarters of drivers with experience of staged driving in the last month reported that it was a very helpful strategy for reducing driver fatigue, however only a relatively small percentage of them judged it to be a most helpful strategy. The percentage of drivers reporting staged driving as a very helpful strategy decreased as experience of it became more remote, such that only about one-quarter of those who had done it more than 5 years ago rated it as very helpful. Again staged driving was judged to be most helpful by only a very small percentage of drivers who had not done it in recent time.

From these results it can be seen that the level of support for staged driving was high in drivers who had current or recent experience of it. Again this could indicate the influence of self-selection by drivers, however a reasonable percentage of those who had not done it for up to a year, still reported a preference for it, indicating that quite a few drivers who were no longer doing staged driving would prefer to do it. Despite this overall support for staged driving, there was a low level of belief that it was most helpful in reducing fatigue. It appears that many drivers like to do staged driving, and find it helpful, but not as helpful as some of the other possible ways of reducing fatigue.

#### **The influence of data collection method**

Two collection methods were used. Approximately one-third of questionnaires (31.5%) were administered by interview. The

bulk were self-administered. Examination of the results generated by each collection method showed that there were very few differences. Mostly, the differences would seem to reflect the different types of drivers that could be contacted using each method. The interviews were performed at truck stops, whereas the self-administered questionnaires were obtained from a wide range of sources. Not all types of drivers use truck stops. For example, staged drivers, due to the nature of their scheduling, are less likely to use truck stops. This can be seen in the results from the two methods (See Tables 42 and 43). Hardly any staged drivers were surveyed using the interview technique, whereas fairly equal percentages of single and two-up drivers were included in the two collection methods. Similarly, very few employees of large companies were represented in the interview group, compared to employees of small to medium companies, which were represented more in the interview group. In addition, more independent owner-drivers were found in the interview group. Therefore in any comparison of the two collection methods such intrinsic differences should be taken into account.

Nevertheless, it is necessary to look at how results from the two collection methods differed, in order to establish whether or not the results obtained using one method were biased relative to the other. There were only a few differences that suggest anything other than differences due to the makeup of the groups. The most striking of these were that interviewed drivers tended to report more often on a range of questions compared to drivers who administered the questionnaire to themselves, yet the pattern of results remained the same between the two groups. This can be seen in the results for such questions as "How was your driving affected by fatigue" (see Table 17) in which the interview group had higher percentages on all alternatives, but the ranking of importance between the alternatives was virtually identical. This suggests that there may be some quantitative differences between the results obtained by the two methods, but that qualitatively there were few differences. These quantitative differences could be due to differences between the types of drivers in each group or to differences between the two data collection techniques. Most likely, however, they are due to factors resulting from the interview method itself which caused the interviewer to work for complete and

Data collection method	Employees			Owner-drivers			
	Small company	Medium company	Large company	Indep- endent	Small company	Medium company	Large company
Self- administered	41.9	60.1	95.8	21.6	51.2	57.1	68.1
Interview	58.1	39.9	4.2	78.4	48.8	42.9	31.9

Table 43: Data collection method by type of driving operation

Data collection method	Type of driving operation				
	Single one-way	Single two-way	Two-up	Staged one-way	Staged two-way
Self- administered	60.3	99.2	51.2	93.9	92.3
Interview	39.7	0.8	48.8	6.1	7.7



comprehensive answers and to the drivers feeling the need to give them. It must be remembered also that because there was no sampling framework available for this study (See Method section), it was necessary to maximise the likelihood of obtaining the views of all types of drivers, some of whom would be missed if questionnaires were only distributed through companies. Ideally, interviews should also have been undertaken with drivers accessed through the companies in the same way as for the self-administered questionnaires, however due to the length of the questionnaire, we experienced some problems in achieving this since when drivers were in the depot, they had little extra time.

#### **COMPARISON OF DRIVERS AND AUSTRALIAN INDUSTRY GROUPS ON POSSIBLE SOLUTIONS TO DRIVER FATIGUE**

Table 4 summarises the results of the discussion groups held with industry interest groups. It can be seen that only two strategies received unanimous endorsement from the groups; better information and training about fatigue and its effects, and improvements to the roads. One strategy was endorsed by all groups except one, better off-road facilities (ABCA dissented) and four strategies were endorsed by all but two groups; more flexible hours (TWUA and TWUB dissenting), staged driving (ABCA and LTA dissenting), reducing economic pressures on drivers through better payments and easing tight schedules (LTA and ABCA dissenting), and more efficient loading and unloading (ABCA and LTA dissenting).

Most of the difficulties with these strategies expressed by ABCA and LTA were that they were not applicable to the demands of their section of the industry, in the one case with transporting people, and in the other with transporting livestock. This suggests that these two groups may be special cases within the long distance transportation industry and should be treated as such. This reasoning is reinforced by the fact that the findings of the driver survey will not reflect the views of drivers in these two groups since they were, for the most part, not represented in it. No bus drivers were sampled and only 42 livestock carriers were included in the sample. For the unique demands of these two groups to be understood fully, they should probably be studied separately. It must be remembered,

however, that a significant amount of information emanating from this survey will have bearing on the work practices of these two driver groups as well. The fact that they do long distance driving which is likely to produce fatigue does not change.

The strategies that were rejected by the greater majority (80% or more) of groups were banning driving between 2 and 6 am (rejected by all groups) and introducing stricter driving hours (accepted by TWUP only). A further group of strategies were regarded to be less acceptable than effective by most groups. These were regulating stay-awake drugs and proper enforcement of current driving hours.

There is considerable agreement between the strategies selected as most helpful by the drivers and those that the groups selected. Road improvement, greater flexibility of driving hours, and more efficient loading and unloading were viewed by all groups and all drivers from all sectors analysed as most helpful for reducing driver fatigue. The strategy of better off-road rest facilities, however, was only judged as very helpful by moderate numbers of drivers. The main strategy on which there was not agreement was information and training which relatively few drivers from any sector rated as even helpful and hardly any as most helpful.

The strategy of reducing economic pressures on drivers also was judged by most industry groups as very helpful, but for the group discussions, economic pressures were interpreted as both levels of remuneration for drivers and the trip schedules that are imposed upon them. When these two aspects were separated out in the driver survey, it was clear that drivers judged each differently. This analysis demonstrated that there were sectorial differences in scheduling demands, with a number of groups of drivers feeling that this was one aspect of the industry that needed change. Increased remuneration, however, was only judged as very helpful by moderate numbers of drivers.

The majority of industry groups were in favour of staged driving as a very helpful strategy, but within the driver groups only drivers who were currently doing staged driving rated it as very helpful in significant numbers.

Furthermore, preference for staged driving appeared to be restricted to drivers who had current or recent experience of it. Nevertheless, drivers who had recent experience of staged driving were very likely both to report it as very helpful in reducing fatigue and to prefer it to single driving. Overall, however, drivers who had past or present experience of staged driving preferred it to single driving.

Two-up driving was rated as very helpful by all but three industry groups. In contrast, the level of driver support for this strategy was relatively low. Only two-up drivers reported it as a very helpful strategy and this was mainly restricted to a small percentage of drivers who had done two-up in the last month. Unlike staged driving, overall, drivers who had past or present experience of two-up preferred single driving.

A different pattern of results was found for the possible strategy of banning driving between 2 am and 6 am. All of the industry groups were not in favour of banning driving between 2 am and 6 am, and neither were most groups of drivers, yet, there was a clear sectorial interest in introducing this strategy from single drivers who reported two-way trips. They were the group who were most likely to do early morning starts, and therefore the drivers who would most benefit from the introduction of such a strategy. Clearly, it was important to them, while the rest of the industry may not be aware that the practice of starting work during these hours presents such a problem for drivers.

Most industry groups were not in favour of regulating drugs, (4 groups) or of strict policing to prevent their use (6 groups). While there was a tendency for the groups to reject allowing drugs by prescription on the basis of emphasising the unacceptability of this strategy rather than focusing on its effectiveness, most groups were not in favour of stricter policing of drugs. The reason for this was not necessarily because the groups felt that drugs should be allowed, rather that they felt that there are better methods of managing fatigue available, and that any attempt to police drug use would most probably be unsuccessful.

Most drivers also were not in favour of preventing drug use, however unlike the industry groups, a significant percentage

of drivers judged allowing drugs by prescription to be a very helpful strategy. This is reinforced by the high level of belief among these drivers that drugs by prescription would be one of the most helpful strategies.

The differences between industry groups and working drivers in their perception of the role of drug-use in long distance driving were almost certainly due to their awareness of particular influences. For drivers the perceived need for drugs to do their job was a product of the pressures that individual drivers experience and their ability to withstand them. As discussed in the earlier sections, drivers from a number of sectors of the industry experienced some significant pressures. For the industry groups, their awareness of the truck driver's problem was overlaid by their acknowledgement of the difficulties in regulating drugs in the industry and the public's perception of drug-taking by truck drivers. A number of industry groups argued, however, that professional drivers should not need to use drugs in order to complete their trips.