DRIVER FATIGUE: A SURVEY OF LONG DISTANCE HEAVY VEHICLE DRIVERS IN AUSTRALIA

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Objectives: To document the driving and fatigue management practices of long distance heavy vehicle drivers in Australia.

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

Abstract: In this study the beliefs and practices, with regard to driver fatigue, of 1007 Australian long distance truck drivers were surveyed. The main aims of the research were to describe the current situation in the industry and to compare the findings with those obtained in an earlier survey (Williamson, Feyer, Coumarelos, and Jenkins, 1992). The participating drivers were recruited according to geographical quotas. Interviewers approached drivers at truck stops in all mainland states except Western Australia and the Australian Capital Territory. Drivers who declined to complete an interview were invited to self-administer the questionnaire at their own convenience. The results suggest that some changes in the frequency of fatigue experiences and in the time to fatigue onset have

occurred since the previous survey, in particular drivers reported fatigue occurring less often compared to the last survey but drivers reported fatigue occurring earlier in the trip. The findings also emphasise the relationships between fatigue and working hours, especially night work, and remuneration system. Drivers' recommendations about action strategies for companies and governments provide additional directions for targeting fatigue management interventions.

Key words: Fatigue, Truck driver, Long distance road transport

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We are grateful to the large number of heavy vehicle drivers who took the time to complete questionnaires for this study. Knowing what a precious commodity time often is for professional drivers, we thank them for their generosity and hope that the results of the study will prompt genuine improvements in their working conditions to reduce the risks of fatigue.

We would also like to acknowledge the invaluable assistance of the research staff at Interviewing Australia.

FOREWORD

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

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

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

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

SUMMARY

This is the report of a second national survey of long distance road transport drivers regarding fatigue and its effects on driving. This report examines the extent of changes in awareness and experiences of fatigue since the first survey, undertaken in 1991. The recent survey involved 1007 long distance road transport drivers from all mainland states of Australia. Two methods were used to collect information, a self-administered questionnaire and an interview, and around half of the responses were collected by each method. As the results from the two methods were quite similar and to increase the sample size for the study, the results from the two methods were combined.

The overall results showed that drivers reported fatigue less often than they had in the previous survey. In addition, only a small percentage of drivers in both surveys reported that fatigue was more than a minor problem for them, although many more felt that it was a significant problem for the industry. On the other hand, drivers reported that fatigue occurred considerably earlier than they had reported in the first survey. Most drivers in the current study reported that they experienced fatigue in the first 10 hours of starting driving which is considerably earlier than the 14 hours found in the first survey and well-within the permitted working hours for long distance drivers.

One of the major findings of this project was that overall, the reported experiences of fatigue while driving were very similar for both surveys and was consistent with the known effects of fatigue. Drivers experienced fatigue most in the early hours of the morning and to a lesser extent in the early afternoon. Long driving hours, and problems with loading and unloading were cited by drivers in both surveys as factors that increased fatigue, although in the second survey drivers were more likely to specify that waiting to load and unload was the most significant factor. Drivers in both surveys reported that fatigue affected their driving by slowing their reactions, impairing their gear changing and steering and by making them drive too slowly. The types of strategies that drivers reported as helpful in managing fatigue were also similar between the two surveys. More permanent methods of fatigue management such as sleep, rest, caffeine-containing drinks and stay-awake drugs were reported as the strategies that are most effective in managing fatigue in both surveys, whereas more temporary strategies like taking a shower, stopping for a meal and CB radios were judged as less helpful. Fewer drivers in the current survey reported using stay-awake drugs and a smaller proportion rated them as helpful. This suggests that drugs are being used less to manage fatigue than previously. This finding may be associated with the lower reporting of personal fatigue by drivers in the second survey. As fewer drivers felt fatigue while driving, fewer needed stay awake drugs to manage their trips.

The pattern of results casts some doubt on the validity of this conclusion, however. Evidence from the patterns of the drivers' work-rest schedules indicates that for many long distance drivers, the length of trips has increased since the earlier survey. While the average hours worked per week was somewhat lower for the current survey compared to the earlier survey, the distribution of weekly working hours was very similar. A significant proportion of drivers had problems recalling their weekly hours so the quality of reporting was limited. In contrast, most drivers were able to report details of the last trip. These results showed that many drivers in the current survey did considerably longer trips both in terms of distance and duration, compared to the drivers in the earlier survey.

Most drivers did at least some driving in the midnight to dawn period and just over one in five reported working for more than 72 hours in the past week, which is longer than allowed by current working hours regulations. This pattern of longer trips may be a reason for the reports of fatigue occurring much earlier in the trip than reported in the earlier survey. Very long trips would have made it difficult for drivers to obtain sufficient rest and recovery after the trip and as a result they tended to experience fatigue much earlier in the subsequent trip than if they had been better rested when the next trip started.

Other characteristics of the drivers' reported work-rest schedules were also likely to be incompatible with good fatigue management. Around three-quarters of drivers did some work in the midnight to dawn period in the last week and on the last trip. On average, these drivers reported doing just over four hours of work in the six hour period between midnight and dawn on the last trip which corresponded to around one-quarter of the total work hours of the last trip. Drivers reported an average of nearly 10 hours over this period in the past week although the information on activities in the past week was much less reliable. These results suggest that night work is a very common part of the work of long distance drivers. Night work is well recognised to increase fatigue because it is more difficult to maintain adequate performance levels when working at night, especially over the early morning hours and because night work commonly leads to sleep deprivation due to the problem of obtaining sufficient sleep during the day. This survey showed that drivers who worked in the midnight to dawn period, in particular, had less access to good quality sleep. Furthermore, the study showed significant positive relationships between fatigue and the length of work on the last trip and between fatigue and the amount of night hours on the last trip. Fatigue increased with the amount of overall work and the amount of night work that drivers did.

There was a considerably higher participation in the current survey of drivers for small companies and a lower participation by drivers for large companies but the participation of owner drivers and drivers for medium-sized companies was quite similar to the earlier survey. Nevertheless, there were relatively few major differences between the different types of employment in the long distance road transport industry in either survey. The major differences were that in both surveys owner drivers did much longer trips than drivers who worked for companies, and compared to company drivers, independent owner drivers did far more non driving work but they had more flexibility in scheduling their trips. Regardless, there were no differences in reported fatigue experiences between any of the employment groups.

This survey provides evidence of other fatigue-related pressures on drivers that are at least partly due to the type of driving they do. Around one in five drivers reported a dangerous event which was fatigue-related on their last trip such as nodding off, crossing lanes and near misses. Nearly half of the drivers reported that they have nodded off while driving in the last year. These findings may appear to be at odds with the crash statistics for heavy vehicles, but clearly these incidents do not all lead to crashes. It is widely acknowledged that crash statistics underestimate the role of fatigue in heavy vehicle crashes. The results signal, however the fact that fatigue-related incidents are a common feature for long distance truck drivers and, if the circumstances in which these near misses occur conspire against them, may lead directly or indirectly to a catastrophic crash.

The survey pointed out a number of other pressures on drivers that are likely to increase their fatigue. Around one-quarter of drivers reported breaking working hours regulations on every trip. This is similar to the findings of the previous survey. The most common reasons cited in this survey by drivers who frequently break working hours regulations were work,

organisational and reward factors like the need to do enough trips to earn a living and to get in early to get the next load.

In support of the role of organisational and reward factors, the survey also showed pressures on drivers due to their systems of remuneration. Drivers who were paid in terms of the amount of work they did (paid by results systems including flat load and trip rates) reported fatigue more often than drivers who were paid in terms of the time they were working (eg: hourly rates). These results suggest that one of the targets for improving fatigue management practices should be a reduction in the amount of results-based remuneration in order to introduce some limits on the contingency between the amount of long distance work and pay that are based on health and safety.

Pressures on drivers due to problems of loading and unloading were clear from a number of parts of the survey. Most drivers were required to load or unload at some stage in their trips, a job that in many cases took two to three hours to complete. It is not surprising then, that loading and unloading were reported most consistently as the most significant contributors to fatigue. In particular, the problem of having delays and having to queue to load and unload was one of the major factors reported by drivers. This suggests that a review the system of freight forwarding would play a part in reducing fatigue for long distance drivers.

Drivers were also asked about their views of company and government approaches to fatigue management. With respect to strategies that companies can use to minimise fatigue, the majority of drivers reported that companies should improve efficiency of loading and unloading, increase driver pay rates, ease tight schedules, allow more time for on-road sleep and prohibit drivers from loading and unloading. In contrast, drivers felt that companies should not use two-up or staged driving or minimise night driving. On strategies that government can use, nearly all of the drivers reported public education about heavy vehicles, better roads, increasing flexibility to complete trips to suit the driver and providing better off-road rest facilities as approaches that the government should use. Introducing shorter driving hours and clamping down and enforcing working hours regulations were seen as approaches that the government should not use.

Overall, this survey has demonstrated a great deal of similarity in the reporting of working conditions and fatigue experiences by long distance drivers between the two surveys. A few factors have shown an apparent improvement over the seven years between the surveys. In particular these include reductions in both the number of drivers reporting fatigue as a personal problem and in the percentage reporting using stay-awake drugs. On the other hand, the current survey has shown a number of factors that do not indicate improvement. These include the higher reporting by drivers in the current survey of doing very long trips and of fatigue occurring much earlier in the trip than in the previous survey. The survey has also suggested some areas where improvement could enhance fatigue management in the industry. These include reducing the number of very long trips required by drivers, reducing the amount of night work, reducing the amount of payment by results, reducing the amount of loading and unloading by drivers and the need to wait for long periods to load and unload. The survey results suggest that these factors provide very likely targets for improving fatigue management practices in the long distance road transport industry. Together with the companion survey of company representatives on fatigue and fatigue management also conducted by this research team, this survey has updated and extended our knowledge of the nature of the problem of fatigue for the long distance road transport industry and of the approaches that are most likely to overcome the problem.

SUMMARY OF MAIN FINDINGS

Characteristics of the sample (see Tables 2-5 in text)

- 1007 long distance drivers were sampled at truck stops in Queensland, New South Wales, South Australia, Victoria and the Northern Territory.
- Almost all drivers were men.
- Most drivers were 30-40 years old. The average age was 39.8.
- Drivers averaged 17.6 years experience as professional drivers.
- 17.9% of drivers reported levels of daytime sleepiness consistent with an increased risk of sleep disorders.

Usual operations (see Tables 5-7 in text)

- Nearly three quarters of drivers (69.1%) were employee drivers, rather than owner drivers or operators.
- Most drivers (57.5%) were employed by small companies running 10 trucks or less or by medium companies running 11-50 trucks.
- Independent owners represented 14.0% of the sample whereas contracted owners comprised 16.1%.
- The most common freight types carried were:

General/mixed freight	50.0% of drivers
Refrigerated goods	24.1%
Farm produce	20.2%
Express freight	18.5%
Groceries	17.6%

- 17.2% of drivers negotiated pay rates for each load. 43.3% of the rest had ongoing contracts for some or all of their loads.
- Most drivers (68.3%) were paid per trip according to the kilometres travelled or the weight or volume of freight delivered. 14.0% were paid a flat load rate and 7.1% an hourly rate.
- 63.2% of drivers were paid the award wage or better, but 17.1% were paid less than the award and 19.7% did not know how their pay compared with the award.

Characteristics of last trip (see Tables 11-26 in text)

Operation:

- 94% of drivers drove their last trip as a single or solo driver.

Scheduling:

- 35.1% of drivers drove to a fixed company schedule.
- 37.1% of drivers had their own reasons for setting a finish time.

Characteristics of last trip continued

- A minority (18.3%) reported travelling above the speed limit on the open road.

Length:

- The mean length of the last trip was 1697.6km and most drivers (84.7%) did at least 700km.
- On average trips lasted about 35 hours of which 19 hours were spent driving.
- 71.4% of drivers did night work (00:00 to 06:00), with an average of 23% of trip working hours completed in the midnight to dawn period.

Loading, unloading and other work:

- 20% of drivers did yard work at the start and/or end of their last trip, for periods averaging 2.5 to 3 hours.
- Also, over half the drivers loaded or unloaded at the start and/or end of their last trip for periods averaging 1.75 to 2.5 hours.
- Approximately 30% of drivers had to wait to load or unload at the start and/or end of their last trip. The average wait was 2 to 3 hours.
- Loading queues were the most common cause of loading and unloading delays.
- One quarter of drivers loaded or unloaded during their trips.

Activities preceding the trip:

- Drivers typically slept and rested in the 10 hours before their last trip, averaging 5.75 hours of sleep and 2.5 hours of rest.
- Drivers who started their trips between midnight and midday reported more sleep in the 10 hours before their trip start than those who started in the midday to midnight period.
- Conversely, more rest was reported by drivers in the 10 hour period before the trip where they started in the midday to midnight period compared to those who started in the midnight to midday period.

Fatigue:

- 80.5% of drivers started their last trip feeling fresh.
- Almost half (45.0%) experienced fatigue during the trip.
- Night work (00:00 to 06:00) was related to increased fatigue.
- 21.1% of drivers reported at least one fatigue related incident on their last trip, most commonly:

Crossing lane lines	11.3% of drivers
Nodding off	5.3%
Having a near miss	5.0%
Over or understeering	5.0%

Characteristics of the last working week (see Tables 27-30 in text)

- Overall drivers averaged 55 hours of work in their last working week.
- 22.6% reported working more than 72 hours in their last working week.
- Drivers averaged 54 hours of sleep across their last working week.
- 77.5% of drivers did night work (00:00 to 06:00) in their last week, averaging 9.1 hours.
- Night work was related to reduced sleep.

The fatigue problem (see Tables 32, 34, 36, 38 & 40 in text)

Scope of the problem:

- 75.9% of drivers rated fatigue as a substantial or major problem for the industry.
- 53.4% of drivers felt that fatigue is badly managed in the industry.
- Most drivers (74.2%) felt that awareness of fatigue in the industry has increased over the last 5 years.
- Only 21.4% rated fatigue as a substantial or major problem for themselves.
- 91.7% of drivers felt that they managed their own fatigue well.
- Almost 60% of drivers felt their own awareness of fatigue had increased over the last five years. Almost 40% felt their awareness had not changed.

Typical fatigue experience:

- Most drivers reported that fatigue happened only occasionally or very rarely (69.1%) but the remainder reported fatigue on at least half of their trips.
- When it occurred, fatigue usually started within 14 hours of commencing driving (75.1%), most often between midnight and dawn. Fatigue was most commonly experienced around dawn itself (04:00 to 06:00).

Contributing factors:

- Drivers reported a wide range of factors that contributed to their fatigue.
- The most commonly reported contributors to fatigue were:

Dawn driving	59.4% of drivers
Waiting to load and unload	56.2%
Long driving hours	47.9%
Poor road conditions	41.9%

- The contributors most consistently rated as important by those affected were:

Waiting to load and unload	48.5%
Having to load and unload	38.3%
Dawn driving	38.0%
Long driving hours	37.1%

The fatigue problem continued

Effects:

- The majority of drivers (71.3%) reported that their driving was impaired by fatigue.
- The most commonly reported effects of fatigue on driving were:

Slowed reactions	56.1% of drivers
Poor gear changes	55.6%
Driving too slowly	53.2%
Poorer steering	41.1%

- 11.7% of drivers reported at least one accident in the past 12 months. Fatigue was felt to be a contributing factor in 19.8% of these accidents.
- 18.1% of drivers reported that they nodded off while driving at least sometimes, and a further 30.3% reported doing so rarely.

Driver strategies for dealing with fatigue (see Table 39 in text)

- Drivers reported using many strategies to deal with fatigue when they experienced it.
- Of the 16 strategies listed for drivers, more than 75% reported using:

  Sleep
  Listening to the radio or music
  Consuming caffeinated drinks
  Taking rest

  at least sometimes to deal with fatigue.
- Only 22.3% used drugs at least sometimes to deal with their fatigue.
- The strategies consistently rated as the most effective by those who used them were:

Sleep	32.4%
Drugs	31.1%
Smoking	21.5%
Rest	21.2%
Caffeine	21.1%

- Most of these strategies directly manipulate the physiological state of the driver's body.

Company strategies for dealing with fatigue (see Table 44 in text)

- Approximately 30% of drivers reported that their companies *do*:

  Ease tight schedules
  Allow more time for on-road sleep
  Use more efficient loading and unloading practices
  Allow more time off between trips
  Allow more breaks during trips

  in an attempt to help drivers manage fatigue.

- More than 50% of drivers felt that their companies *should*:

  Use more efficient loading and unloading practices
  Increase pay rates for drivers
  Ease unreasonably tight schedules
  Allow more time for on-road sleep
  Prohibit drivers from loading and unloading
  Provide more information on fatigue management

- More than 50% of drivers felt their companies *should not*:

  Use two-up driving
  Try to minimise night driving

Government strategies for dealing with fatigue (see Table 45 in text)

- The current involvement of governments was perceived to be minimal, with less than 20% of drivers reporting government input on any of the fatigue reduction strategies listed.

- The strategies currently used by governments were most commonly perceived to be:

Stricter enforcement of current working hours	19.8% of drivers
Stricter drug policing	19.2%
Provision of slow vehicle lanes	18.5%.

- More than 90% of drivers felt that governments *should*:

  Educate the public about heavy vehicles
  Improve the roads.

- More than 80% of drivers felt that governments *should*:

  Allow greater flexibility in working hours regulations, especially to finish a trip,
  Provide better off-road rest facilities
  Make freight schedulers accountable
  Adopt uniform national rules and regulations
  Provide more slow vehicle lanes.

- More than 50% of drivers felt that governments *should not*:

  Introduce stricter (shorter) driving hours
  Enforce current working hours regulations more strictly
  Permit the legal use of drugs.

Breaking the rules

Working hours regulations:

- 56.9% of drivers reported breaking working hours regulations on at least half their trips.
- The most common reasons were:

To return home	46.8%
To do enough trips to earn a living	36.5%
As a result of tight schedules	31.4%.

Road rules:

- 31.1% of drivers reported breaching road rules on at least half of their trips.
- The most common reasons were:

The effect of tight schedules	33.7%
To do enough trips to earn a living	30.0%

MAIN DIFFERENCES BETWEEN DRIVERS ACCORDING TO TYPE OF EMPLOYMENT

(statistically significant at $p \leq 0.05$)

Characteristics of the sample (see Table 46 in text)

- Employee drivers, especially those working for small companies, were approximately 5 years younger than owner drivers.
- Employee drivers for small and medium companies had approximately 5 years less professional driving experience than other drivers.

Usual operations (see Tables 48-49 in text)

- Although general or mixed freight was the most common load carried by drivers in all the employment groups, differences between the groups were seen for livestock, refrigerated goods, manufactured goods, general freight, dangerous goods and machinery.
- Owner drivers, especially independent owners, were more likely to negotiate pay rates for some or all their loads than employee drivers.
- As expected, of those who did not negotiate rates for individual loads, independent owners were least likely and contract owners most likely to have ongoing contracts for some or all their loads.
- Owner drivers were more likely than employee drivers to be paid a flat rate per load and less likely to be paid an hourly rate. However, most drivers in all employment groups were paid by the km, tonne or by volume.

Characteristics of last trip (see Tables 52-62 in text)

Operation:

- Although most drivers drove their last trip as a single or solo driver, independent owners were more likely than other drivers to have driven a two-up operation.

Scheduling:

- Employee drivers, especially those working for small or medium companies, were the groups most likely to drive to a fixed company schedule.
- Employee drivers were more likely than owner drivers to report having a personal arrival time goal designed to maximise their sleep at the end of the trip.
- Large company employees were less likely than other drivers to report travelling above the speed limit.

Characteristics of last trip continued

Length:

- Independent owners were the group most likely to do long trips (> 1500 km) but medium company employees averaged the longest trips. Large company employees and contracted owners were the groups most likely to do short trips (< 700 km).
- Independent owners averaged more time on their last trip than all other groups except medium company employees. Independent owners and medium company employees also averaged more hours driving on their last trip than large company employees.
- Despite differences in overall trip length, the employment groups did not differ in the average number of hours worked per day.

Loading, unloading and other work:

- Among the employment groups, independent owners spent the most time on yard work at the start and end of their last trip whereas large company employees spent the least amount of time.
- Independent owners averaged the most time loading and unloading at the start and end of the last trip. Large company employees were least likely to do loading work and, when they did, averaged the smallest amount of time loading.
- Small company employees were more likely than the other groups to report loading delays due to the depot being closed.

Activities preceding the trip:

- Although the employment groups did not differ in the amount of time spent sleeping in the 10 hours prior to their last trip, there were some differences in other activities:

  Among the groups, small company employees spent the least time resting and relaxing in the 10 hours prior to their last trip, whereas contract owners spent the most time resting and relaxing.

  Among the groups, independent owners spent the most time checking or repairing vehicles, whereas medium and large company employees spent the least time on maintenance activities.

Fatigue:

- Employee drivers were more likely than owner drivers to report being very fresh at the start of the last trip, but there were no differences between the employment groups in the experience of fatigue or reports of dangerous events during the trip.

Characteristics of the last working week (see Tables 63-64 in text)

- Drivers in all employment subcategories averaged 50 to 60 hours of work in their last work week, completed, on average, in 10 to 12 blocks.
- Employees of small companies, who reported the most sleep in their last work week of all the employment categories, averaged 7 hours more sleep than contracted owners, who reported the least sleep among the employment groups.
- Drivers in all employment categories averaged 7.5 to 8.5 sleeps in their last working week.
- The groups did not differ in the pattern of night work performed.

The fatigue problem (see Tables 67-68 in text)

Scope of the problem:

- Of the employment groups, independent owners were least likely to see fatigue as a major problem for the industry.

Typical fatigue experience:

- There were no differences among employment groups in the frequency with which they usually experienced fatigue.
- In all employment groups, fatigue onset was most commonly between midnight and 6:00am. However, employees of large companies were more likely than other drivers to start feeling fatigued at this time. Large company employees were also less likely than other drivers to start feeling fatigued in the afternoon (12:00 to 18:00).
- Among the groups, independent owners were the most likely to experience fatigue in the afternoon.

Contributors to and effects of fatigue:

- Drivers in the different employment groups were quite similar in their reporting of contributing factors and effects of fatigue.

Driver strategies for dealing with fatigue (see Tables 72-73 in text)

- There were very few differences between employment groups in their use of strategies to deal with fatigue while driving.

Company strategies for dealing with fatigue (see Table 77 in text)

- Large company employees were more likely than other employment groups to report that their companies *do*:

  Provide more information about fatigue management
  Use more efficient loading and unloading practices
  Prohibit drivers from loading and unloading
  Use staged or changeover driving
  Increase rates of pay for drivers in an attempt to help drivers manage fatigue.

- There were few differences among the employment groups regarding their perceptions of what their companies *should do* to help drivers manage fatigue:

- There were also few differences between the employment groups regarding their perceptions of what their companies *should not do* to help drivers manage fatigue.

Government strategies for dealing with fatigue (see Table 78 in text)

- Perceptions of current strategy use by governments differed among the employment subcategories, with large company drivers generally reporting greater government involvement.

- Driver perceptions of things governments *should do* to help manage driver fatigue were similar across the employment groups.

- The employment groups did not differ in their views about strategies that governments *should not* pursue.

Breaking the rules

Working hours regulations:

- Reasons for breaking the working hours regulations varied between the employment subcategories:

  Independent owners were more likely to report the need to do enough trips to earn a living than other drivers and large company employees were less likely to offer this reason, and

  Independent owners and small and medium company employees were more likely than large company employees and contracted owners to report the need to get in early to get the next load.

Road rules:

- The employment subcategories gave similar reasons for breaking the road rules, but there was a trend for large company employees to report the need to get in early for the next load less often than other drivers.

MAIN DIFFERENCES BETWEEN DRIVERS ACCORDING TO TYPE OF OPERATION ON LAST TRIP

(statistically significant at $p \leq 0.05$)

Characteristics of the last trip	(see Tables 79-90 in text)

- Very few staged (or changeover) drivers participated making it difficult to draw conclusions about this group.
- Two-up drivers were more likely to travel long distances (> 1500 km) than other drivers.
- Two-up drivers did trips of longer duration.
- Two-up drivers were more likely to spend longer hours driving.
- However, single drivers spent proportionately more of their last trip working, whereas two-up drivers spent proportionately more of their last trip on breaks from work.
- Two-up drivers were more likely than other drivers to carry manufactured goods.
- Two-up and single drivers were both most likely to work for very small companies (< 5 trucks), but two-up drivers were more heavily represented in this employment category.
- Staged drivers were less likely to load and unload at the start and end of their last trip than single or two-up drivers.
- Two-up drivers spent slightly longer on vehicle checks and repairs during the 10 hours preceding their last trip than other drivers.
- Staged drivers reported very few dangerous occurrences on their last trip. Two-up drivers were somewhat more likely to cross lane lines and over or under steer than single drivers.
- There were no differences between the groups in the reported experience of fatigue on the last trip.

MAIN DIFFERENCES BETWEEN THE RESULTS OF THE CURRENT SURVEY AND THAT CONDUCTED IN 1991 (Williamson, Feyer, Coumarelos, & Jenkins, 1992)

Compared with participants in the earlier survey, participants in the current survey: (see Tables 3, 5-7, 10-11, 13-14, 19 in text)

Characteristics of the sample:

- Were approximately 2 years older on average.
- Averaged approximately 2 years more experience as professional drivers.

Usual operations:

- Were more likely to be employees of small companies (37.2 vs 22.7%) or owner drivers and operators (30.1 vs 22.1%) and less likely to be employees of large companies (10.9 vs 40.0%).
- Were less likely to have an ongoing contract for all their loads (25.0 vs 34.8%).

Characteristics of the last trip:

- Were slightly more likely to have driven their last trip as single or solo drivers and less likely to have driven a staged or changeover operation (1.0 vs 6.4%).
- Were less likely to have driven their last trip to a fixed company schedule (35.1 vs 65.8%).
- Were more likely to report the desire to maximise sleep as a reason for setting their own ETA (18.6 vs 7.0%) and less likely to report loading and unloading demands (25.3 vs 36.1%).
- Were more likely to do trips greater than> 1500 km (37.6 vs 24.9%) and less likely to do short trips (< 700 km).
- Did trips of approximately 8 hours longer duration on average, and were more likely to do trips exceeding 30 hours in duration (36.2 vs 26.5%) and less likely to do trips less than 12 hours in duration.
- Were less likely to report loading delays due to closed depot (8.9 vs 18.5%), loading queues (32.0 vs 53.9%) or unavailable machinery (4.8 vs 15.2%).

Compared with participants in the earlier survey, participants in the current survey: (see Tables 32, 34, 36-41, 43 in text)

The fatigue problem:

- Reported fatigue less frequently. 69.1% reported fatigue rarely or occasionally compared to 53.9% in the first survey.
- Were more likely to report early fatigue onset, within 10 hours of starting driving.
- Were less likely to report fatigue as a substantial personal problem (15.2 vs 26.3%) and more likely to report no problem with fatigue.

Contributors to and effects of fatigue:

- Were more consistent in reporting impaired gearing and driving too slowly as symptoms of fatigue.
- Were less likely to report loading and unloading as a contributor to fatigue (35.8 vs 47.2%), but strongly endorsed waiting to load and unload as a contributor (56.2%). Current survey participants were also less likely to report inadequate pre-trip sleep, poor roads and poor weather as contributors.
- Were more likely to identify insufficient rest breaks, dawn driving, city traffic, and the after-effects of stay-awake drugs as important contributors to fatigue.

Driver strategies for dealing with fatigue:

- Reported greater use of sleep, rest and showers to combat fatigue, and less use of drugs (22.3 vs 31.7%).
- Found sleep, drugs, and using the CB radio less helpful in combating fatigue.

Breaking the rules:

- Were less likely to explain breaches of the working hours regulations in terms of the need to do enough trips to earn a living.
- Were less likely to explain breaches of the road rules as being a result of fatigue.

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1. INTRODUCTION

Fatigue while driving is acknowledged to be one of the primary causes of motor vehicle crashes in Australia (Haworth, Heffernan, & Horne, 1989; Moore & Moore, 1996; NSW RTA, 1998). Along with alcohol and speed, fatigue is being targeted in road safety campaigns in most states. All drivers are likely to experience driver fatigue at some stage due to, for example, driving at particular times of the day or night or to driving for long periods. Probably the most vulnerable group for driver fatigue, however, are long distance road transport drivers, because of the large amount of time they spend on the road and because they often need to drive at night and into the early hours of the morning. It is known that long periods of exposure to a monotonous task, like driving, is likely to increase the likelihood of fatigue (Hamelin, 1987; Krueger, 1989) and that fatigue is most likely in the early hours of the morning, between around 4am and 6am (Feyer & Williamson, 1995; Monk & Folkard, 1985).

In 1991, a national survey conducted of the long distance road transport industry (Williamson, Feyer, Coumarelos and Jenkins, 1992) showed the effects of different pressures on drivers working in the industry. Some of the main findings were that fatigue was a common experience for long distance drivers and presented a problem for a significant number of them. Most drivers reported a similar pattern of fatigue occurrence. Drivers also reported consistent effects of fatigue on driving, that is slowed reactions, poorer gear changes and steering, and slower driving. Drivers were also able to report on their most effective methods of overcoming on-road fatigue. Again there was considerable consistency between drivers in their views of the best ways of managing driver fatigue. Sleep and rest were regarded by most drivers to be most effective for reducing on-road fatigue. A smaller group of drivers also reported using stay awake drugs to manage driver fatigue and of those, a large proportion reported that this was a most helpful method of managing fatigue.

The survey also showed that specific groups of drivers appeared to be most at risk of experiencing fatigue. The first group were two-up drivers because their trips were two to three times as long as any other group. Staged or relay drivers reported earlier fatigue onset than the other groups even though they did relatively short distances. For this group the main risk factor for fatigue was the fact that most of them worked across the night, therefore enhancing the risk of experiencing fatigue. Drivers employed by larger companies also reported fatigue onset earlier into their trips than other drivers.

In the time since that last survey, there have been a large number of changes in the long distance road transport industry, many of which might have had an impact on fatigue management in the industry. Activities like Queensland Department of Transport's Fatigue Management Programme, the Australian Trucking Association's Trucksafe campaign as well as more general media coverage on the issue of fatigue may have increased awareness of fatigue in the industry.

All of these changes might have made an impact on the level of fatigue experienced by long distance drivers and the work-rest schedules in which they work. The aim of this project is to investigate whether there have been changes in the awareness and experience of fatigue by drivers in the long distance road transport industry and whether work-rest practices have changed in the seven years since the previous survey. The survey is also intended to provide a further baseline from which future changes to work scheduling practices can be judged. For this reason, the survey was undertaken immediately prior to the implementation of revised driving hours regulations in New South Wales, Victoria, Queensland and South Australia.

In addition, a second survey was undertaken to include companies, with particular focus on work-rest scheduling practices and the factors which motivate companies to organise schedules that acknowledge the problem of fatigue. The results of this aspect of the study are reported in a companion document.

2. METHOD

2.1 Study design

Two different methods were used to collect questionnaire data in this study; a self-administered survey and an interview. The same questions were asked in each method to allow combining of the questions. For the self-administered questionnaire, 1,449 questionnaires were handed out and for the interviews, 565 drivers were invited to participate in the study. Long distance drivers, doing trips of at least 300 km, were recruited at truck stops in all states and territories except Western Australia, Tasmania and the Australian Capital Territory. Drivers were approached by interviewers and invited to participated in a face-to-face interview or, failing that, a self-administered version of the questionnaire. Drivers were approached during the day and night. There were no apparent systematic differences in the selection process for interviewees or self-administered drivers.

A stratified strategy was used for questionnaire distribution, based on an analysis of the Australian road transport industry conducted by the National Road Transport Commission (1998) which attempted to estimate the relative composition of the long distance road transport industry across states. Table 1 shows the distribution of questionnaires and interviews in each state. Most questionnaires were distributed in the three most populous states, New South Wales, Victoria and Queensland. No drivers were sampled in the Australian Capital Territory because of its size and proximity to New South Wales. Tasmania was not included, consistent with the previous survey. Finally, Western Australia was not included in the sample as other research has been carried out in that state (e.g., Hartley, Arnold, Penna, Hochstadt, Corry, & Feyer, 1996; Arnold, Hartley, Penna, Hochstadt, Corry & Feyer, 1996).

Both interview and self-administered questionnaires were distributed by trained and experienced market researchers employed by a market research company which was contracted for the purpose.

Drivers were approached by the market researchers in truck stops in city and rural locations, the background and purpose of the questionnaire were explained and they were invited to participate. Surveys were handed out and interviews conducted through the day and into the late evening. Appendix 1 contains a complete list of the truck stops that were included in this study. Appendix 2 contains copies of the background information and the self-administered version of the questionnaire. The interview questionnaire was virtually identical to the self administered one with the exception of a few grammatical changes to make some of the questions more suitable for use in an interview.

Table 1: Distribution of questionnaires across states showing the number and percentage (in brackets) of questionnaires distributed in each state.

	Self-administered		Interview	
Queensland	336	(23.2%)	156	(27.6%)
New South Wales	436	(30.1%)	143	(25.3%)
Victoria	274	(18.9%)	144	(25.5%)
South Australia	492	(27.1%)	117	(20.1%)
Northern Territory	11	(0.8%)	5	(0.9%)
TOTAL	**1449**		**565**	

2.2 Analysis

The overall survey results were described in summary form. The results from this survey were also compared with the results of the previous national survey of the long distance road transport industry (Williamson et al., 1992). The analysis also involved breaking the respondents into groups. The groups were selected to be the same as those used in the previous survey. These groups were company drivers for small (≤10 trucks), medium (11-50 trucks) and large (>50 trucks) companies and owner drivers who were contract or independent. An analysis was also carried out on different types of driving; single, two-up (two drivers sharing the driving) and staged (also known as relay driving). When statistical techniques were used to test the significance of these comparisons, they included t-tests, analysis of variance and χ^2 tests. Although multiple tests increase the likelihood of erroneously concluding that a 'real' difference exists when it does not, statistical significance was used as a guide only. Rather, the analysis focussed on patterns of significant findings to guide interpretation.

3. RESULTS

The response rates for the questionnaire are described for each state in Table 2. Overall 485 self-administered questionnaires were returned so giving a response rate of 34% and 522 interviews were conducted giving a 92% response rate of those invited to participate in the survey. The response rate for self-administered questionnaires, although relatively low, is fairly typical of large-scale surveys of this type. It was considerably better than the response rate obtained for the first survey which was 15.6% overall. The response rate for interviews was excellent, with almost no refusals. This, again, was better than the response rate for interviews in the first survey which was around 81.4%. The response rates varied by state with the best rates obtained from South Australia, Victoria and New South Wales. The response rate from Queensland was poorer than the other states and even though very few questionnaires were distributed by either mode, the response rate was much poorer than for all other states.

Table 2: Number of survey responses and percentage response rates for self administered and interview questionnaires for each state.

	Self-administered		Interview	
• Queensland	64	(19.0%)	120	(76.9%)
• New South Wales	130	(29.8%)	142	(99.3%)
• Victoria	101	(36.9%)	142	(98.6%)
• South Australia	146	(37.2%)	117	(100%)
• Northern Territory	1	(9.1%)	1	(20.0%)
• Origin not known		43		0
TOTAL	**485**	**(33.5%)**	**522**	**(92.4%)**

It is possible that the two collection methods used in this survey could have biased the results through driver selection factors or differences in response using the two methods. Comparison of the results for the two collection methods (see Appendix 4) indicates that the methods differ for a range of questions, but that overall these differences are quite small and trivial. For example, there was a roughly two year difference in age and experience of drivers surveyed using the two methods, which although statistically significant, is of little consequence in reality. For these reasons, the data from both collections were combined for this analysis.

3.1 Description of Second Survey Results and Comparison with the First Survey of Drivers

3.1.1 Description of survey participants

In total, 1007 drivers participated in this study (Table 3). Almost all participants were male, with only 14 female participants (1.4%). Most of the female respondents did the self-administered survey (86%). Most of the participants were in the 30 to 40 age group. Very few drivers were under 25 (3.1%) but a larger percentage were over 50 years of age or over (13.6%). The majority of drivers were living with a partner either in a marital or de facto

relationship and more than three-quarters had children. Around one-third of these (29.4%) had children under the age of five years.

The sample of drivers in the current survey was very similar in composition to the driver sample for the first survey. There was a very small difference in age, with new survey participants being slightly older than those in the old survey. The new survey participants were less likely to be married, but the percentage of drivers with children and the number of children per driver were very similar.

Table 3: Characteristics of participants in old and new surveys.

	First Survey (1991) (n=960)	New Survey (1998) (n=1007)
• Mean *(SD)* age	37.9 *(8.9)*	39.8 *(9.6)*
• % married or de facto	77.9	68.5
• % with children	78.6	78.7
• Mean *(SD)* number of children per driver	2.63 *(1.27)*	2.75 *(1.39)*

3.1.1.1 Sleepiness tendencies

The Epworth Sleepiness Scale is a well-recognised measure for detecting excessive daytime sleepiness tendencies in the normal population. Using specific scoring methods, it is argued that the Scale can be used to detect individuals prone to sleep disorders, including apnea, with a reasonable level of accuracy and reliability (Johns, 1991; 1992; 1993; Johns & Hocking, 1997). The Scale was used in the second survey in an attempt to assess the proportion of drivers surveyed who might be at risk of sleep apnea or excessive daytime sleepiness.

The results (see Table 4) show that lying down and resting in the afternoon was the only situation in which more than half of the participants reported a high chance of falling asleep and for watching television, only around one-quarter reported a high chance of dozing. Very few participants reported falling asleep in a car stopped in traffic or while sitting and talking to someone. The overall pattern of responses is consistent with that reported for groups in the general population (Johns & Hocking, 1997).

Using the most common scoring method for predicting sleep disorders based on the responses to this scale (e.g., Johns & Hocking, 1997), the majority of participants could be classified as showing a normal profile (82.1% had a score of less than 10), 15.9% showed a moderate risk of sleep disorders (score of between 11 and 15) and only 2% had a high risk of sleep disorder (score of 16 or more). These results indicate that only a very small proportion of participants was likely to have a significant tendency to sleepiness or a sleep disorder. Johns and Hocking (1997) report that 10.9% of their sample of day workers scored higher than 10, but they recommend caution in applying this figure to shiftworkers who might be expected to have higher scores.

Table 4: Rated likelihood of dozing on the Epworth Sleepiness Scale items (% of second survey participants; not used in first survey).

Epworth Scale items:	Likelihood of dozing			
	Never	Slight	Moderate	High
• Sitting and reading	42.7	26.6	16.0	14.7
• Watching TV	20.9	28.7	22.9	27.5
• Sitting inactive in public	65.6	20.9	8.2	5.3
• Passenger in car for one hour	52.6	20.1	11.5	15.7
• Lying down and resting in the afternoon	9.0	12.3	22.1	56.7
• Sitting and talking to someone	90.6	7.4	1.2	0.8
• Sitting after lunch with no alcohol	61.0	24.8	10.2	4.0
• Car stopped in traffic	95.5	3.8	0.4	0.3

3.1.2 Work characteristics of drivers

Table 5 shows the driving characteristics of drivers in the two surveys. Half of the drivers in the second survey had been driving heavy vehicles for at least 16 years. Only around 7 percent of drivers had been driving heavy vehicles for less than 5 years. There was a small difference between the surveys in the years of experience of driving heavy vehicles, with participants in the second survey having slightly more experience than in the new survey. This result is consistent with the finding that new survey participants were also slightly older than those in the first survey. The results also show that slightly more participants in the second survey were owner drivers than in the first survey. Further breakdown of the employee and owner driver groups shows that far fewer respondents in the second survey were employees for large companies than in the first survey whereas drivers in the second survey were more likely to be employees of small companies owner-drivers.

Table 5: Driving experience for participants in old and new surveys.

	First survey (1991) (n=960)	New survey (1998) (n=1007)
• Mean *(SD)* years driving heavy vehicles	15.6 *(8.9)*	17.6 *(9.9)*
Employment type:		
• Employee drivers	77.8	69.1
• Owner drivers	22.2	31.9
Employee drivers:		
• ≤ 10 trucks	22.7	37.2
• 11-50 trucks	15.1	20.3
• > 50 trucks	40.0	10.9
Owner drivers:		
• Independent	10.6	14.0
• Contracted	11.5	16.1

The type of freight carried by participants in each of the surveys is shown in Table 6. In both surveys general freight was the most common type of freight reported. Refrigerated freight, farm produce and groceries were also reported by a significant percentage of drivers in both surveys, although far fewer drivers reported them compared to general freight. The main differences between the two surveys were that a smaller percentage of drivers in the second survey reported carrying dangerous goods and other bulk. A considerable percentage of participants in the new survey also reported carrying express freight, however it is not possible to compare the two groups as this question was not asked in the first survey.

Table 6: Main types of freight usually carried by participants in both surveys (participants allowed to report more than one freight type).

Freight type (%)	First Survey (1991) n=960	New Survey (1998) n=1007
• Livestock	4.4	6.6
• Refrigerated	20.3	24.1
• Dangerous materials	23.7	11.2
• Farm produce	17.5	20.2
• Other Bulk	21.7	12.5
• Machinery	12.5	14.6
• Building materials	15.2	14.5
• Groceries	21.3	17.6
• Manufactured goods	16.1	11.8
• General freight	48.5	50.0
• Car carrying	n/a	3.9
• Express freight	n/a	18.5
• Other (inc. removals)	18.7	5.2

Questions were asked in both surveys about the nature of remuneration for the drivers. The results for the second survey show that only a relatively small percentage of drivers had to negotiate their rate of pay for each load (17.2%), yet most drivers reported not having an on-going contract for their loads. One in four drivers reported that they had an on-going contract for all their loads and slightly fewer (18.4%) reported that they had contracts for some of their loads. In contrast, in the first survey around one-third of drivers had on-going contracts for all of their loads and only a very small percentage only had some on-going contracts.

As Table 7 shows, most drivers were paid in terms of the kilometres covered or tonnage carried. For both surveys this form of payment was the most common, with around two-thirds of all drivers being remunerated in this way. Only a very small percentage of drivers were paid by flat rate. Most drivers in both surveys reported that they earned the award rate or higher. A significant percentage reported that they did not earn as much as the award rate in the second survey (17.1%) and in the first survey, 15.9%. Interestingly, a significant percentage in the second survey did not know how their pay compared to the award rates (19.7% in the second survey versus 10.5% in the first).

Table 7: Usual payment types reported by drivers in both surveys (participants allowed to report more than one payment type).

Payment type (%)	First Survey (1991) n=960	New Survey (1998) n=1007
• Hourly rate	12.2	7.1
• Flat day rate	0.4	2.3
• Day rate with overtime	0.6	1.0
• Weekly rate with overtime	12.2	5.3
• Flat rate per load	6.9	14.0
• Rate per trip per km/tonne	52.9	68.3
• Pay system other	12.1	4.9

Table 8 shows that drivers paid by result (piece rates) were more likely to report incomes below the award rate than drivers paid by time. This result was apparent in both the first and second surveys. In both surveys, those drivers who negotiated their rate of pay for each load were more likely to be paid by result, than by time. Among the remaining drivers, those *without* ongoing load contracts were more likely to be paid by time than by result. This result failed to reach statistical significance in the second survey.

Table 8: The relationships between payment type and the percentage of drivers in the old and new surveys who earn award rates, and have ongoing contracts for loads.

	First survey (1991)		New survey (1998)	
	Paid-by-result[1]	Paid-by-time[2]	Paid-by-result[1]	Paid-by-time[2]
Payment rate:				
• < award	22.6	1.7	18.0	5.4
• Award	51.4	76.4	38.0	40.5
• > award	13.6	17.6	23.7	38.7
• Don't know	12.4	4.6	20.3	15.3
	$\chi^2_{(3)}$=73.60, p<0.001		$\chi^2_{(3)}$=19.34, p<0.001	
• Negotiates rate for each load	10.7	3.5	17.3	9.9
	$\chi^2_{(1)}$=10.76, p=0.001		$\chi^2_{(1)}$=3.88, p=0.049	
• If not, ongoing contracts for:				
All loads	37.6	33.2	22.5	18.7
Some loads	11.1	1.1	18.8	13.2
No loads	51.3	65.8	55.6	68.1
	$\chi^2_{(3)}$=21.59, p<0.001		$\chi^2_{(3)}$=5.05, p=0.08	

[1] Paid-by-result = flat load and trip rates

[2] Paid by time = hourly, daily with overtime, and weekly with overtime rates

3.1.3 Driving experience on last trip

3.1.3.1 Start and finish points for last trip

Drivers were asked a number of details about their last trip. As shown in Table 9, around one-third of trips (32.1%) began and ended in the same state and this was the most common type of trip for each state except for Victoria where most trips were between Victoria and the adjoining states of NSW or South Australia. Overall most trips (68.3%) were within the eastern states (Victoria, NSW and Queensland), around one-quarter (24.3%) were mixed trips between the eastern states and the western states of South Australia, Western Australia and the Northern Territory and less than 10 percent (7.4%) were within the western states. This considerably smaller representation of trips within the western states is likely to be largely due to the exclusion of Western Australia in the sampling.

Table 9: Distribution of drivers in the second survey by the state in which they began and ended their last trip (%).

Start state / **Finish state**	**NSW**	**VIC**	**QLD**	**SA**	**WA**	**NT**
NSW	*8.8*	9.1	8.2	2.1	0.9	0
VIC	9.2	*6.6*	4.0	2.8	0.9	0
QLD	5.5	5.7	*11.2*	1.3	0.9	0.2
SA	3.9	7.3	2.1	*4.3*	0.4	0.4
WA	0.5	0.8	0.3	0.8	*1.2*	0
NT	0	0.2	0.1	0.3	0	*0*

3.1.3.2 Freight carried on last trip

The type of freight carried by drivers on the last trip is shown in Table 10. The results show that the different types of freight were fairly evenly spread across participants in both surveys. The most common freight carried on the last trip in the second survey was general freight, refrigerated goods and farm produce. For the first survey, the most common type of freight was also general freight, followed by other bulk and refrigerated goods. It is notable that this is the same overall finding as for the usual freight that the drivers reported carrying, suggesting that the last trip was fairly representative of what the drivers normally do.

Table 10: Type of freight carried on the last trip by drivers in the first and second surveys (%).

Freight type	First Survey (1991) n=960	New Survey (1998) n=1007
• Livestock	2.5	4.5
• Refrigerated	9.6	16.8
• Dangerous materials	8.5	4.2
• Farm produce	5.2	10.7
• Other Bulk	10.3	7.4
• Machinery	2.5	5.5
• Building materials	4.1	7.7
• Groceries	5.4	7.0
• Manufactured goods	6.0	7.6
• General freight	22.7	26.1
• Car carrying	n/a	3.1
• Express freight	n/a	6.5
• Other (inc. removals)	23.2	5.7

3.1.3.3 Type of driving and scheduling on the last trip

Drivers were asked about the type of driving operation they used on the last trip. The greater majority in the second survey did the last trip as a single driver (94%), with only small percentages doing the trip with another driver as a two-up operation (5%) or as a staged or changeover operation (1.0%). This was very similar to the driving operations reported in the first survey, where 89% had done their last trip as a single driver and 4.7% in a two-up operation although considerably more had done staged driving (6.4%).

Only around one-third of the drivers in the second survey had been working to a fixed company schedule on their last trip (35.1%). This is considerably less than the percentage of drivers in the first survey who had Estimated Times of Arrival (ETA's) set by someone other than themselves (65.8%), but around the same as reported by Hensher, Battellino, Gee and Daniels (1991) in a previous national study of speeding in truck drivers. Just over one-third of drivers in the second survey (37.1%) had other reasons for wanting to arrive at their destination by a specific time (Table 11). These reasons included avoiding peak hour traffic, needing to get to their destination in order to fit in with the demands of unloading and loading, maximising sleep, and social, family or personal reasons. Interestingly, the demands of loading were reported less often in the second survey than in the first, but more drivers reported sleep as a reason in the second survey.

Most drivers reported travelling at or below the speed limit on their last trip (81.8%), but a relatively large group of drivers (16.8%) reported travelling above the speed limit by up to 15 km per hour. Only a very small percentage (1.5%) reported travelling more than 30 km per hour above the speed limit on the open road.

Table 11: Drivers' reasons for setting their own arrival time (%).

Reasons for arrival time other than ETA	First Survey (1991) n=960	New Survey (1998) n=1007
• Avoid peak hour traffic	23.4	24.6
• (Un)loading	36.1	25.3
• Sleep	7.0	18.6
• Social/family/personal	17.1	16.5
• Fit in with other driver	1.9	0.0
• Comply with regulations	1.2	0.4
• Other	13.3	14.7

The largest group of drivers reported starting work between 06:00 and 11:59, with just under one-third starting work between midday and 18:00 (Table 12). As might be expected, more drivers started driving on their last trip between 12:00 to 18:00. For the largest group of drivers, the end of the driving period occurred between midnight and midday. The end of the work period was somewhat later, with most drivers ending work between 6am and 6pm. Although the majority of drivers started work during the daylight hours, there was less consistency in the time when drivers stopped work, probably because schedules and distances varied.

Table 12: Last trip start and finish time for drivers in the second survey including work time and driving time (%).

Time of day	Start work	Start driving	End driving	End work
00:00 – 05:59	10.5	10.3	30.5	20.6
06:00 – 11:59	41.6	27.4	28.0	35.6
12:00 – 17:59	30.6	38.0	19.5	24.6
18:00 – 23:59	17.3	24.3	21.9	19.3

3.1.3.4 Amount of work and nonwork activity on the last trip

Work on last trip:

The average total distance covered in the last trip by participants in the second survey was 1,697.6km (s.d.=1508). A small percentage of drivers did trips of less than 700km, but most did between 700 and 1,500km and for around one-third of the drivers their last trip was longer than 1,500km. Compared to the drivers participating in the first survey (see Table 13), the drivers in the second survey covered considerably longer distances.

Table 13: Average distance covered in the last trip by participants in the first and second surveys (%).

Distance covered	First survey (1991)	Second survey (1998)
• <700km	25.1	15.2
• 700-1500km	50.0	47.1
• >1500km	24.9	37.6

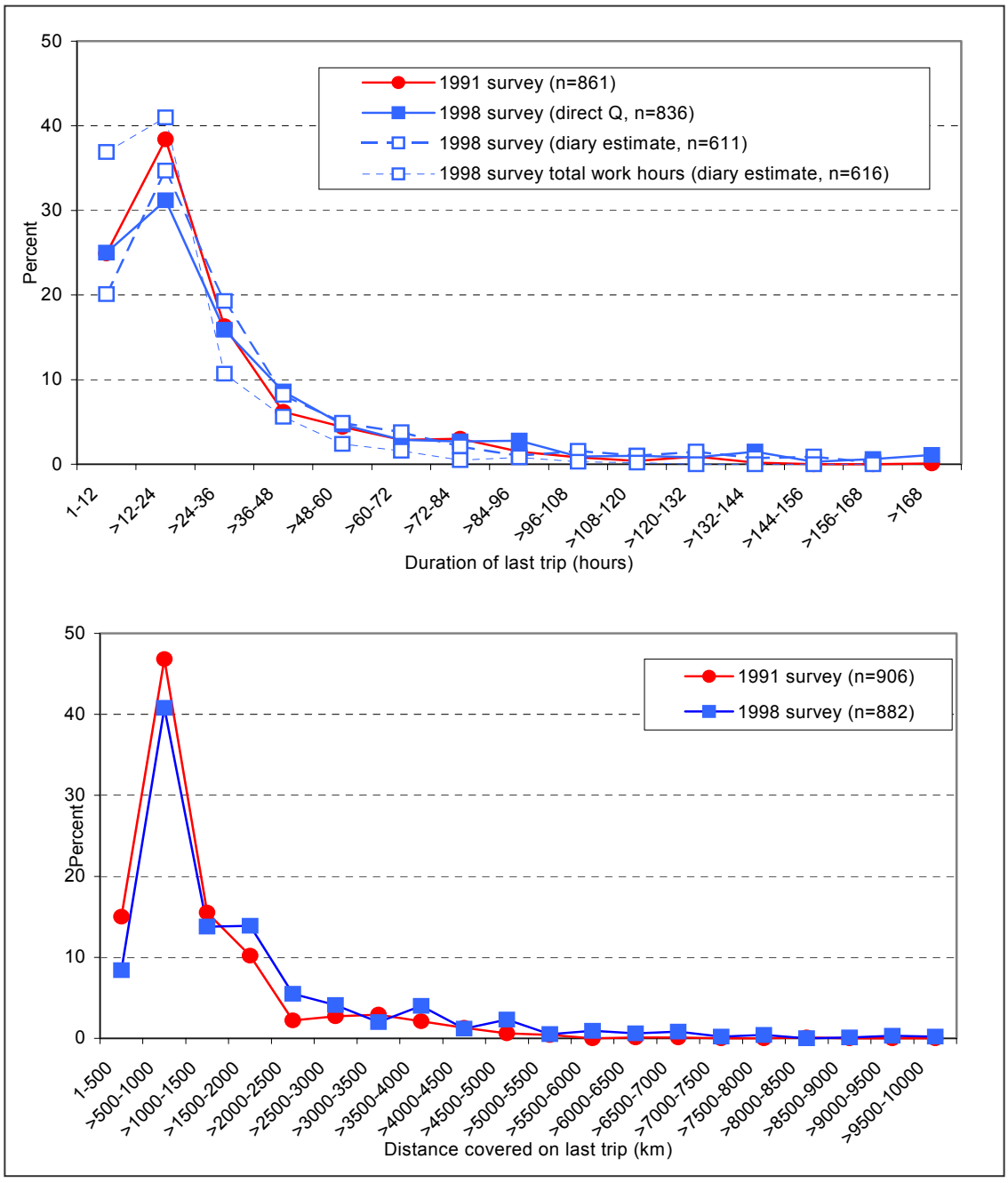
The distributions of time and distance reported for the last trip by all drivers in the first and second surveys are shown in Figure 1. No matter which measure of the duration of the last trip is examined, it is clear that a higher percentage of drivers in the second survey reported trips of more than 96 hours compared to the first survey drivers. Similarly, the percentage of drivers doing longer distances was slightly higher for the second survey compared to the first.

The average trip duration across all participants in the second survey was 34:51hrs (s.d.=38:05) and the average driving time was 19:07 (s.d.=17:00). Compared to the first survey in which the average trip duration was 27:00hrs (s.d.=23:42), drivers in the second survey were doing considerably longer distances. This can be seen from Table 14 which indicates that a greater percentage of drivers in the second survey were doing trips of longer than 30 hours. It is important to note that these trips did not involve only driving. In fact nearly half of the drivers in the second survey reported driving for less than 12 hours on their last trip, although more than one in three drove for 12 to 30 hours in their last trip. The tendency to do large hours is consistent with the larger distances travelled.

Table 14: Distribution of trip duration and driving time on the last trip for drivers participating in the second survey and the distribution of trip duration for drivers in the first survey. (Driving time was not asked in the first survey.)

	First survey (%)		Second survey (%)	
	Trip duration	Driving time	Trip duration	Driving time
<12:00hrs	19.2	n/a	20.2	44.6
12:00-29:59hrs	54.3	n/a	43.5	39.5
≥30:00hrs	26.5	n/a	36.2	16.0

Figure 1: Distributions of trip distances and trip durations reported by drivers in the first and second surveys.



For the second survey, work and nonwork activity on the last trip was examined in some detail (Table 15 and Appendix 3). This analysis shows that for just over half of the drivers the last trip spanned two days (53.9%). On average, drivers worked for nearly three-quarters of the trip or around 20 hours and spent about half as much time again doing nonwork activities which included sleep and breaks. On average, the trip involved work in around four blocks, although for around 10% of drivers their trip involved more than eight blocks of work. Breaks on their last trip occurred in around three blocks on average, although around 10% of drivers had more than seven break periods across their trip. These results corresponded to between eight and nine hours of work per day on average, arranged in about two blocks of work and about four hours of nonwork per day in one to two breaks.

Table 15: Patterns of work and nonwork activity on last trip for second survey participants showing means and (standard deviations).

Work and nonwork activities	Mean *(SD)*
For entire trip:	
• Average duration of last trip (direct question, n=836)	34:51 *(38:05)*
• % hours driving	67.31 *(21.62)*
• Average duration of last trip (diary estimate, n=611)	31.84 *(29.3)*
• % hours working	72.07 *(18.6)*
• % hours not working	28.08 *(18.7)*
• Total work hours	20.03 *(15.6)*
• Total nonwork hours in trip	11.77 *(16.4)*
• Total number of work blocks	4.44 *(3.15)*
• Total nonwork blocks	3.39 *(3.12)*
Per day:	
• Average work hours per day	8.57 *(3.19)*
• Average nonwork hours per day in trip	3.94 *(3.40)*
• Average number work blocks	1.93 *(0.77)*
• Average number nonwork blocks	1.39 *(0.75)*

Note: The numbers for work and nonwork hours per day are apparently low and do not add to 24 because the 24 hour periods within each trip do not all contain trip-relevant time. A trip is likely to begin and end part way through the day. The time before the trip started and after the trip finished would not be counted as part of the trip time.

As shown in Table 16, the majority of drivers did some work between midnight and dawn on their last trip. Many drivers worked for most of this period since the average work time over this period was just over four hours in a single block, which corresponded to around 18% of the trip time and around 23% of the work hours in the last trip. The fact that approximately one quarter of the working hours were done in the 6 hours between 00:00 and 06:00 is consistent with previous findings (e.g., Feyer & Williamson, 1995) that drivers work is evenly distributed across the 24 hour day.

Table 16: Patterns of night work (00:00 to 06:00) on last trip for second survey participants.

Night work	
	%
• Worked between 00:00 and 06:00	71.4
For drivers who worked between 00:00 and 06:00:	**Mean *(SD)***
• Total night work hours	4.3 *(3.2)*
• Total number of night work blocks	1.2 *(1.1)*
• % trip involving night work	18.0 *(12.9)*
• % work hours involving night work	23.8 *(14.7)*

When the pattern of work and rest on the last trip for participants in the second survey was compared for those drivers paid by result and those paid by time, very little difference was observed (see Table 17).

Table 17: Patterns of work and nonwork activity on last trip for second survey participants broken down by type of payment

Work and nonwork activities	Paid-by-result[1] Mean *(SD)*	Paid-by-time[2] Mean *(SD)*
• Average duration of last trip (diary estimate)[3]	30.77 *(27.43)*	31.54 *(32.23)*
• Total work hours	19.65 *(15.14)*	19.49 *(15.45)*
• Total work hours at night (00:00-06:00)	4.37 *(3.17)*	3.74 *(2.25)*
• Total nonwork hours in trip	11.09 *(15.16)*	12.05 *(19.13)*
• % trip hours worked	72.37 *(18.52)*	75.21 *(19.23)*
• % work hours done at night	23.79 *(13.92)*	24.64 *(32.23)*

[1] Paid-by-result = flat load and trip rates

[2] Paid by time = hourly, daily with overtime, and weekly with overtime rates

[3] Average duration was taken from diary estimates, as more data was provided. Other data in the table was from diagrammatic representation of trip duration. For this reason, the percentages cannot be calculated from the information in the Table.

Analysis of other activities:

In addition to driving, the last trip included other yard and loading/unloading work at the beginning, during and/or at the end of the last trip for a number of drivers. Table 18 shows the percentage of drivers in the second survey who did other work at the beginning and end of their last trip. Only around one in five of the drivers did yard work at the beginning or end or the last trip. However when drivers did yard work, it added around three hours to the beginning of the trip and around two hours to the end of the trip. Most drivers (67.6%) were involved in loading at either the beginning or the end of the trip, or both. Around one-quarter of the drivers (24.7%) also loaded at other times within the trip. For most of these drivers (79.7%) this involved up to four extra loading or unloading stops.

Table 18: Participation in non-driving work activities on the last trip.

Activity	% participation	Time spent by those participating Mean *(SD)*	Range
• Yard work at start point	20.1	3:17 *(2:57)*	00:05 - 16:00
• Yard work at end point	19.6	2:27 *(2:28)*	00:05 - 16:00
• Waiting to un/load at start	31.5	2:50 *(5:21)*	00:02 - 84:00
• Un/loading at start	56.0	2:23 *(2:36)*	00:05 - 24:00
• Waiting to un/load at end	26.8	1:53 *(3:24)*	00:01 - 48:00
• Un/loading at end	59.0	1:48 *(2:13)*	00:02 - 20:00

Loading at the beginning of the trip took a little over two hours on average, whereas unloading took considerably less time. For a significant percentage of drivers, time was taken in waiting to load and unload and it is notable that the average time waiting was longer than the average time taken to load or unload. Indeed, 8.8% of drivers waited in excess of 6 hours to load at the start of their last trip and 3.3% waited more than 6 hours to unload at the end.

Table 19: Reasons for delays in loading or unloading on the last trip (%).

Reasons for delays	First survey	Second survey
• Depot not open	18.5	8.9
• Waiting for other trucks to load/unload	53.9	32.0
• Freight not available	n/a	16.7
• Machinery not available	15.2	4.8
• Poorly organised un/loading system and/or booking procedures	n/a	8.8
• Other	26.1	3.8

The main reasons for delays in loading or unloading are listed in Table 19. Waiting for other trucks to complete their loading, freight not being available and the depot being poorly organised or not being open were the reasons cited most often by participants in the second survey for delays on their last trip. Although the reasons that were asked in both surveys were reported less often by participants in the second survey than by the first survey participants, this cannot necessarily be interpreted as showing improvement between the surveys because new reasons were added to the second survey causing some redistribution of responses. However, it can be said that the relative ranking of the reasons is similar in both surveys.

3.1.3.5 Experience of fatigue on the last trip

A number of questions were asked in the second survey about the effects of the last trip on drivers. More than three-quarters (80.5%) reported that they felt at least quite fresh at the beginning of the last trip and only around 5% reported feeling quite or very tired. A relatively large number of drivers, almost half (45.0%), reported that they experienced fatigue at some stage in the last trip. This is similar to the findings of the first survey where around half of the drivers reported fatigue on their last trip (50.6%).

The timing and patterns of fatigue experiences on the last trip were also examined in some detail (see Table 20). Drivers reported feeling fatigue for just over 12% of the trip. On average, drivers reported experiencing four hours of fatigue spread over one to two periods across the trip. This corresponds to experiencing fatigue in one block of between one to two hours per day.

Comparison of the pattern of fatigue experiences for drivers who worked between midnight and dawn (00:00 to 06:00) with drivers who did not showed that drivers who worked this period reported significantly more hours of fatigue and significantly more blocks of fatigue over their last trip (see Table 21). On average, the drivers who worked in the midnight to dawn period spent around twice as many hours in the trip feeling fatigue than drivers who did not work over that time. The same finding of more fatigue hours and more fatigue blocks were also shown over each day of the trip.

Table 20: Pattern of fatigue experiences across the last trip for the second survey.

Fatigue occurrence	Mean *(SD)*
For entire trip:	
• % of trip in which fatigue reported	12.89 *(12.3)*
• Total hours reported fatigue	4.02 *(5.01)*
• Total fatigue blocks	1.83 *(1.48)*
Per day:	
• Average hours reported fatigue	1.64 *(1.69)*
• Average number blocks of fatigue	0.79 *(0.45)*

Table 21: Effect of night work on fatigue experiences on the last trip for participants of the second survey.

	Worked between 00:00 and 06:00	
Reported fatigue	**Yes**	**No**
For entire trip:		
• Total fatigue hours *($t_{(558.3)}$=5.37,p<0.001)*	2.36 *(4.41)*	0.87 *(2.41)*
• Total blocks of fatigue *($t_{(558.3)}$=4.76,p<0.001)*	1.03 *(1.43)*	0.50 *(1.16)*
• % trip hours fatigued *($t_{(418.4)}$=4.58,p<0.001)*	7.42 *(11.59)*	3.46 *(8.73)*
Per day:		
• Average fatigue hours *($t_{(491.1)}$=4.63,p<0.001)*	0.94 *(1.57)*	0.44 *(1.02)*
• Average number of fatigue blocks *($t_{(610)}$=3.60,p<0.001)*	0.42 *(0.50)*	0.26 *(0.49)*

Table 22 compares the fatigue experienced on the last trip by drivers who were paid by result and those who were paid by time. Those paid by result (piece rates) reported approximately 50 minutes more fatigue on average during the trip than those paid by time, but when the time spent fatigued was expressed as a percentage of the total time spent on the trip, there was no statistically significant difference between the payment groups.

Table 22: Effect of payment type on fatigue experiences on the last trip for second survey participants.

	Paid-by-result[1]	Paid-by-time[2]
Fatigue reports	**Mean *(SD)***	**Mean *(SD)***
• Total fatigue hours in trip *($t_{(210.0)}$=3.05,p=0.003)*	2.00 *(4.22)*	1.13 *(1.78)*
• % trip hours spent fatigued	6.44 *(11.18)*	5.25 *(10.00)*

[1] Paid-by-result = flat load and trip rates
[2] Paid by time = hourly, daily with overtime, and weekly with overtime rates

3.1.3.6 Experiences of dangerous occurrences due to fatigue on the last trip

Drivers were asked to report any potentially dangerous occurrences in the last trip that might have been due to fatigue (see Table 23). In total, 21.1% of drivers reported at least one fatigue related occurrence during the last trip. The most common occurrences reported were crossing lane lines, nodding off while driving, having a near miss and under/over steering.

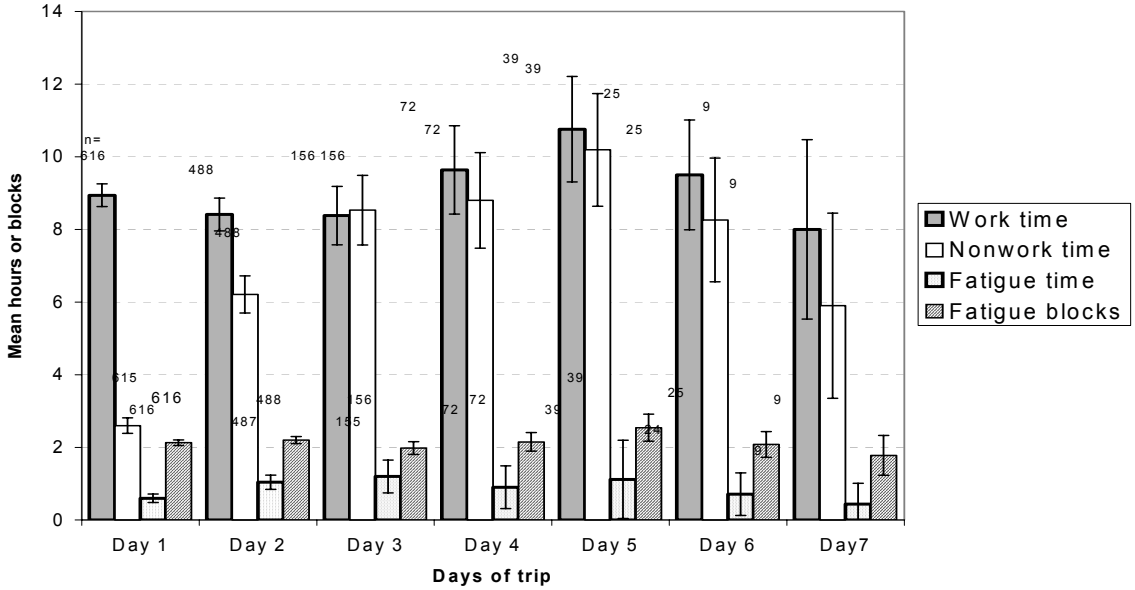
Table 23: Reports of potentially dangerous occurrences on the last trip due to fatigue for second survey participants.

Types of occurrences	% reporting on last trip
• Nodding off	5.3
• Having a near miss	5.0
• Running off the road	2.7
• Crossing lane lines	11.3
• Over/under steering	5.0
• Late braking	3.7
• Colliding with something	1.1
• Other	2.7

3.1.3.7 Relationship between work/nonwork and fatigue on the last trip

The changes in work and nonwork activities and fatigue experiences across the days of the trip were examined and the results are shown in Figure 2. There was not much change in the hours worked per day no matter how many days were involved in the trip. Work time was around nine hours for every day of the trip, although there was a tendency for the fifth day to be longer than the first few days. Nonwork time on the other hand differed across the days of the trip such that nonwork time on the first day was very small, but by the third day it had increased around three-fold. Reports of fatigue experiences were also quite consistent across the days of the last trip, although fatigue was reported for shorter periods on the first day of the trip and on day 7 of the trip for the few trips which lasted for that long.

Figure 2: Average hours working, taking breaks from work, and experiencing fatigue on each day of last trip.



Correlation analysis between the amount of work done on the last trip, the amount of nonwork activity and fatigue experiences on the last trip showed statistically significant positive relationships between the total work hours, total number of blocks of work, average work hours per day and the total hours in which fatigue was experienced (see Table 24). These indicate that drivers who did the longest trips, longest work hours in the last trip and the longest work hours per day experienced the longest periods of fatigue and the most blocks of fatigue. The relationships between measures of nonwork and fatigue experiences indicate marginal but significant relationships between total nonwork hours and average nonwork hours and the fatigue experienced on the whole trip.

The average fatigue hours per day while on the trip were not significantly related to nonwork hours in the trip or to the average number of nonwork hours each day. When correlations were calculated only for participants who reported at least one fatigue experience on their last trip, the relationships between work and fatigue were considerably stronger and those between nonwork and fatigue were also slightly stronger except for the average fatigue hours per day which remained nonsignificant.

Table 24: Correlations between hours of work and fatigue experiences on the last trip for drivers in the second survey. Top correlation coefficients include results from all participants who answered the question fully. Lower correlations (shaded) include only those who reported at least one period of fatigue.

	Total hours in last trip	Total work hours in last trip	Average work hours per day	Total nonwork hours in trip	Average nonwork hours per day
• Total fatigue hours in last trip	0.30**	0.42**	0.32**	0.14**	0.11**
	*0.42***	*0.52***	*0.35***	*0.22***	*0.17***
• Total blocks of fatigue	0.34**	0.44**	0.34**	0.18**	0.13**
	*0.52***	*0.60***	*0.37***	*0.34***	*0.24***
• Average fatigue hours per day	0.10*	0.21**	0.31**	-0.02	0.005
	0.09	*0.19***	*0.33***	*-0.05*	*-0.02*

* $p<0.01$ ** $p<0.001$

As shown in Table 25, there were significant relationships between work in the midnight to dawn period and the experience of fatigue. As the amount of night work increased, so did the level of fatigue. This was the case even after taking the length of the trip into account.

Table 25: Correlations between variables describing involvement in night work and fatigue experiences for drivers in the second survey. Top figures are results with complete data, lower figures (shaded) are results where at least one period of fatigue was reported.

	Unadjusted for trip length		Adjusted for trip length	
	Total night hours	**Total night blocks**	**Total night hours**	**Total night blocks**
• Total fatigue hours	0.30**	0.28**	0.20**	0.12*
	*0.39***	*0.29***	*0.25***	*0.11*
• Total fatigue blocks	0.35**	0.32**	0.24**	0.20**
	*0.50***	*0.36***	*0.36***	*0.28***
• Average fatigue hours per day	0.16**	0.16**	0.13**	0.04
	*0.19***	*0.09*	*0.15**	*0.02*

* $p<0.05$ ** $p<0.01$

3.1.3.8 Activities in the 10 hour period before the last trip

Drivers were asked to report their activities in the 10 hour period leading up to their last trip. Table 26 shows that on average, drivers spent the most time sleeping and or resting or relaxing over the period. Around one-fifth of the drivers (16.4%) reported getting eight hours sleep, but a third of the drivers (39.9%) reported getting less than six hours sleep in the 10 hours, with 12.1% reporting getting no sleep over the period. Most drivers did not report doing any work-related activities in the period before their last trip. Only 14.2% reported doing any checking or repairing of their vehicle, 13.6% reported loading or unloading a vehicle, 12.4% reported driving a heavy vehicle and very small percentages reported doing other yard work (5%) or driving a light vehicle (6.6%).

Table 26: Activities reported by drivers during the 10 hours leading up to their last trip.

Activity	**Mean hours *(SD)***
• Sleeping	5:41 *(3:04)*
• Resting/relaxing (but not sleeping)	2:38 *(2:38)*
• Checking or repairing heavy vehicle	0:13 *(0:45)*
• Loading/unloading heavy vehicle	0:20 *(1:05)*
• Other yard work	0:08 *(0:52)*
• Driving light vehicle	0:06 *(0:38)*
• Driving heavy vehicle	0:32 *(1:47)*

Analysis of the relationship between start time and the amount of sleep and rest obtained in the 10 hour period just before the trip showed that those who started in the midnight to midday time period obtained more sleep than those who started between 12:00 and 24:00 ($F_{(3,751)}=22.27$, $p<0.001$). On the other hand, drivers who started between midday and midnight obtained more rest ($F_{(3,751)}=35.40$, $p<0.001$; see Figure 3).

3.1.4 Driving experiences over the last week (from second survey)

Drivers in the second survey were asked to report on their work, nonwork and sleep experiences over the last seven days. Unfortunately, many drivers did not answer this question fully, possibly because it was too arduous. Around one-fifth of all drivers (22.8%) did not report any work in the past week so did not complete the question. Of the drivers who reported working last week, about one third (34.7%) did not provide any information about their last week and just over one-quarter (29.8%) only provided partial information so leaving just over one-quarter of drivers in total (27.5%) providing sufficient information on work and nonwork over the past week, but complete sleep information for this question was only provided from 16.2% of drivers. The final results are shown in Table 27 for those drivers who reported any sleep data, for those drivers with complete work and rest data, and for the subset of these who also had complete sleep data. The latter gives a more accurate reflection of the relationship between sleep and work and rest, but the second set of data is based upon more people and therefore gives a more representative picture of work and rest (but not sleep). The first set of data reflects everything that was reported about sleep obtained but is not likely to be most accurate. It is likely that the real average amount of sleep per week is between 35 and 54 hours per week, or 5 to 8 hours per 24 hour period.

Figure 3: **Mean hours slept or rested in 10 hours prior to the start of the last trip as a function of time of day at start of work on last trip. (Solid horizontal lines indicate the mean hours slept and rested by those starting work in the periods 00:00-05:59, 06:00-11:59, 12:00-17:59 and 18:00-23:59.)**

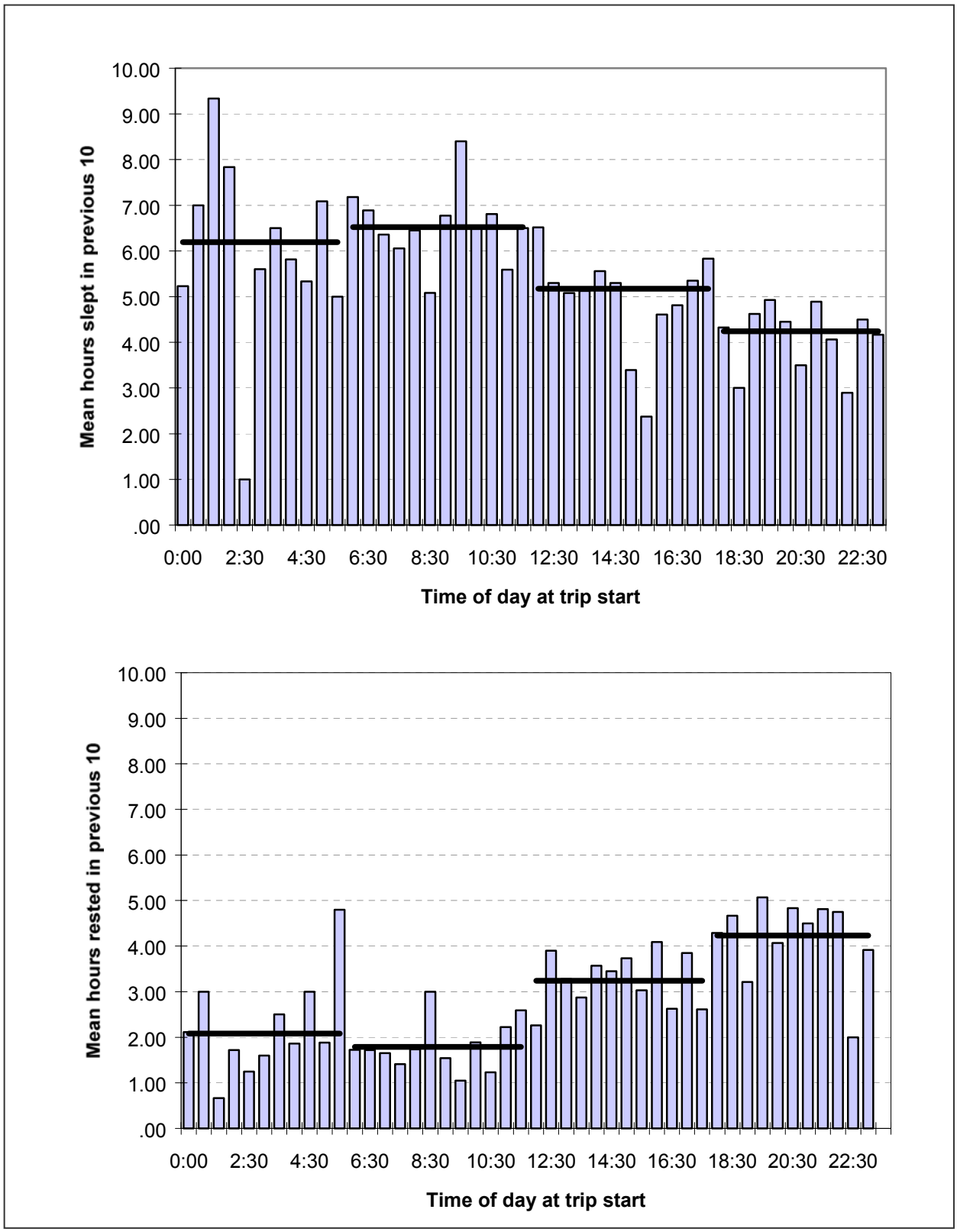


Table 27: Distribution of work, nonwork and sleep over the past week.

Work and nonwork activity in the week	Some sleep data (n=412)	Complete work and rest data (n=252)	Complete work, rest and sleep data (n=149)
	Mean *(SD)*	**Mean *(SD)***	**Mean *(SD)***
• Total work hours	45.7 *(24.5)*	55.1 *(22.7)*	57.8 *(23.3)*
• Total nonwork hours	84.8 *(38.7)*	113.0 *(22.7)*	110.2 *(23.3)*
• Total sleep hours	34.9 *(20.0)*	46.2 *(17.5)* *(n=227)*	54.3 *(11.7)*
• Total blocks of work	9.3 *(5.1)*	10.8 *(4.9)*	11.8 *(4.8)*
• Total blocks of nonwork	10.1 *(5.1)*	11.5 *(4.8)*	12.5 *(4.8)*
• Total blocks of sleep	5.6 *(2.9)*	7.2 *(2.5)* *(n=226)*	8.1 *(1.4)*
Work hours:	**%**	**%**	**%**
• < 39 hours per week	41.4	24.6	19.5
• 39 – 72 hours per week	42.7	52.8	54.4
• > 72 hours per week	15.8	22.6	26.2

The total sleep hours reported by drivers who provided complete data are consistent with estimates for the general population. For example, Hyyppa, Kronholm, and Mattlar (1991) reported norms of 7 to 7.5 hours of sleep per night or 49 to 52.5 hours per week. Perhaps of more relevance to shiftworkers are the findings of Roehrs, Shore, Papineau, Rosenthal and Roth (1996). These researchers observed habitual sleep patterns of 7.5 hours per night (52.5 hour per week) which rose to 9 hours per night (63 hours per week) when "catch-up" sleep was permitted, and plateaued at approximately 8.5 hours per night (59.5 hours per week) when unrestricted sleep was allowed to continue. The fact that drivers in the second survey were averaging more than one sleep period per day suggests that although the total sleep hours seem comparable or higher than community norms, they may include periods of restricted and "catch-up" sleep. (More details of the distributions of work and sleep in the last week can be found in Appendix 3.)

The results show that work and nonwork were fairly evenly distributed across the last week with around eleven or twelve blocks of each, mostly in the format of nonwork following work, but sleep did not occur on each nonwork occasion as there were only eight blocks of sleep on average over the week.

Just under one-quarter of drivers did less than 39 hours work over the last week, but most did between 40 hours and the regulated limit of 72 hours per week. A significant proportion, however, reported doing more than the regulated 72 hours of work in the past week. Over the last week, the greater majority of drivers did some night work between the midnight and 06:00am period (see Table 28). On average drivers did around 9.1 hours of night work during their last week in two to three blocks. Night work corresponded to around five percent of the last week which represented nearly 16 percent of the total working hours.

Table 28: Patterns of night work (00:00 to 06:00) across the last working week for second survey participants.

Night work	**%**
• Worked between 00:00 and 06:00	77.5
For drivers who worked between 00:00 and 06:00:	**Mean *(SD)***
• Total night work hours	9.1 *(7.3)*
• Total number of night work blocks	2.5 *(2.2)*
• % week involving night work	5.4 *(4.4)*
• % work hours involving night work	15.9 *(11.1)*

It was possible to compare the distribution of working hours over the last week for the first and second surveys (see Figure 4). The comparison shows relatively little difference between the two surveys in the hours worked in the last week. There was a tendency for first survey drivers to report working slightly longer average hours in the past week. For the first survey, the average duration of work over the past week was 63 hours compared to between 55 and 58 hours reported in the second survey (see Table 27). Similarly, 30 percent of drivers in the first survey reported working more than 72 hours over the last week compared to between 22 and 26 percent in the second survey. As the reporting of work over the last week was much less complete across drivers than reports of work on the last trip, it is not possible to conclude that these differences between the two surveys are of significance.

Figure 4: Distribution of hours worked in the last week for first and second surveys.

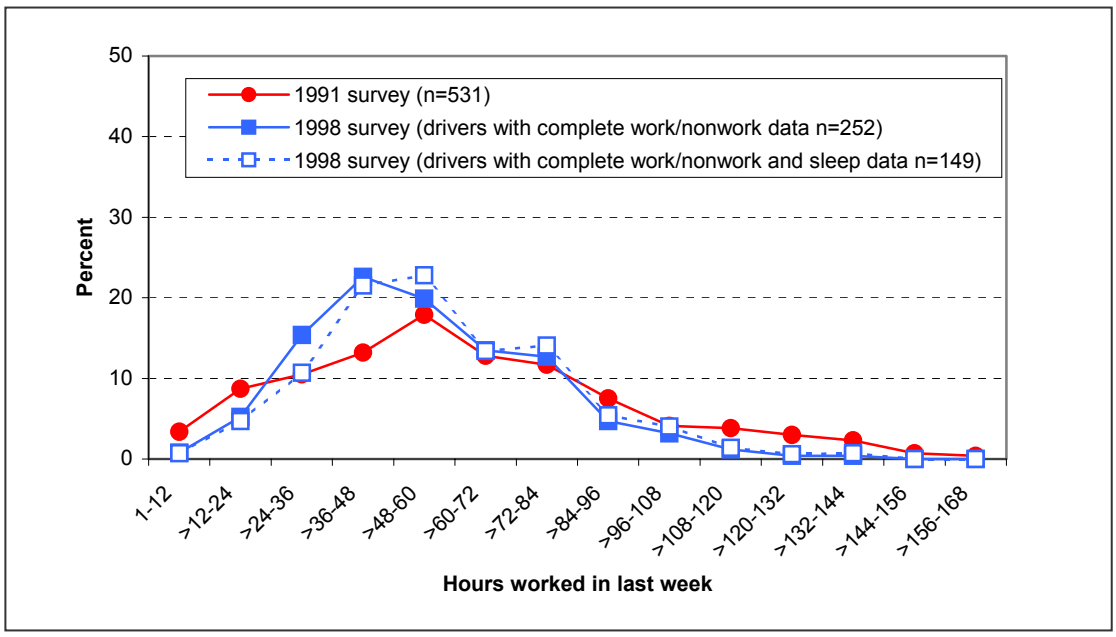


Table 29 shows the relationship between working between midnight and dawn and the amount of sleep obtained. The results show that drivers who worked in this period obtained significantly less sleep although there was no relationship between night work and the number of blocks of sleep obtained in the last week.

Table 29: Relationship between night work and sleep during the last working week. Figures are results of drivers reporting complete work and sleep data.

	Worked between 00:00 and 03:00	
Mean *(SD)* sleep	**Yes**	**No**
• Total sleep hours $t_{(88.2)}=5.57, p<0.001$	52.2 *(11.9)*	61.51 *(7.4)*
• Total sleep blocks	8.2 *(1.6)*	7.9 *(0.6)*

For those who did work between 00:00 and 06:00, there were significant negative correlations between the number of night hours worked and the amount of sleep obtained such that drivers who did more night work reported less sleep (Table 30). Similarly drivers who had more blocks of night work had less sleep. As might be expected night work appears to reduce the amount of sleep that can be obtained by drivers.

Table 30: Correlations between variables describing involvement in night work and sleep experience for drivers in the second survey. Figures are results of drivers reporting complete work and sleep data.

	Total night hours	Total night blocks
• Total sleep hours	-0.46**	-0.49**
• Total sleep blocks	-0.08	0.10

** $p<0.01$

When work, rest and sleep in the last week were examined according to the payment that drivers received (see Table 31), very few differences emerged. Drivers paid by result were more likely to have done some work between midnight and 06:00 in the last week compared to drivers paid by time. In addition, drivers paid by result averaged approximately 3 hours more night work in the last week. These results were only apparent when drivers with complete work and rest, but not complete sleep, data were used, possibly because of the increased numbers of people involved in the analyses. Total work, nonwork and sleep hours did not differ according to payment type, nor did the percentage of total work hours that were done at night.

Table 31: Patterns of work and nonwork activity in last week for second survey participants broken down by type of payment.

Work and nonwork activities	Complete work and rest data		Complete work, rest and sleep data	
	Paid-by-result[1]	Paid-by-time[2]	Paid-by-result[1]	Paid-by-time[2]
	Mean *(SD)*	**Mean *(SD)***	**Mean *(SD)***	**Mean *(SD)***
• Total work hours	55.65 *(23.40)*	53.76 *(17.39)*	58.09 *(24.77)*	58.44 *(14.48)*
• Total nonwork hours	112.35 *(23.40)*	114.24 *(17.39)*	109.91 *(24.77)*	109.56 *(14.48)*
• Total sleep hours	45.83 *(17.60)*	51.08 *(14.17)*	54.05 *(12.17)*	53.86 *(9.84)*
	%	**%**	**%**	**%**
• Worked between 00:00 and 06:00	80.9	64.7	77.7	76.2
	$\chi^2_{(1)}=4.43, p=0.04$			
For drivers who worked between 00:00 and 06:00:	**Mean *(SD)***	**Mean *(SD)***	**Mean *(SD)***	**Mean *(SD)***
• Total work hours at night (00:00-06:00)	9.50 *(7.76)*	6.30 *(4.67)*	9.44 *(7.63)*	6.50 *(4.94)*
	$t_{(40.3)}=2.77, p=0.008$			
• % work hours done at night	33.93 *(24.30)*	28.13 *(20.87)*	31.92 *(21.45)*	24.34 *(13.04)*

[1] Paid-by-result = flat load and trip rates
[2] Paid by time = hourly, daily with overtime, and weekly with overtime rates

3.1.5 Experience of fatigue in general while driving

Fatigue was reported less often by participants of the second survey than by participants of the first survey (see Table 32). In the first survey nearly half of the participating drivers reported being fatigued on at least half of their trips and just over one-quarter reported fatigue on most or every trip. In contrast, quite a small percentage of drivers in the second survey reported being fatigued on most or every trip. Around two-thirds of the drivers in the second survey reported fatigue only occasionally or very rarely.

Table 32: Frequency of becoming fatigued while driving (%).

Frequency of fatigue	First Survey	Second Survey
• On every trip	10.7	7.5
• On most trips	17.9	10.4
• On half the trips	17.4	13.0
• Occasionally	38.6	44.0
• Very rarely	15.3	25.1

The results show that most drivers reported starting to feel fatigue within around 10 hours after beginning work (51.2%) and around three quarters reported feeling fatigue within the first 14 hours of starting work (75.1%). Significantly, for most drivers, this placed the beginning of their fatigue within the current regulated driving hours. Compared to the results of the previous survey, these results indicate that drivers in the second survey were experiencing fatigue earlier than those in the first survey in which only 59.7% of drivers reported experiencing fatigue within 14 hours of driving.

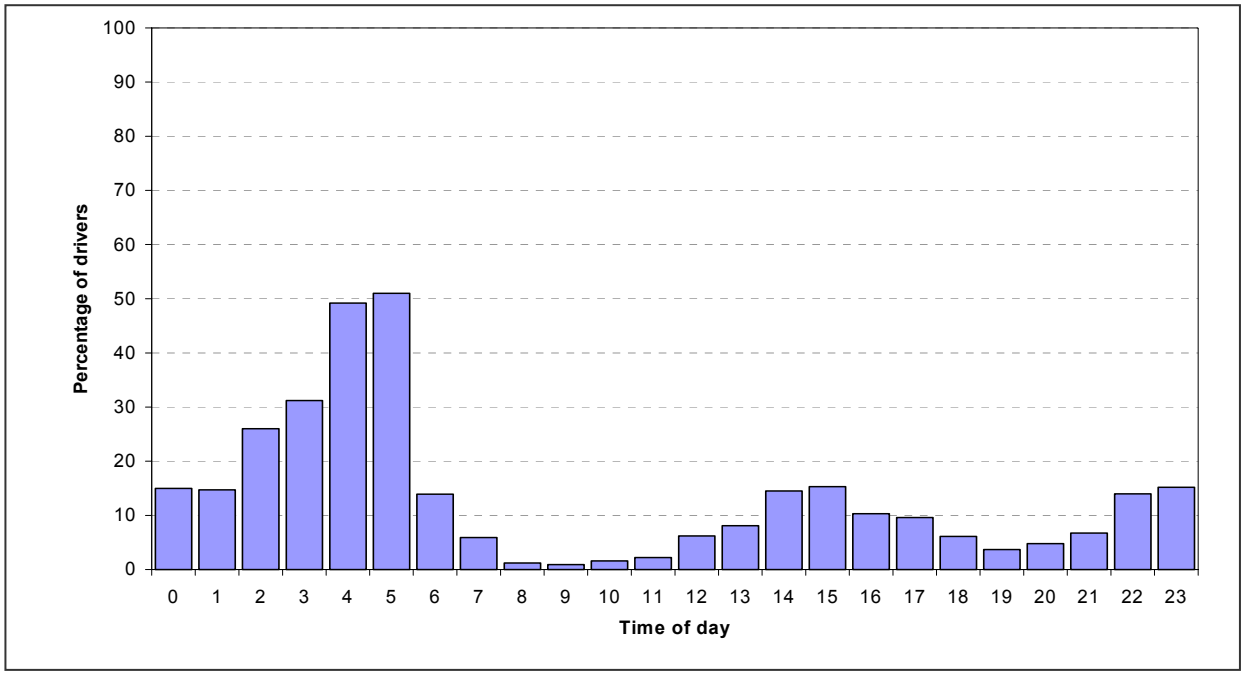
An analysis of both fatigue frequency and the typical time to fatigue onset in the second survey showed that these two dimensions of fatigue experience were not independent. Rather, drivers who reported fatigue more frequently also tended to report earlier onset (see Table 33; $\chi^2_{(2)}=19.66$, $p<0.001$). When the typical time to fatigue onset was correlated with the duration of the last trip, the total hours worked during that trip and the time spent driving on the trip, all three relationships were positive and statistically significant. (Trip duration - $R=0.15$, $p<0.001$; Total work hours – $R=0.11$, $p=0.01$; Total driving hours – $R=0.15$, $p<0.001$). The strength of the relationships increased when only those drivers reporting that fatigue occurred on their last trip were included (Trip duration - $R=0.24$, $p<0.001$; Total work hours – $R=0.23$, $p<0.001$; Total driving hours – $R=0.28$, $p<0.001$).

Table 33: Usual fatigue onset time as a function of fatigue frequency (%).

	Frequency of fatigue	
Fatigue onset lag	**Rarely/occasionally**	**At least sometimes**
• <10 hours	32.4	47.5
• 10-14 hours	39.8	34.2
• >14 hours	27.8	18.3

Analysis of when fatigue was, typically, most likely to occur showed that for most drivers (74.7%), fatigue started between midnight and 06:00, with the period between 04:00 and 06:00 being most commonly the period in which fatigue was reported (see Figure 5). Where drivers reported a second period of fatigue (36.3%), it started between 12:00 and 18:00 most often (53.6% drivers) or for a smaller percentage of drivers between 18:00 and midnight (38.8%). These results are very similar to those found for the previous survey in which 75.3% reported fatigue onset during the midnight to dawn period.

Figure 5: Percentage of drivers reporting that they typically experience fatigue at each hour of the day.



As shown in Table 34 in the second survey a much larger percentage of drivers reported fatigue to be no problem for them compared to drivers in the first survey. Similarly, compared to the first survey results, a considerably smaller percentage of second survey drivers reported that fatigue was a substantial problem for them, although around the same percentage of drivers in both surveys reported fatigue as a major problem or as a minor problem. On the other hand, the perceptions of fatigue as a problem for the industry were very similar between the first and second surveys, indicating that this had changed little over the intervening years between the two surveys.

Table 34: Perceptions of fatigue as a problem for the industry and for each driver personally for the first and second surveys (%).

Fatigue problem rated as:	First survey		Second survey	
	For industry	Personally	For industry	Personally
• Major	37.5	8.6	40.1	6.2
• Substantial	40.0	26.3	35.8	15.2
• Minor	20.1	50.1	20.6	48.9
• No problem	2.3	15.0	3.5	29.7

As shown in Table 35, there were statistically significant differences in the experience of fatigue depending on the type of payment made to survey participants. Drivers who were paid on the basis of the amount of work they did, such as trip rates and flat loads, were more likely to report fatigue on at least half of their trips and, in the first survey, were more likely to

experience it as at least a substantial problem. It seems that pressure to do more work by linking it to their payments has the effect of increasing the fatigue that drivers experience.

Table 35: The relationship between payment type and the percentage of drivers in the old and new surveys who experienced fatigue frequently or found it problematic.

	Fatigue experienced on at least half of trips		Fatigue a substantial or major personal problem	
Payment rate	**Old survey**	**New survey**	**Old survey**	**New survey**
• Paid-by-result [1]	53.5	32.6	40.0	22.8
• Paid by time [2]	28.9	18.8	24.5	17.9
	$\chi^2_{(1)}$=40.41, p<0.001	$\chi^2_{(1)}$=8.84, p=0.003	$\chi^2_{(1)}$=17.60, p<0.001	not statistically significant

[1] Paid-by-result = flat load and trip rates
[2] Paid by time = hourly, daily with overtime, and weekly with overtime rates

The response to the question in the second survey on whether the driver believed that awareness of fatigue had changed in the industry and for them personally showed that drivers were twice as likely to report that their awareness of fatigue had not changed over the past five years as reported industry awareness had not changed (see Table 36).

Table 36: Change in awareness of fatigue in the industry over the past five years (asked in the Second survey only).

Nature of change in fatigue awareness	For industry (%)	Personally (%)
• Increased a lot	34.3	26.1
• Increased	39.9	32.5
• No change	20.0	38.4
• Decreased	3.1	1.9
• Decreased a lot	2.6	1.2

3.1.5.1 Effects and modifiers of fatigue

The greater majority of drivers in both surveys reported that their driving was worse when they were fatigued. In the first survey 74.5% of drivers and in the second survey 71.3% of drivers reported that their driving was worse when they were tired. When asked to report how their driving was effected by fatigue (see Table 37), as might be expected, participants in both surveys responded in very similar ways. In both surveys the most common effects were slower reactions, driving too slowly and poorer steering. If anything, drivers in the second survey were more consistent as larger proportions of participants reported poor gear changes and driving too slowly as problems of being tired while driving.

Table 37: Effects of fatigue on driving reported by participants of the first and second surveys.

Effects of fatigue on driving	First survey	Second survey
	% of those who experience fatigue	
• Slower to react	49.2	56.1
• Poorer steering	37.2	41.1
• Poorer braking	11.3	14.0
• Poorer gear change	40.4	55.6
• Poorer overtaking	5.8	9.5
• Speeding	7.7	8.9
• Driving too slowly	38.5	53.2
• Poorer signalling	9.2	11.0
• Poorer attention to traffic lights	22.7	20.9
• Poorer awareness of other road users	27.5	24.5
• Others	6.9	3.6

Drivers were also asked to indicate which of a range of potential factors contributed to their fatigue while driving. Table 38 shows the results for the two surveys. Overall, the results indicate that the same main factors were reported as contributing to fatigue in both surveys, only the relative frequency in which they were reported was changed. For the first survey, the most common factor reported was poor road conditions, followed by dawn driving, long driving hours, poor weather and having to load and unload. In the second survey the order became dawn driving, waiting to load and unload, long driving hours, poor roads and poor weather. In both surveys, the factors reported least frequently were also very similar; the need to check the load, truck vibration, the after-effects of stay-awake drugs, and the effects of alcohol. The factors judged to be most important in contributing to fatigue were also quite similar between the two surveys. For the first survey loading and unloading, poor roads, inadequate sleep before trips and long driving hours were rated as the most important contributors, whereas in the second survey waiting to load/unload, dawn driving, long driving hours and poor roads were reported as most important by most drivers.

Drivers in both surveys were asked to report the strategies they use to manage driver fatigue. Most drivers (in the second survey 74.2%), reported using up to 11 of the 17 strategies listed at least sometimes. Only about one-quarter (25.9%) use seven or less strategies. These results indicate that drivers use a large number of strategies to help them manage fatigue.

Table 38: Contributors to driver fatigue reported in the first and second survey and the factors reported to be most important.

Contributing Factor	First survey		Second survey	
	% reporting	% of these rating it as important *(% of total)*	% reporting	% of these rating it as important *(% of total)*
• Long driving hours	48.6	32.5 *(15.8)*	47.9	37.1 *(17.8)*
• Too much non-driving work	n/a	-	30.0	31.0 *(9.3)*
• Insufficient rest breaks	24.8	17.3 *(4.3)*	23.2	28.3 *(6.6)*
• Having to un/load	47.2	42.6 *(20.1)*	35.8	38.3 *(13.7)*
• Waiting to un/load	n/a	-	56.2	48.5 *(27.3)*
• Checking the load	2.1	4.8 *(0.1)*	3.5	5.7 *(0.2)*
• Rest away from home	n/a	-	11.3	14.3 *(1.6)*
• Irregular/inadequate sleep during trips	40.1	26.9 *(10.8)*	38.2	30.6 *(11.7)*
• Inadequate pre-trip sleep	38.9	34.2 *(13.3)*	22.8	32.3 *(7.4)*
• Not enough night sleep	n/a	-	23.4	22.8 *(5.3)*
• Night driving	16.8	19.6 *(3.3)*	11.1	19.1 *(2.1)*
• Dawn driving	56.0	24.5 *(13.7)*	59.4	38.0 *(22.6)*
• Dusk driving	19.0	23.2 *(4.4)*	22.8	23.5 *(5.4)*
• Early afternoon driving	n/a	-	18.3	21.0 *(3.8)*
• Poor road conditions	58.2	37.5 *(21.8)*	41.9	35.9 *(15.0)*
• Boring/monotonous route	37.2	27.7 *(10.3)*	32.4	21.8 *(7.1)*
• Heavy highway traffic	13.8	15.2 *(2.1)*	13.6	22.2 *(3.0)*
• Heavy city traffic	25.3	17.8 *(4.5)*	23.2	26.5 *(6.1)*
• Poor weather conditions	47.5	28.0 *(13.3)*	38.5	33.5 *(12.9)*
• Poor cab design	n/a	-	14.8	13.6 *(2.0)*
• Poor truck ventilation	18.9	19.6 *(3.7)*	18.4	16.5 *(3.0)*
• Truck vibration	8.8	12.5 *(1.1)*	11.0	11.0 *(1.2)*
• Family problems	13.8	18.8 *(2.6)*	15.7	22.4 *(3.5)*
• Poor diet/irregular eating	30.2	18.9 *(5.7)*	27.2	17.8 *(4.8)*
• After-effects of stay-awake drugs	7.7	10.4 *(0.8)*	8.5	22.6 *(1.9)*
• Use of alcohol	6.2	16.1 *(1.0)*	7.2	21.1 *(1.5)*
• Other	15.1	15.2 *(2.3)*	6.8	19.4 *(1.3)*

n/a = question was not asked in first survey

Table 39 shows the drivers who selected strategies for both surveys. The most commonly used strategies reported in each survey by more than three-quarters of participants were music or the radio, sleep, and caffeine use. While the order of popularity of use differed between the two surveys, the numbers of drivers selecting them was very similar across the top four or five strategies. The same strategies were judged as most helpful in both surveys, sleep and stay-awake drugs, but by a smaller percentage of drivers in the second survey. In the first survey, more than three quarters of drivers reported using sleep to manage fatigue and just under half of these drivers selected it as one of the most helpful strategies, whereas for stay-awake drug use, only around one-third of drivers reported using it, but around half of them reported drug use as a most helpful strategy for managing fatigue. In the second survey, a very large percentage of drivers reported using sleep, but only one-third of them selected sleep as most helpful. For drug use, just over one driver in five reported using drugs and, again, one third of them reported it as a helpful approach to fatigue management.

Table 39: Strategies used at least sometimes by drivers in the first and second surveys to manage fatigue while driving and the percentage of drivers who use the strategies who also report them as most helpful.

Strategy currently used by drivers	First survey			Second survey		
	% reporting use at least sometimes	% of these rating it as helpful	*(%of total)*	% reporting use at least sometimes	% of these rating it as helpful	*(%of total)*
• Stopping to eat	n/a	-		69.0	10.7	*(7.4)*
• Sleep	78.2	45.9	*(35.9)*	86.7	32.4	*(28.1)*
• Rest	70.2	21.9	*(15.4)*	81.5	21.2	*(17.3)*
• Stopping for meal	63.2	14.8	*(9.4)*	70.7	18.1	*(12.8)*
• Eating while driving	49.2	14.2	*(7.0)*	45.9	7.0	*(3.2)*
• Caffeine drink	78.4	20.7	*(16.2)*	83.0	21.1	*(17.5)*
• Non-caffeine drink	38.5	6.0	*(2.3)*	47.4	7.8	*(3.7)*
• Smoking	47.0	20.0	*(9.4)*	48.7	21.5	*(10.5)*
• Drugs	31.7	53.3	*(16.9)*	22.3	31.1	*(6.9)*
• Kicking tyres and walking around	77.4	21.7	*(16.8)*	71.1	14.6	*(10.4)*
• Shower	54.0	15.2	*(8.2)*	69.6	17.3	*(12.0)*
• Music/radio	80.7	20.0	*(16.1)*	83.5	17.0	*(14.2)*
• CB Radio	70.3	22.9	*(16.1)*	65.6	10.2	*(6.7)*
• Singing	36.1	6.6	*(2.4)*	34.7	8.2	*(2.8)*
• Using ventilation	79.9	17.5	*(14.0)*	73.4	15.3	*(11.2)*
• Ignoring driving hours to finish a trip when close to home	n/a	-		66.7	7.9	*(5.3)*
• Other	10.6	n/a		4.8	18.8	*(0.9)*

3.1.6 Experience of dangers on the road and fatigue in the past year

Participants in the second survey were asked to report on their experiences of accidents on the road over the past year. Just over ten percent of drivers (11.7%) reported having at least one accident over the past 12 months. Of these, most involved property damage or injury (97.0%). Only a small percentage of drivers (19.8%) reported that fatigue, in their view, was a factor in their accident. Participants were also asked about their experience of a range of dangerous incidents on the road since the beginning of the year. As Table 40 shows most drivers reported never experiencing any of the dangers that they were asked about. Around one in five drivers reported nodding off or falling asleep while driving at least sometimes and about one in eight reported having a near miss. For both of these dangers a further nearly one-third admitted that it happened, but rarely. The percentage reporting running off the road was quite small, with only one in ten drivers reporting that it happened sometimes, and about double the number reporting that it happened rarely. Almost all drivers reported that they had not collided with something while driving over the past year.

Table 40: Reported experience of dangers when driving over the last year for participants of the second survey (%).

On-road danger	At least sometimes	Rarely	Never
• Nodding off	18.1	30.3	51.6
• Having a near miss	13.1	30.3	56.6
• Running off the road	9.0	22.0	69.0
• Colliding with something	4.0	8.0	88.0
• Other	6.0	3.8	90.2

3.1.7 Experience of breaking road rules and working hours regulations

3.1.7.1 Working hours regulations

Drivers in both surveys were asked about their experiences of working contrary to the working hours regulations and road rules. The results were very similar between the two surveys. With respect to the working hours regulations (see Table 41), there was a fairly even split between drivers who reported breaking working hours regulations on most or every trip and those who broke them only occasionally or very rarely. Nevertheless, in both surveys around one-quarter of drivers reported breaking working hours regulations on every trip. The most common reasons in the both surveys for breaking these rules were to do with the work-rest schedules and the problem of fitting them in with their life. The top three reasons were to return home, to do enough trips to earn a living and because of tight scheduling. Interestingly, a considerable number of drivers provided other reasons for breaking these regulations and almost half of these reasons were that the drivers felt the regulations were bad for fatigue management.

Table 41: Frequency and reasons for breaking working hours regulations (%).

Breaking working hours regulations	First survey	Second survey
Frequency:		
• Every trip	30.0	25.7
• Most trips	18.4	21.5
• On half the trips	8.1	9.7
• Occasionally	16.7	20.7
• Very rarely	23.9	22.5
• Never	2.9	n/a
Reasons:		
• Tight schedules	29.5	31.4
• Rewards or penalties for being late	5.7	7.6
• To get in early to get the next load	27.5	26.3
• To do enough trips to earn a living	46.2	36.5
• To return home	45.4	46.8
• To reach adequate rest facilities	26.6	26.2
• To keep your job	n/a	23.7
• Other	22.6	12.3

In an attempt to look in more depth at the possible pressures on drivers, a further analysis was conducted on the second survey results to compare drivers who breached the working hours regulations on at least half of their trips with drivers who reported doing so only rarely or occasionally (see Table 42). This analysis demonstrated that drivers who frequently breached the regulations were more likely to report all of the reasons especially the main reasons relating to scheduling and work organisation. Drivers who only rarely or occasionally breached were more likely to justify it on the basis that they needed to return home, the desire to maximise their break after the trip or because of the needs of livestock.

3.1.7.2 Road rules

Considerably fewer drivers admitted to breaking road rules than working hours regulations in both surveys (see Table 43). Only around one-quarter of drivers in both surveys reported breaking them on most trips and close to half of the drivers reported doing so very rarely. As for the working hours regulations, the main reasons given for breaking road rules were related to operational and scheduling problems of tight schedules, getting enough trips done and the pressures of loading and unloading.

Table 42: Comparison of reasons for breaking working hours regulations for drivers who do so frequently compared to those who do so only rarely or occasionally (%).

Reasons for breaking working hours regulations	Frequency of breaches	
	Rarely or occasionally	**Frequently**
• Tight schedules*	26.0	35.1
• Rewards/penalties for being early/late*	3.6	10.1
• To get in early to get the next load*	20.7	30.2
• To do enough trips to earn a living*	23.7	45.2
• To return home#	50.6	44.4
• To reach adequate rest facilities	28.7	24.6
• To keep your job*	12.7	31.2
• Other*:	8.6	14.7
Breakdown of "Other"	**% of Other** ***(% of total)***	**% of Other** ***(% of total)***
Regulations bad for fatigue management	27.6 *(2.4)*	50.0 *(7.4)*
Maximise (sleep) break at end of trip	17.2 *(1.5)*	2.7 *(0.4)*
Regulations are not practical	3.4 *(0.3)*	17.6 *(2.6)*
Demands of livestock	20.7 *(1.8)*	1.4 *(0.2)*

* χ^2 significant at $p<0.05$ # χ^2 significant at $p<0.10$

Table 43: Frequency and reasons for breaking road rules (%).

Breaking road rules	**First survey**	**Second survey**
Frequency:		
• Every trip	19.0	13.2
• Most trips	9.0	12.3
• On half the trips	4.3	5.6
• Occasionally	22.3	26.8
• Very rarely	41.3	42.1
• Never	4.2	N/a
Reasons:		
• Tight schedules	25.0	33.7
• Rewards or penalties for being late	4.3	9.3
• To get in early to get the next load	18.2	24.9
• To do enough trips to earn a living	28.6	30.0
• Because of fatigue	16.8	7.6
• Because of the effects of alcohol	0.0	0.0
• Because of the after-effects of stay-awake drugs	2.3	2.6
• Because of lack attention	n/a	17.0
• Other	35.7	24.6

3.1.8 Drivers views of the fatigue management policies and practices of their company and the government

Drivers in the second survey were asked a range of questions about how they view the management of fatigue by themselves, their company, the industry and the government. When asked how they feel that fatigue is managed in the industry at the moment, more than half of the drivers (53.4%) reported that they felt it was badly managed. In contrast, the vast majority of drivers (91.7%) reported that they managed fatigue well.

When asked what their company does, should and should not do to minimise fatigue for their drivers (See Table 44), nearly one-third of the participants reported that their companies allowed more time for sleep on the road and that they eased unreasonably tight schedules. On the other hand very small percentages (only around 10%) of drivers reported that their companies did two up driving or minimised night driving. In comparison, nearly three-quarters of the drivers responded that their companies should have more efficient loading/unloading, around two thirds reported that their pay should be increased and more than half reported that their companies should ease tight schedules, not have drivers loading and unloading and that they should allow more time for sleep on road. Most drivers also reported that their companies should not use two-up driving and just over half responded that their company should not minimise night driving.

The responses were analysed further by looking at the extent of discrepancy where the company uses the strategy, but drivers disagree with it. The largest discrepancies were found for two-up driving where more than one-third of drivers thought that their company that used two-up should not use it. Similarly, the strategies of allowing more time off between trips, more breaks during trips and minimising night driving were not supported by around one-third of participants in the second survey.

Table 44: Drivers views from the second survey regarding fatigue management strategies that their companies currently use, should use or should not use (%). The last column shows the percentage of drivers who believe that their company does use each strategy but who disagree with its use.

Strategies	Company strategy use			
	Does	**Should do**	**Should NOT do**	**DOES but SHOULD NOT**
• More information on fatigue management	22.6	56.8	21.6	20.3
• More efficient loading and unloading	28.7	73.5	8.6	15.4
• Not having to load/unload	21.1	57.9	23.8	19.5
• Two-up driving	10.1	17.1	65.0	39.0
• Changeover or staged driving	14.7	34.4	45.6	11.6
• Increase rates of pay for drivers	12.9	68.7	17.0	18.5
• Ease unreasonably tight schedules	30.7	62.1	14.2	20.4
• Minimise night driving	10.2	29.4	52.5	30.4
• Allow more time off between trips	28.5	49.4	27.4	37.8
• Allow more time for sleep on road	30.1	57.4	20.0	29.3
• Allow more breaks during trips	27.3	49.0	26.1	35.5

When asked about the fatigue management strategies currently used by government (see Table 45), relatively small percentages of drivers responded that the government used any of the strategies listed. Just under one in five of the drivers reported that the government employs strict enforcement of driving hours, stricter policing of drug use and slow vehicle lanes. Far more of the participants responded to the questions on the strategies that the government should and should not adopt. Nearly all of the drivers responded that the government should educate the public about trucks, improve the roads, and allow greater flexibility in driving hours regulations, especially more flexibility to finish trips when just out of regulated driving hours. The only strategies for government that were not favoured by the majority of participants were stricter driving hours and stricter enforcement of driving hours. Only around one-third thought the government should permit the use of stay-awake drugs although around one third of drivers thought that the government should not use stricter policing to prevent stay-awake drugs.

Table 45: Drivers views from the second survey regarding fatigue management strategies that governments currently use, should use or should not use (%). The last column shows the percentage of drivers who believe that governments do use each strategy but who disagree with its use.

Strategies	Government strategy use			
	Does	Should do	Should NOT do	DOES but SHOULD NOT
• More information on fatigue management	13.8	64.1	19.7	31.8
• Stricter policing to prevent stay-awake drugs	19.2	45.2	39.8	50.7
• Stricter (shorter) driving hours	10.1	12.2	76.3	83.3
• Permitting stay-awake drug use	2.5	36.1	53.1	66.7
• Stricter enforcement of current driving hours	19.8	20.9	62.9	72.6
• Better off-road facilities	10.6	85.0	5.2	16.0
• More flexibility to finish trips when just out of hours	4.5	88.3	3.7	4.3
• Greater flexibility in driving hours regulations	4.0	86.4	6.6	16.7
• Improvements to roads	12.8	92.1	1.4	2.9
• Slow vehicle lanes	18.5	80.9	4.7	3.1
• Depot to depot driving	7.5	69.6	17.0	0
• Uniform national driving hours and road rules	10.3	82.9	7.7	8.9
• Making freight schedulers accountable	7.5	83.6	7.1	0
• Educating public about trucks	6.2	92.6	1.4	0
• Permit industry self-regulation	5.4	58.9	25.9	22.5

Analysis of the discrepancies between government strategies in use and driver views about strategies that should be used showed that the majority of drivers disagreed with stricter driving hours strategies, stricter enforcement of current driving hours and permitting stay-

awake drug use, although, as before a significant percentage (around half) did not agree with stricter policing to prevent stay-awake drugs.

3.2 Effect of Characteristics of Employment on Work, Rest and Fatigue

The results from the second survey were analysed further on the basis of the driver's type of employment. The dataset was divided initially into employees and owner drivers. These groups were then subdivided further according to the size of the company for which employees worked; large (> 50 trucks), medium (11-50 trucks) and small (≤ 10 trucks) companies. Owner drivers were subdivided further into independent owner drivers and contract owner drivers where contract owner drivers own their trucks but work primarily for one company on contract, whereas independent owner drivers own their truck and work for a wide range of companies.

3.2.1 Description of drivers in each employment category

Table 46 shows the characteristics of the drivers in each employment category. These results indicate that the small number of female drivers were evenly distributed across all categories. Large company employees were slightly more likely to be divorced or otherwise separated than other drivers, but the differences between the groups were not very large. Small company employees were less likely to have children compared to the other categories whereas large company employees were most likely to have children. Employee drivers, particularly small company employees, were also more likely to be younger than large company employees and owner drivers and probably as a consequence, had less driving experience.

Table 46: Demographic characteristics of drivers in each employment category.

	Employee drivers			Owner drivers	
	≤10 trucks (n=365)	**11-50 trucks (n=204)**	**>50 trucks (n=110)**	**Indep Owner (n=141)**	**Contract Owner (n=162)**
Sex:					
• Male	98.4	100.0	99.1	98.6	98.8
• Female	1.6	0.0	0.9	1.4	1.2
Marital status and family:					
• Married or defacto	65.6	70.1	67.3	69.5	75.2
• Single	22.2	18.1	14.5	19.1	12.4
• Divorced, separated or widowed	12.3	11.8	18.2	11.3	12.4
• % with children*	74.0	79.4	86.4	80.1	83.8
• Number of children	2.7	2.8	2.8	2.7	2.8
Age and experience:					
• Age (yrs)*	37.5	39.1	41.4	42.0	43.3
• Driving experience (yrs)*	15.2	16.9	20.3	19.7	20.8

* test of group differences significant at $p<0.05$

3.2.1.1 Sleepiness tendencies

The employment category groups did not differ significantly on the tendency to sleepiness as measured on the Epworth Sleepiness Scale (Johns, 1991). There was no statistically significant difference in average scores on the Epworth scale between the employment

categories nor on the distribution of moderate and high Epworth Scale scores since only a few drivers in each subcategory showed high scores. It seems, therefore, that any differences between subcategories in their experience of fatigue are not due to inherent personal sleepiness (see Table 47).

Table 47: Results of the Epworth Sleepiness Scale for participants in each of the employment categories for the second survey.

	Employee drivers			Owner drivers	
	≤10 trucks (n=340)	**11-50 trucks (n=194)**	**>50 trucks (n=103)**	**Indep Owner (n=136)**	**Contract Owner (n=150)**
• % classed with moderate or high sleepiness	17.7	23.7	13.6	16.9	15.3
• Mean Epworth score (/24)	7.0	7.4	7.0	7.0	6.7
% with moderate or higher change of dozing when:					
• Sitting and reading	31.5	26.8	39.4	32.1	28.3
• Watching TV	51.6	53.8	48.1	50.0	45.1
• Sitting inactive in public	13.9	19.0	8.7	13.9	10.4
• Car passenger for 1 hour	29.3	30.8	27.0	21.3	23.7
• Lying down and resting in the afternoon	75.7	80.5	80.0	80.3	80.5
• Sitting and talking	1.8	2.6	1.0	2.2	2.6
• Sitting after lunch with no alcohol	13.3	15.4	10.6	16.9	15.2
• Car stopped in traffic	0.6	0.0	1.0	1.5	1.4

3.2.2 Work characteristics of drivers in each employment group

Comparison of the categories in terms of the type of payment they receive showed that the two owner driver subgroups were far more likely to negotiate their pay for each load than were employee drivers. Of the drivers who did not negotiate their rate for each load, independent owners were the least likely, and contracted owners the most likely, to have on-going contracts for some or all of their loads (Table 48).

For all categories of employment, the main type of payment was Trip rate per km or per tonne or volume. Owner drivers were also commonly paid by flat rates per load. A small percentage of company employees, especially from large companies were paid an hourly rate.

Table 48: Payment arrangements for employee and owner drivers participating in the second survey (%).

	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Negotiate rate for some or all loads	13.6	5.9	3.7	40.0	29.0
• If not, ongoing contracts	47.4	42.0	36.5	24.4	53.5
Usual rate:					
• Hourly*	8.2	9.3	14.5	1.4	2.5
• Flat day	2.7	2.9	0.9	1.4	2.5
• Day plus overtime	1.4	1.0	0.9	0.7	0.6
• Week plus overtime	6.6	5.9	6.4	0.7	4.3
• Flat rate per load*	12.3	7.8	3.6	29.1	21.6
• Trip rate per km or tonne	62.7	72.1	76.4	66.7	71.0
• Other*	8.2	4.4	0.9	2.8	1.9

* test of group differences significant at $p<0.05$

Table 49: Type of freight usually carried for employee and owner drivers and their subcategories, showing percentage of drivers reporting for each type of freight.

Freight type	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Livestock*	5.5	6.4	14.5	4.3	4.9
• Refrigerated*	21.1	24.8	37.3	18.6	23.5
• Dangerous materials*	9.6	18.8	18.2	5.0	6.2
• Farm produce	20.3	21.3	25.5	23.6	13.6
• Other bulk#	12.9	12.9	4.5	14.3	16.0
• Machinery*	12.3	21.8	7.3	20.0	10.5
• Building materials	14.5	16.8	6.4	15.7	16.7
• Groceries	15.9	19.8	23.6	17.9	16.0
• Manufactured goods*	11.2	14.4	4.5	16.4	11.1
• General freight*	52.3	55.0	40.9	60.0	37.7
• Car carrying#	2.5	3.5	6.4	2.1	6.8
• Express freight	18.4	23.3	19.1	17.1	15.4
• Other* (inc. removals)	6.0	6.9	0.9	2.9	6.8

* χ^2 significant at $p<0.05$ # χ^2 significant at $p<0.10$

The employment groups differed in terms of the type of freight carried (Table 49). The results show that the majority of drivers in all employee and owner driver subgroups reported carrying general freight, although independent owner drivers and small and medium company

employees most commonly did so. Large company employees were more likely than other drivers to carry livestock and refrigerated freight. Dangerous goods were mostly carried by large and medium companies whereas large company drivers were least likely to carry other bulk and manufactured goods. Car carrying was mostly done by large company and contracted drivers, whereas machinery was least likely to be carried by these groups.

3.2.3 Driving experience on last trip

3.2.3.1 Start and finish points for drivers in each employment category

Table 50 shows that the majority of drivers in each employment group started and finished their last trip in the eastern states. However, employees of larger companies were more likely to do so than other drivers. The low number of drivers in all groups who completed their trips within the central and western states probably reflects the fact that surveys were not conducted in WA.

Table 50: Distribution of employment types in the second survey by the region in which they worked on their last trip (%).

	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
• Only in eastern states[1]	66.8	64.6	80.8	64.4	69.5
• Only in central and western states[2]	7.8	6.1	5.8	6.7	9.1
• Mixed start/finish states	25.4	29.3	13.5	28.9	21.4

[1] NSW, VIC, QLD [2] WA, NT, SA

3.2.3.2 Freight carried on last trip

The distribution of the type of freight carried on the last trip was very similar to that reported when drivers were asked about their usual freight. This indicates that there is a reasonable amount of consistency in the type of freight carried by each sector or the road transport industry, for example, that car carrying is done mainly by drivers of large companies or drivers contracted to them while building materials and groceries are not usually carried by large company drivers (see Table 51). These results also suggest that the last trip reported in this survey is reasonably representative of what drivers normally do, at least in terms of the freight they were carrying.

Table 51: Type of freight carried on the last trip for employment subcategories (%).

Freight type	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Livestock*	3.1	4.1	14.8	2.2	2.5
• Refrigerated*	13.7	15.7	25.0	14.0	19.6
• Dangerous materials	4.8	4.6	6.5	1.5	3.2
• Farm produce	11.7	12.2	12.0	9.6	7.0
• Other bulk#	6.6	6.6	3.7	9.6	12.0
• Machinery	5.1	6.1	1.9	4.4	8.2
• Building materials*	9.1	5.1	0.9	11.0	10.1
• Groceries#	6.8	9.1	12.0	4.4	4.4
• Manufactured goods	6.8	7.1	3.7	11.8	9.5
• General freight*	26.8	32.5	16.7	32.4	18.4
• Car carrying*	2.0	2.0	6.5	1.5	5.7
• Express freight#	9.1	6.6	3.7	5.1	3.2
• Other (inc. removals)	6.5	5.1	4.6	5.1	6.3

* χ^2 significant at $p<0.05$ # χ^2 significant at $p<0.10$

3.2.3.3 Type of driving on last trip for each employment category

Table 52 shows the pattern of types of driving used by drivers in each employment type who participated in the second survey. The results show that virtually all drivers whether owner driver or employee driver operated as a single driver. Independent owner drivers were most likely to do two up, followed by drivers employed by small companies and contracted owner drivers. Large companies did not have any two-up drivers participating in this survey, suggesting that this is not a common form of driving for them, at least in the states sampled. Only a very small percentage of all the drivers in the survey were doing staged or changeover driving. Where they were represented in the survey, they were mainly from large or small companies, although a very small percentage of independent owner drivers were operating in a staged driving mode.

Table 52: Distribution of different types of driving for each employment type in the second survey (%).

	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Single drivers	92.6	96.5	98.2	91.2	95.6
• Two-up drivers	5.7	3.0	0.0	8.0	4.4
• Staged drivers	1.7	0.5	1.8	0.7	0.0

Note: χ^2 comparison of groups significant at $p<0.05$ but test assumptions violated

3.2.3.4 Scheduling on last trip by employment category

As shown in Table 53, employee drivers were slightly more likely to be working to a fixed schedule than were owner drivers. This was especially so for employees of small and medium companies. Regardless of whether or not they had a fixed schedule, drivers were also asked for other reasons why they wanted to arrive by a particular time. Across the sub-categories, the three main motivators were to maximise sleep at the end of the trip, to meet loading and unloading demands, and to avoid peak traffic. Employees of medium companies and independent owners also cited personal commitments. The main difference between the subcategories was that sleep was a major motivator for employee drivers to reach their destination by a particular time. However, sleep was not among the most important motivators for owner drivers.

Table 53: Motivators to complete the trip for each employment type in the second survey (%).

	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
• Working a fixed schedule[#]	39.1	38.4	33.6	29.0	28.8
• Own reasons for arrival ETA	38.3	37.1	26.9	38.8	40.0
• Motivation to arrive at a specific time	Sleep (22.3%)	Sleep (27.6%)	Avoid peak traffic (33.3%)	Un/load (45.2%)	Un/load (30.9%)
	Un/load (21.4%)	Avoid peak traffic (27.6%)	Sleep (19.0%)	Avoid peak traffic (31.0%)	Avoid peak traffic (21.8%)
	Avoid peak traffic (19.4%)	Social & family life (19.0%)	Un/load (19.0%)	Social & family life (11.9%)	Other (21.8%)

χ^2 comparison of groups significant at $p<0.1$

Drivers were asked to estimate their cruising speed on the open road on their last trip with respect to the speed limit. Employees of small and medium companies were quite likely to report travelling above the speed limit and owner drivers were only slightly less likely, however very few employees of large companies reported exceeding the speed limit on their last trip (Table 54).

Table 54: Average speed and the average distance covered in the last trip by employee and owner drivers in the second survey. Data from the first survey are included (in brackets) for comparison.

	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
• % drivers travelling at or below the speed limit	78.8	79.3	91.7	83.1	83.2
Distance covered:					
• % < 700km	13.7	12.6	19.6	10.5	22.1
	(12.4)	*(14.9)*	*(43.8)*	*(16.8)*	*(12.3)*
• % 700-1500km	50.5	47.1	52.9	41.9	42.2
	(57.6)	*(57.5)*	*(47.1)*	*(48.5)*	*(54.7)*
• % > 1500km	35.8	40.2	27.5	47.6	35.7
	(30.0)	*(27.6)*	*(9.1)*	*(34.7)*	*(33.0)*
• Average distance (km)	1713	1875	1320	1815	1554
	(1480)	*(1383)*	*(887)*	*(1589)*	*(1552)*

The employment sub-categories also differed on the distance travelled in their last trip. A larger percentage of independent owner drivers did the longest trips compared to the other groups and more employees of large companies and contracted owner drivers did the shortest trip. For all groups, except independent owner drivers, most of the drivers did between 700 and 1500 kilometres on their last trip. In contrast, the majority of the independent owner drivers did more than 1500 kilometres on their last trip. A larger percentage of contracted owner drivers and large company employees did less than 700 kilometres on their last trip than the other subgroups. Analysis of the average distance travelled by drivers in each subcategory indicated statistically significant differences ($F_{(4,861)}$=2.84,p=0.023) such that drivers from medium-sized companies averaged the greatest distance and large company employees travelled the smallest distances. Comparing the distances reported for second survey trips with those reported in the first survey, it is clear that trips have increased in length for drivers in all employment sub-categories except contracted owner drivers.

3.2.3.5 Work during last trip for each employment category:

Looking at the duration of the last trip for each of the employment subcategories (see Table 55) showed differences between them. Comparing the employment categories on the duration of the last trip showed the same pattern as seen for the distance travelled. More independent owner drivers did trips of the longest duration compared to the other subcategories although this difference was not statistically significant. On the other hand the percentage of time spent driving on the last trip did differ across employment types ($F_{(4,797)}$ =3.89, p=0.004), with independent owner drivers showing the shortest driving time for each level of trip duration. There was also a significant difference in the time spent driving for each level of trip duration ($F_{(2,797)}$=135.08, p<0.001). A greater percentage of shorter trips was spent in driving than for the longest trips. For trips lasting longer than 30 hours duration only about half of the trip was spent driving compared to nearly all of the trip for durations less than 12 hours. Analysis of the percentage of time spent working on the last trip showed a similar significant effect of trip duration where a greater proportion of the shortest trips was spent working ($F_{(2,536)}$=99.7,p<0.000), but there were no differences between employment subcategories.

Table 55: Distribution of total trip time and the mean percent of the last trip spent driving and working (including driving) for the employment categories in the second survey. 'Trip' figures are the percentage of drivers doing trips of each duration. '*Drive*' figures are the average percent of the trip time spent driving and 'Work' figures are the average percent of the trip time spent working (including driving) by drivers doing trips of each duration.

Trip duration		Employee drivers									Owner drivers					
		≤10 trucks			11-50 trucks			>50 trucks			Indep Owner			Contract Owner		
		Trip	*Drive*	Work	Trip	*Drive*	Work	Trip	*Drive*	Work	Trip	*Drive*	Work	Trip	*Drive*	Work
• <12:00hrs	%	20.6	*88.4*	88.5	20.1	*90.9*	87.6	22.4	*84.8*	89.2	12.3	*80.3*	88.4	24.5	*83.9*	*82.6*
	N	59	*59*	48	34	*34*	24	22	*22*	15	15	*15*	11	35	*34*	*30*
• 12:00-29:59hrs	%	44.6	*68.3*	75.2	42.0	*72.8*	77.1	46.9	*69.9*	71.2	41.8	*60.8*	69.6	43.4	*68.7*	*73.3*
	N	128	*128*	98	71	*70*	48	46	*46*	35	51	*51*	40	62	*61*	*44*
• >30:00hrs	%	34.8	*54.8*	59.9	37.9	*56.5*	59.6	30.6	*52.7*	56.0	45.9	*50.7*	56.0	32.2	*54.4*	*62.4*
	N	100	*94*	52	64	*59*	35	30	*29*	15	56	*52*	32	46	*44*	*24*
• >30:00hrs (from first survey)	%	34.9			30.0			13.1			45.2			34.0		
	N	68			39			43			42			35		

Table 56 shows the average duration of the last trip and the duration of driving time on the last trip. There were statistically significant differences in the duration of the last trip such that independent owner drivers spent longer on the last trip than drivers for large companies, small companies and contract owners ($F_{(4,818)}$=3.66,p<0.006). The average duration of driving also differed between the subcategories such that independent owner drivers and medium-sized company employees spent longer driving than did large company employees ($F_{(4,827)}$=2.42,p<0.047).

Further analysis of activities on the last trip with respect to the amount of time spent working and time off is shown in Table 56. This analysis shows again that independent owner drivers were different to all other employment groups. Independent owner drivers had a different pattern or work and rest such that as described above, their trips were considerably longer than the other driver categories. Even though they spent a smaller percentage of time actually working, the average total work hours was still longer than for the other groups, and their average work hours per day was not different from the other groups. As their trips were longer, independent owner drivers also showed a larger number of periods of work, longer nonwork hours and a slightly larger number of blocks or periods of nonwork in their trip. In addition, independent owner drivers did not show longer average work hours per day nor a greater number of blocks of work for each day. The main feature of the trips for independent owner drivers, therefore, seems to be that their trips cover greater distances and are, as a consequence, longer than the trips for drivers in the other employment categories. The patterning of work and rest in a day in the last trip, and in the last trip as a whole, is very similar across employment groups.

The results on the relationship between type of employment and experience of night work on the last trip are shown in Table 57. There were no differences between employment types in the percentage who work in the midnight to dawn period, the total hours worked over this period, the total number of blocks of work involving this period or the percentage of the trip or working time spent working between midnight and dawn. The results showed that on average drivers from all employment groups did just over four hours of night work on the last

trip, usually in one block. This constituted about 18 percent of the hours they spent doing the trip and between one-fifth and one-quarter of their working time.

Table 56: Patterns of work and nonwork activity on last trip for second survey participants showing means.

	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
Averaged across trip:					
• Average duration of last trip (Direct question, n=819)	33:44	36:59	26:30	44:25	31:44
• Average duration of driving on last trip	18:47	21:13	15:50	21:21	17:36
• % hours driving	68.00	70.68	68.16	58.83	67.90
• Average duration of last trip (Diary estimate, n=597)	31.61	34.23	27.43	38.14	28.59
• % hours working	73.77	72.72	72.24	65.78	72.33
• Total work hours	20.41	21.50	18.01	22.15	17.83
• Total nonwork hours	11.07	12.94	9.27	15.98	10.84
• Total number of work blocks	4.49	4.43	4.33	4.98	4.11
• Total nonwork blocks	3.43	3.41	3.25	3.98	3.04
Per day:					
• Average work hours	8.75	8.36	8.37	8.68	8.51
• Average nonwork hours	3.68	3.96	3.66	5.12	3.83
• Average number work blocks	1.94	1.78	2.05	2.01	1.99
• Average number nonwork blocks	1.41	1.27	1.44	1.52	1.39

Table 57: Patterns of night work (00:00 to 06:00) across the last trip for employment subcategories.

Night work	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
			%		
• Worked between 00:00 and 06:00	73.5	78.0	70.0	68.2	63.6
For drivers who worked between 00:00 and 06:00:			**Mean *(SD)***		
• Total night work hours	4.3 *(3.2)*	4.8 *(3.0)*	4.3 *(3.6)*	4.8 *(3.6)*	3.5 *(2.6)*
• Total number of night work blocks	1.3 *(1.1)*	1.3 *(1.1)*	1.2 *(1.1)*	1.2 *(1.2)*	0.9 *(0.9)*
• % trip hours involving night work	18.3 *(13.3)*	19.3 *(13.0)*	18.1 *(14.2)*	15.1 *(11.4)*	16.7 *(11.4)*
• % work hours involving night work	23.4 *(14.4)*	25.9 *(16.0)*	24.7 *(15.8)*	21.3 *(12.5)*	22.3 *(14.1)*

Analysis of other activities for each employment category:

Around one-quarter of the drivers in each category did yard work as part of their last trip (see Table 58). Independent owner drivers who did yard work spent significantly more time doing it compared to the other groups. They spent nearly seven hours on average for the last trip. In comparison, drivers for large companies did only around two hours of yard work for the last trip which was the lowest amount for any of the employment categories.

Table 58: Participation in non-driving work activities on the last trip by drivers in each employment category showing the percentage participating in each activity and the average time spent doing the activity (in italics).

Activity		Employee drivers			Owner drivers	
		≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Yard work at start or end of last trip*	%	24.9	31.4	25.5	22.2	28.7
	*hrs**	*4:08*	*4:21*	*2:23**	*6:53**	*3:40**
• Un/load at start or end of last trip*	%*	71.3	67.7	54.6	68.0	70.2
	*hrs**	*3:21**	*3:09**	*2:29**	*4:51**	*3:37*
• Un/load during trip	%	22.7	28.4	29.4	24.3	21.7
	# times	*3.7*	*2.9*	*2.3*	*4.3*	*3.7*
• Waiting for un/load at start or end of last trip	%	44.8	41.7	35.2	48.4	45.7
	hrs	*3:29*	*2:53*	*2:56*	*4:50*	*3:18*

* test for group differences significant at $p<0.05$

In contrast, the majority of drivers in each category were involved in loading and unloading on their last trip although large company drivers were least likely to do loading and unloading. Large company drivers also spent least time doing loading and unloading activities on their last trip. Independent owner drivers spent nearly five hours loading and unloading which is more time than any of the employee driver categories.

Similar results were seen for differences between the categories on the amount of time spent waiting to load or unload. Again, independent owner drivers were more likely to have to wait for a load and large company drivers were least likely. Furthermore, independent owner drivers spent more time waiting to load/unload than any of the employer categories although these differences were not statistically significant.

Examination of the reasons reported by drivers for the delay in loading and unloading on the last trip (see Table 59) shows that for all categories the most common reason was waiting for other trucks to load or unload followed by the freight not being available. The only differences between the categories was in reporting that they were delayed because the depot was not open. Employees of small companies were most likely and contract owner drivers were least likely to report that the depot not being open delayed them on the last trip.

Table 59: Reasons for delays in loading or unloading on the last trip for each employment category.

Reasons for delays	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Depot not open*	12.2*	9.6	6.4	7.4	3.2*
• Waiting for other trucks to un/load	34.6	28.8	31.5	36.8	27.2
• Freight not available	17.3	14.6	17.6	18.4	15.2
• Machinery not available	4.0	4.1	1.9	5.9	8.9
• Poor booking procedures	8.2	7.6	4.6	8.1	7.6
• Other	5.7	4.6	10.2	3.6	3.8

* Groups differ at $p<0.05$

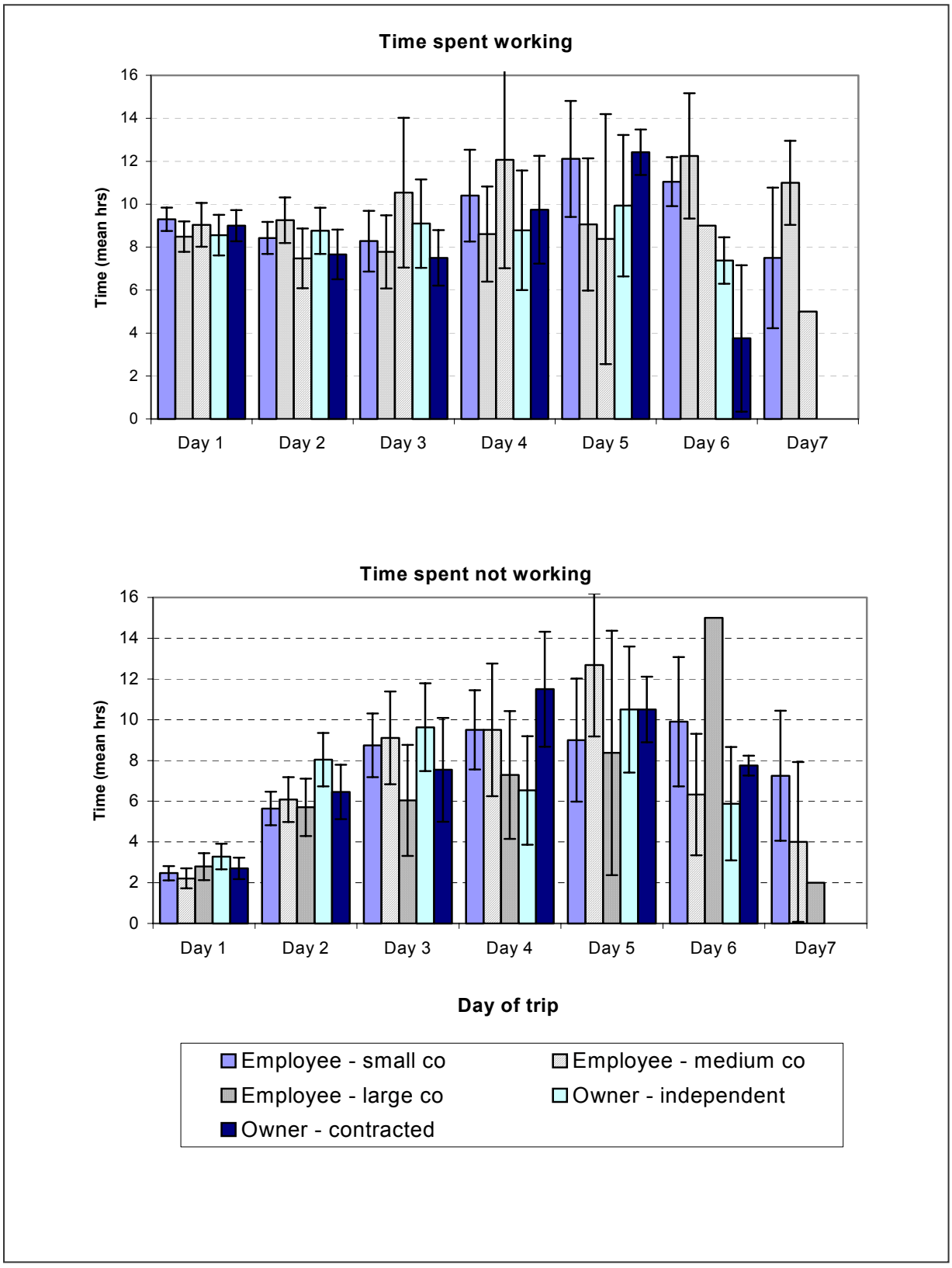
3.2.3.6 Fatigue experiences on the last trip for each employment category

The fatigue experiences of each of the categories of employment were very similar (see Table 60). Just under half of the drivers in each category reported feeling fatigue on the last trip. The categories differed, however, in the ratings of fatigue at the beginning of the trip. Owner drivers were less likely to report that they were very fresh at the start of the trip compared to employee drivers. The employment categories were very similar in how long fatigue lasted throughout the last trip. The categories were also similar in the average amount of fatigue experienced per day in their last trip, and in the number of periods of fatigue experienced in the trip.

Table 60: Pattern of fatigue experiences across the last trip for different employment types in the second survey.

	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
% reporting fatigue on the last trip	46.9	45.9	42.2	43.5	41.5
% at beginning of the last trip feeling:					
Quite fresh	35.1	26.5	31.2	46.0	44.2
Very fresh	44.1	52.6	50.5	37.2*	36.5*
Averaged across trip:					
% of trip in which fatigue reported	6.08	8.10	5.78	5.77	5.32
Total hours reported fatigue	1.88	2.42	2.15	1.96	1.41
Total number fatigue blocks	0.87	0.91	1.00	0.94	0.74
Per day:					
Average hours fatigue	0.79	0.96	0.81	0.78	0.65
Average number of fatigue blocks	0.37	0.37	0.40	0.40	0.36

Figure 6: Amount of work and nonwork across the days of the last trip for each employment subcategory in the second survey.



As shown in Figure 6, there was a change in the amount of time spent working with increasing time into the trip and this varied according to employment type to some extent. All company drivers and contract owner drivers showed an increase of one to two hours work time by the third or fourth day of the trip. It appears that the drivers in these groups started their trips with moderate length work periods on the first two days, but around day three, the length of the work day increased considerably. This change is likely to be due to the need to finish their trips and perhaps to make up time. Only independent owner drivers did not show this pattern. They showed very similar length of working time across all of the days that they were working, perhaps because they are able to organise themselves more than the other drivers can.

The number of fatigue periods mirrors the patterns of work time over the last trip (see Figure 7). Drivers reported feeling more periods of fatigue in the later days of the trip than in the earlier ones. It seems that the longer work periods at this time were associated with more feelings of fatigue. Consistent with the work time findings, independent owner drivers did not show increases in the number of periods of fatigue over the days of the last trip.

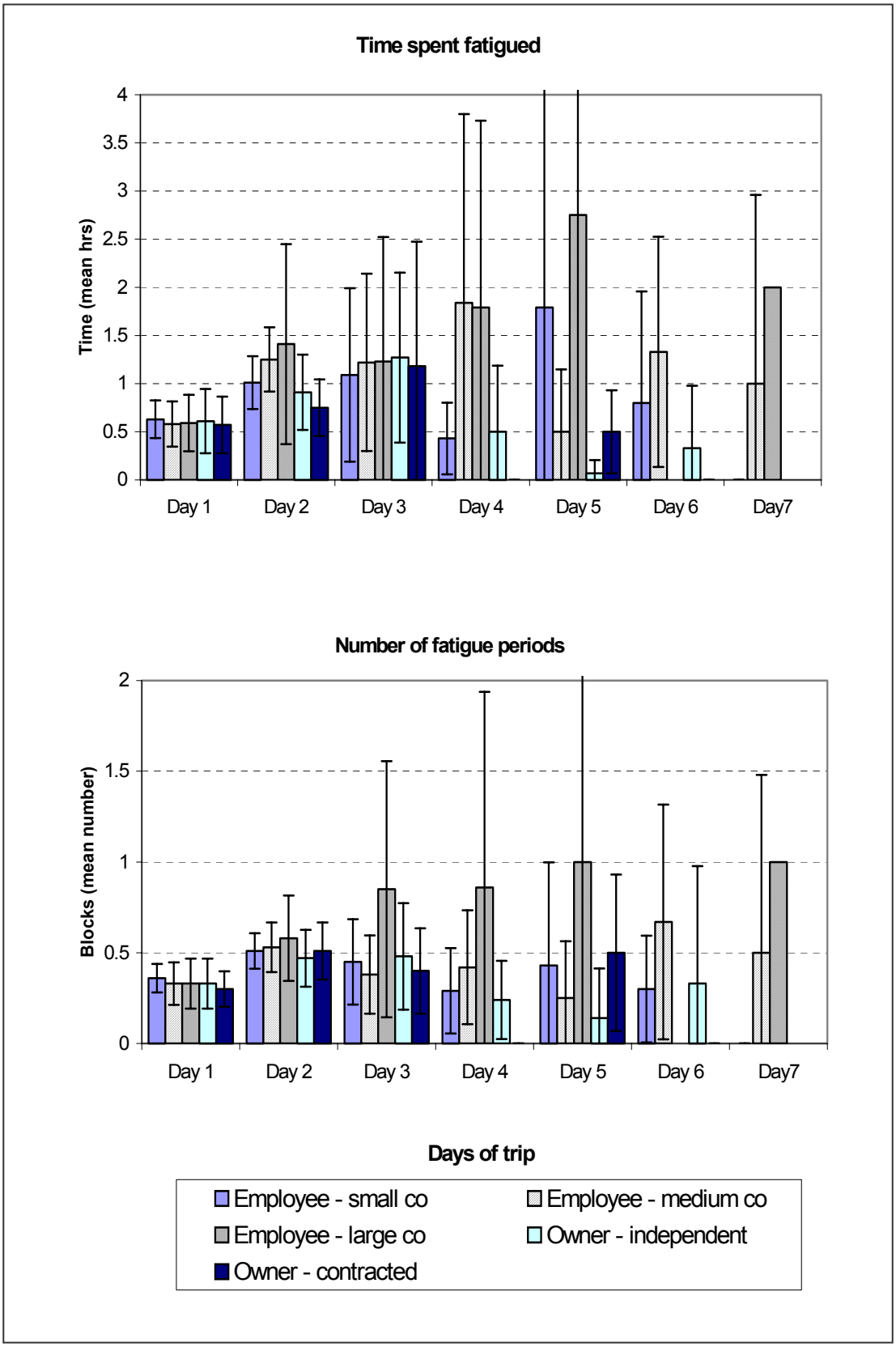
3.2.3.7 Experience of dangerous occurrences on last trip

Investigation of the drivers' reports of dangerous occurrences encountered on their last trip shows no significant differences between employment categories. For all categories, the most common occurrences were crossing lane lines and, perhaps not surprisingly, the least common was colliding with something and running off the road (Table 61).

Table 61: Reports of potentially dangerous occurrences on the last trip reported by drivers in each employment category.

Types of occurrences	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Nodding off	5.8	3.7	7.8	7.9	2.8
• Having a near miss	4.4	7.5	4.0	3.9	5.5
• Running off the road	3.8	2.2	2.0	3.2	0.7
• Crossing lane lines	12.5	11.6	10.8	12.4	8.8
• Over/under steering	4.4	6.5	2.0	7.2	4.8
• Late braking	4.7	5.4	3.0	0.8	2.8
• Colliding with something	1.3	1.1	2.0	0.8	0.7
• Other	2.3	3.0	2.5	2.1	4.2

Figure 7: Amount of fatigue experienced across the days of the last trip for each employment subcategory in the second survey.



3.2.3.8 Activities in the 10 hour period before the last trip

Drivers in each of the employment categories reported a similar combination of activities in the ten hour period prior to their last trip (see Table 62). There were no differences in the amount of time spent sleeping, loading/unloading, yard work or driving light or heavy vehicles. The employment categories differed, however in the amount of resting and relaxing and the amount of time spent checking or repairing their vehicle. Drivers for small companies spent least time relaxing and resting during the ten hour period and contract owner drivers spent the most. Medium and large company drivers spent the least amount of time checking or repairing heavy vehicles whereas independent owner drivers spent the most time.

Table 62: Activities reported by drivers in each of the employment categories during the 10 hours leading up to their last trip.

Activity	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Sleeping	5:49	5:43	6:15	5:04	5:25
• Resting/relaxing (but not sleeping)*	2:12 *	2:55	2:26	2:57	3:03*
• Checking or repairing heavy vehicle*	0:12	0:08*	0:06*	0:25*	0:17
• Loading/unloading heavy vehicle	0:20	0:13	0:18	0:31	0:19
• Other yard work	0:11	0:06	0:00	0:12	0:09
• Driving light vehicle	0:07	0:08	0:03	0:04	0:08
• Driving heavy vehicle	0:42	0:21	0:37	0:31	0:26

* test of group differences significant at $p<0.05$

Table 63: Distribution of work, nonwork and sleep over the past week for each employment category. Data are presented separately for drivers with complete work and nonwork data (A) and for the subset of these drivers with complete sleep data (B).

Mean (SD) time spent working, not working, and sleeping last week	Set of drivers	Employee drivers			Owner drivers	
		≤10 trucks	11-50 trucks	>50 trucks	Indep	Contract
• Number of drivers involved	A	94	49	19	34	51
	B	49	23	13	28	35
• Total work hours per week	A	54.2 *(22.4)*	59.7 *(21.6)*	50.1 *(20.1)*	50.3 *(19.0)*	57.7 *(26.6)*
	B	56.3 *(23.6)*	61.6 *(22.3)*	53.3 *(18.7)*	53.2 *(19.5)*	62.2 *(27.5)*
• Total nonwork hours per week	A	113.8 *(22.4)*	108.3 *(21.6)*	117.9 *(20.1)*	117.8 *(19.0)*	110.3 *(26.6)*
	B	111.7 *(23.6)*	106.4 *(22.3)*	114.7 *(18.7)*	114.8 *(19.5)*	105.8 *(27.5)*
• Total sleep hours per week	A	45.2 *(20.1)*	43.7 *(17.8)*	45.4 *(16.8)*	53.5 *(12.3)*	47.7 *(13.8)*
	B*	57.4 *(10.8)*#	52.8 *(12.7)*	52.3 *(9.6)*	56.6 *(9.0)*	50.3 *(13.5)*#
• Total work blocks per week	A	10.2 *(4.7)*	11.0 *(4.1)*	11.1 *(5.3)*	10.5 *(4.3)*	11.9 *(5.8)*
	B	11.3 *(4.9)*	11.3 *(3.4)*	12.7 *(5.5)*	10.9 *(4.2)*	13.1 *(5.5)*
• Total nonwork blocks per week	A	11.0 *(4.8)*	11.7 *(4.2)*	11.5 *(5.2)*	11.4 *(4.3)*	12.7 *(5.8)*
	B	12.1 *(4.9)*	12.0 *(3.7)*	13.0 *(5.3)*	11.7 *(4.3)*	13.8 *(5.4)*
• Total sleep blocks per week	A	6.9 *(2.5)*	6.8 *(3.1)*	7.5 *(2.7)*	7.8 *(1.6)*	7.6 *(1.8)*
	B	8.3 *(1.6)*	7.5 *(0.8)*	8.5 *(1.5)*	8.0 *(1.4)*	8.1 *(1.4)*
• < 39 hours worked last week (%)	A	25.5	14.3	31.6	29.4	23.5
	B	22.4	17.4	23.1	21.4	14.3
• 39 – 72 hours worked last week (%)	A	51.1	57.1	52.6	52.9	56.9
	B	49.0	52.2	61.5	57.1	60.0
• >72 hours worked last week (%)	A	23.4	28.6	15.8	17.6	19.6
	B	28.6	30.4	15.4	21.4	25.7

* Test for group differences significant at p<0.05 # Significant at p<0.10

3.2.4 Experiences over the past week for drivers in each employment category

The distribution of work, nonwork and sleep over the past week is shown in Table 63 for drivers with complete work and nonwork data and separately for those who also recorded complete sleep information. There were no significant differences between any of the employment categories for the total hours or the number of blocks of work or nonwork over the past week. Most drivers did between 40 and 72 hours work in the past week, but around one-fifth of the drivers in most employment groups reported doing less than 40 hours.

There were no significant differences between the employment categories in the number of sleeps taken in the last week, with the average being just over one per day. There was evidence, however, that small company employees obtained more hours of sleep overall than contracted owners. On average the difference was about 7 hours. As might be expected, this result was only apparent when drivers with incomplete sleep records were excluded.

There were no significant differences between any of the employment groups on the pattern of night work involving work between midnight and dawn (see Table 64). The greater majority of all employment groups did some work over that period at some time over the last week. On average between approximately eight and ten hours of work was done in the midnight to dawn period in between two to three blocks. Night work represented a small percentage of the work week, but a considerably larger percentage of the hours worked at around 16 percent.

3.2.5 Experience of fatigue while driving in general for each employment category

Drivers were asked about the frequency with which they experience fatigue while driving (see Table 65).

Table 64: Patterns of night work (00:00 to 06:00) across the last week for employment subcategories in the second survey.

Night work	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
			%		
• Worked between 00:00 and 06:00	73.4	81.6	84.2	82.4	72.5
For drivers who worked between 00:00 and 06:00:			**Mean *(SD)***		
• Total night work hours	9.4 (6.9)	10.0 *(8.3)*	7.9 *(4.8)*	7.5 *(5.8)*	9.0 *(8.9)*
• Total number of night work blocks	2.4 *(2.2)*	2.6 *(2.2)*	2.6 *(2.0)*	2.3 *(2.0)*	2.4 *(2.3)*
• % week involving night work	5.6 *(4.1)*	5.9 *(4.9)*	4.7 *(2.9)*	4.5 *(3.4)*	5.3 *(5.3)*
• % work hours involving night work	16.1 *(10.6)*	16.1 *(11.2)*	16.7 *(8.0)*	16.1 *(12.8)*	14.6 *(12.3)*

Table 65: Frequency of experiencing fatigue in general for drivers in each of the employment categories.

Frequency of fatigue	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• On every trip	7.5	10.1	5.6	7.8	5.7
• On most trips	9.7	8.0	7.4	8.5	19.0
• On half the trips	14.7	11.1	11.1	15.6	10.1
• Occasionally	43.6	43.7	51.9	46.8	36.1
• Very rarely	24.4	27.1	24.1	21.3	29.1

Some of the groups differed in fatigue frequency ($\chi^2_{(16)}$=26.45, p<0.05). Relatively few drivers reported experiencing fatigue on every trip, especially large company drivers and contracted owner drivers although contracted owners were considerably more likely to report feeling fatigue on most trips. Slightly more independent owner drivers and small company employees reported feeling fatigue on around half of their trips. Overall, however, most drivers in each category reported feeling fatigue occasionally and about a quarter of the drivers in any category reported feeling it very rarely. This reinforces again the consistent finding that the job for long distance drivers does produce fatigue at least occasionally.

Around three-quarters of drivers in all employment sub-categories reported that fatigue occurred for them within 14 hours of starting their trip. As shown in Table 66, approximately 35% reported fatigue within 10 hours and about 40% in 10 to 14 hours. For all employment categories, most drivers experienced fatigue in the midnight to 06:00 time period. A smaller, but considerable percentage, also reported fatigue in the midday to 18:00 time period. Independent owners were the group most likely to report experiencing fatigue in the afternoon, regardless of when it first occurred for them and large company employees were least likely to experience afternoon fatigue. Comparing the sub-categories on the time at which the first fatigue period usually began, employees of large companies were more likely than the other drivers to first feel fatigued in the early morning (00:00 to 05:59) and less likely to start feeling fatigued in the afternoon (12:00 to 17:59). Contracted owners appeared to show the reverse pattern.

Table 66: Period when fatigue is usually experienced for drivers in each employment category (%).

	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
Time since trip start when fatigue first experienced:					
• < 10 hrs	38.7	36.3	31.5	34.5	37.7
• 10 – 14 hrs	35.1	38.5	39.1	44.5	39.9
• > 14 hrs	26.2	25.3	29.3	20.9	22.5
Time of day when fatigue typically starts*:					
• 00:00-05:59	76.0	75.0	82.1	74.6	66.2
• 06:00-11:59	7.5	3.6	8.5	6.2	6.4
• 12:00-17:59	9.5	12.0	3.8	14.6	15.9
• 18:00-23:59	6.9	9.4	5.7	4.6	11.5
Times of day when fatigue typically experienced:					
• 00:00-05:59	80.3	79.7	85.8	79.2	72.6
• 06:00-11:59	19.1	14.6	17.9	16.9	14.6
• 12:00-17:59*	31.8	32.8	23.6	43.1	33.8
• 18:00-23:59	28.3	28.1	22.6	21.5	31.2

* Test of group differences significant at $p<0.05$.

In response to the questions about the extent that fatigue is a problem for the industry and themselves (see Table 67), most of the employment groups reported that they saw fatigue as a major problem for the industry, except independent owner drivers who were more likely to see fatigue as only a substantial industry problem. Very small percentages of drivers from all groups reported that fatigue was no problem for the industry, however more owner drivers tended to see that fatigue was not a problem for the industry than did the employee groups. The results for driver perceptions of fatigue as a personal problem were quite different since only very small percentages of drivers in any group supported the idea that fatigue is a major problem for them. Rather, most groups reported that fatigue is a minor problem or, in fact, no problem for them. Driver perceptions of fatigue as a personal problem did not differ very much at all between the employment groups.

Table 67: Perceptions of fatigue as a problem for the industry and for each driver personally from each employment category for the second survey (%).

	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
Fatigue problem in industry:					
• Major	40.3	40.1	42.1	32.8	46.0
• Substantial	38.6	35.1	30.8	35.8	32.3
• Minor	18.1	23.8	25.2	26.3	15.5
• No problem	3.0	1.0	1.9	5.1	6.2
Fatigue problem for drivers:					
• Major	5.5	7.9	8.2	2.1	7.5
• Substantial	15.6	17.8	10.9	15.7	14.3
• Minor	49.6	44.1	50.0	54.3	46.0
• No problem	29.3	30.2	30.9	27.9	32.3

Drivers' reports of how well they think the industry manages fatigue indicate that all employment subcategories are in agreement (see Table 68). Only around one-third felt that the industry manages fatigue well and the majority in each subcategory felt that industry fatigue management practices were bad or very bad. In contrast, virtually all drivers reported that they managed fatigue well. Very few drivers in any group reported that they managed fatigue badly.

When asked how the industry awareness of fatigue has changed over the past five years, most drivers reported that they felt it had increased. Around one in five drivers in all of the employment groups took the view that industry awareness of fatigue had not changed, except employees of large companies who tended to report that awareness had deceased considerably more than any of the other employment groups.

Reports of changes in the drivers' personal awareness of fatigue showed many more drivers reporting no change. The majority of drivers reported that it had increased and only a very small percentage reported that their awareness of fatigue had decreased over the past five years. Large company employees were again more likely to report that their awareness of fatigue had decreased.

Table 68: Perceived change in awareness of fatigue in the industry over the past five years for each employment category (%).

	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
INDUSTRY manages fatigue:					
• Well or very well	33.4	34.0	45.5	31.9	30.4
• No opinion	15.2	8.5	9.1	13.8	12.7
• Badly or very badly	51.4	57.5	45.5	54.3	57.0
PERSONALLY manages fatigue:					
Well or very well	90.8	90.1	96.4	92.9	93.8
No opinion	2.5	3.0	0.9	2.1	2.5
Badly or very badly	6.7	6.9	2.7	5.0	3.8
Changed awareness of fatigue in INDUSTRY:					
Increased a lot	34.2	38.4	35.8	29.5	34.0
Increased	40.2	34.5	37.6	49.6	37.7
No change	20.1	20.7	12.8	17.3	27.2
Decreased	1.9	4.9	7.3	2.9	0.6
Decreased a lot	3.6	1.5	6.4	0.7	0.6
Changed awareness of fatigue PERSONALLY:					
Increased a lot	28.7	27.2	28.4	25.0	18.5
Increased	32.0	30.2	34.9	33.6	32.7
No change	35.4	40.6	29.4	40.7	46.3
Decreased	1.7	1.5	5.5	0.7	1.9
Decreased a lot	2.2	0.5	1.8	0.0	0.6

3.2.5.1 Effects and modifiers of fatigue

The majority of drivers in each group reported that their driving was worse when they experienced fatigue (see Table 69). Of these, the three main effects of fatigue on driving for employee groups were being slower to react, poorer gear change and driving too slowly. The same three effects were reported by owner drivers except that poorer gear changing was reported by most drivers followed by slow reactions and slow driving. Poorer steering was also reported by a significant percentage of all groups as well as poor awareness of other traffic. These results indicate that the experience of fatigue affects drivers in all employment groups in the same way.

In response to the list of potential contributors to fatigue, drivers in all of the employment categories cited the same main three contributors (see Table 70). Dawn driving, waiting to load and unload and long driving hours were seen by the most drivers in all groups as contributors to their fatigue. Furthermore, there were few significant differences for any of the factors between the employment groups. The only exceptions were poor cab design which was cited more often by medium-sized company employees than any other group and dawn driving which was reported more often by large and small company employees. Overall, it seems that factors that contribute to fatigue do so across all employment types. It is notable that only very small percentages of drivers in each group reported the after-effects of stay-awake drugs as an important contributor (Table 71) and in contrast, factors like poor diet and irregular eating were cited by a reasonable number of drivers as major contributors to their on-road fatigue.

Table 69: Effects of fatigue on driving reported by participants in each employment category from the second survey (%).

	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Driving worse when fatigued	75.4	70.2	64.5	71.5	69.2
Effects of fatigue on driving: (for drivers reporting fatigue)					
• Slower to react	54.9	58.0	65.2	52.6	52.7
• Poorer steering	42.5	42.8	37.7	37.1	42.7
• Poorer braking	13.2	15.9	15.9	14.4	10.9
• Poorer gear change	53.8	53.6	65.2	56.7	57.3
• Poorer overtaking	10.2	8. 7	8.7	7.2	10.9
• Speeding	11.7	8.0	7.2	6.2	7.3
• Driving too slowly	48.9	55.1	50.7	63.9	52.7
• Poorer signalling	10.9	13.0	11.6	7.2	11.8
• Poorer attention to traffic lights	19.5	24.6	30.4	15.5	17.3
• Poorer awareness of other road users	22.6	27.5	31.9	19.6	23.6
• Others	4.5	2.2	4.3	5.2	1.8

Table 70: Contributors to driver fatigue reported in the second survey for drivers from each employment category (%).

Contributing Factors	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Long driving hours	52.7	44.8	41.8	46.8	45.9
• Too much non-driving work	31.4	32.8	24.5	30.2	29.6
• Insufficient rest breaks	24.9	23.9	18.2	23.0	20.8
• Having to un/load	37.0	41.3	29.1	36.7	30.2
• Waiting to un/load	55.7	54.7	57.3	64.0	52.8
• Checking the load	3.4	2.5	1.8	5.0	5.0
• Rest away from home	13.7	8.0	12.7	7.9	12.6
• Irregular or inadequate sleep during trips	41.7	38.3	31.8	38.8	34.0
• Inadequate pre-trip sleep	21.0	23.4	23.6	23.7	24.5
• Not enough night sleep	22.7	24.4	26.4	23.0	22.0
• Night driving	9.5	12.9	10.9	10.1	13.8
• Dawn driving*	64.7	53.2	68.2	55.4	54.1
• Dusk driving	25.8	21.4	22.7	23.7	15.7
• Early afternoon driving	18.2	16.4	15.5	20.1	21.4
• Poor road conditions	42.3	41.8	32.7	47.5	42.1
• Boring/monotonous route	30.3	32.8	37.3	35.3	29.6
• Heavy highway traffic	12.3	11.9	15.5	12.9	15.1
• Heavy city traffic	22.1	23.4	20.9	28.1	22.6
• Poor weather conditions	39.5	37.8	33.6	39.6	37.7
• Poor cab design*	14.8	20.9	14.5	10.8	10.1
• Poor truck ventilation	19.9	20.9	19.1	18.0	12.6
• Truck vibration	13.2	12.4	6.4	7.9	8.2
• Family problems	14.8	14.9	18.2	15.1	16.4
• Poor diet/irregular eating	28.3	32.8	21.8	21.6	26.4
• After-effects of stay-awake drugs	7.3	11.9	9.1	10.1	6.3
• Use of alcohol	7.3	7.5	9.1	6.5	5.7
• Other*	3.6	8.5	11.8	6.5	9.4

* χ^2 tests of group differences significant at $p<0.05$

Table 71: The contributing factors judged to be most important in producing fatigue for each employment category from the second survey (%). (Italicised values are the number of drivers who judged the contributor to be important expressed as a percentage of the total sample. Non-italicised values are the number of drivers who judged the contributor to be important expressed as a percentage of those who reported being affected by it.)

Factors judged as most important contributors to fatigue				
Employee drivers			Owner drivers	
≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
Waiting to un/load 45.7 *(25.5)*	Waiting to un/load 47.3 *(25.9)*	Waiting to un/load 60.3 *(34.6)*	Poor roads 47.0 *(22.3)*	Waiting to un/load 53.6 *(28.3)*
Un/loading 41.7 *(15.4)*	Poor road 40.5 *(16.9)*	Dawn driving 50.7 *(34.6)*	Waiting to un/load 44.9 *(28.7)*	Un/loading 50.0 *(15.1)*
Long driving hours 39.9 *(21.0)*	Dawn driving 40.2 *(21.4)*	Inadequate pretrip sleep 50.0 *(11.8)*	Use of alcohol 44.4 *(2.9)*	Long driving hours 39.7 *(18.2)*
Dawn driving 36.4 *(23.6)*	Long driving hours, Family problems, Drug after-effects 33.3 *(17.5, 5.0, 4.0)*	City traffic 43.5 *(9.1)*	Un/loading 41.2 *(15.1)*	Inadequate rest breaks 39.4 *(8.2)*

3.2.6 Strategies used to manage fatigue while driving by drivers in each employment category

Drivers reported on the strategies they use to attempt to deal with fatigue while driving. As can be seen in Table 72, the same main strategies were reported most frequently by each of the employment categories. Sleep was reported by almost all drivers in all sub-categories, together with rest, caffeine drinks and music or the radio. With the exception of small company drivers sleep was the most common strategy for all groups. More small company drivers reported using music or the radio and caffeine than sleep to manage fatigue at least sometimes, but the differences were not very large at all. The strategy reported the least by drivers in all groups was taking stay-awake drugs. Medium and small company drivers reported using them most often, with around one-quarter admitting to using them at least sometimes, compared to less than one in five drivers for large companies and contract owner drivers.

Table 72: Strategies used at least sometimes to manage fatigue while driving by drivers in each employment category in the second survey (%).

Strategy use	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
• Stopping to eat*	66.1	65.4	64.4	72.9	78.9
• Sleep	83.1	89.9	89.5	88.5	86.6
• Rest	79.8	80.0	88.2	78.4	85.8
• Stopping for meal	69.9	67.4	71.1	71.1	74.5
• Eating while driving*	53.2	43.6	43.9	41.2	38.2
• Caffeine drink	86.4	81.2	82.5	80.5	83.0
• Non-caffeine drink	46.0	46.8	46.4	45.8	51.4
• Smoking	53.8	50.3	48.5	45.6	40.7
• Drugs	24.0	27.1	17.2	22.1	16.8
• Kicking tyres/walking around	72.8	67.0	76.9	68.8	71.0
• Shower	73.1	67.0	72.1	61.2	70.1
• Music/radio*	89.1	80.6	85.7	80.0	78.9
• CB Radio	66.3	73.0	61.2	63.9	58.2
• Singing	37.9	37.0	28.1	30.3	30.7
• Using ventilation	74.2	73.0	68.9	72.2	75.9
• Ignore driving hours to finish trip when close to home	69.0	69.5	60.4	62.7	64.6
• Other	4.5	2.0	8.2	5.8	6.2

* χ^2 tests of group differences significant at $p<0.05$

Statistically significant differences were observed for stopping to eat, a strategy used more by owner drivers, especially contract owners, than by employee drivers. Eating while driving and listening to music or the radio were more popular strategies among small company employees than other driver groups.

Table 73: Strategies judged by drivers in each employment category to be most helpful for managing driver fatigue (%). (Italicised values are the number of drivers who judged the strategy as helpful expressed as a percentage of the total sample. Non-italicised values are the number of drivers who judged the strategy as helpful expressed as a percentage of those who reported using it.)

Strategies judged as most helpful for managing fatigue				
Employee drivers			Owner drivers	
≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
Stay-awake drugs 33.3 *(8.0)*	Stay-awake drugs 36.7 *(10.0)*	Stop to sleep 39.4 *(35.3)*	Stop to sleep 33.6 *(29.7)*	Stop to sleep 32.6 *(28.2)*
Stop to sleep 29.3 *(24.4)*	Stop to sleep 32.9 *(29.6)*	Stay-awake drugs 29.4 *(5.1)*	Stay-awake drugs 29.6 *(6.5)*	Stop to rest 18.9 *(16.2)*
Caffeine 24.7 *(21.3)*	Stop to rest 22.3 *(17.8)*	Stop to rest 27.8 *(24.5)*	Stop to rest 23.5 *(18.4)*	Caffeine 18.9 *(15.7)*
Smoking 22.9 *(12.3)*	Stop for meal 20.8 *(14.0)*	Smoking 24.5 *(11.9)*	Smoking 22.8 *(10.4)*	Showering 18.8 *(13.2)*

Analysis of the strategies that were judged to be most helpful for managing fatigue showed that stopping to sleep and stay-awake drugs were the top two most helpful strategies as judged by users in all driver groups except contract owner drivers (see Table 73). Around one third of all of the other groups reported that stay-awake drugs and sleep were the most helpful method of dealing with fatigue while driving. More temporary measures for fatigue reduction like smoking, stopping for a meal or taking a shower were reported much less often as helpful strategies.

3.2.7 Experience of dangers on the road and fatigue

Participants in the second survey were asked to report on their experiences of dangers on the road over the past year. A similar percentage of drivers in each subcategory reported having at least one accident over past 12 months. For all employment types, around one in ten drivers had an accident and for most of them the accident involved property damage or injury. For employees of medium companies and for independent owners, accidents were slightly less likely to involve property damage and injury, and also slightly less likely to involve fatigue. Large company drivers and contract drivers were most likely to report that fatigue was a factor in their last accident however these differences were not statistically significant. Many participants also reported that they had experienced a range of dangerous incidents on the road since the beginning of the year. As Table 74 shows there was no difference between the employment subgroups in terms of their experiences of dangerous events while driving. Just under one in five drivers in each subcategory reported that they nodded off or fell asleep while driving at least sometimes.

Table 74: Experience of dangerous events at least sometimes while driving in the last year for drivers in each employment category (%).

	Employee drivers			Owner drivers	
	≤10 trucks	**11-50 trucks**	**>50 trucks**	**Indep Owner**	**Contract Owner**
• Accidents in past 12 months	9.8	14.2	14.7	14.1	8.9
• % accidents with property damage/injury	98.8	94.9	100.0	92.2	100.0
• Fatigue a factor in the accident	23.5	14.3	26.7	10.5	30.8
On-road dangers:					
• Nodding off	20.7	17.4	15.0	17.6	16.4
• Having a near miss	13.7	12.6	17.5	7.8	13.9
• Running off the road	8.5	7.3	12.4	11.1	8.1
• Colliding with something	4.3	2.7	4.8	3.2	4.1
• Other	8.1	2.8	10.3	6.7	2.2

3.2.8 Experience of breaking working hours regulations and road rules

3.2.8.1 Working hours regulations

There were no significant differences between employment categories in drivers reports of how often they break working hours regulations (see Table 75). For all subcategories, approaching half of the drivers reported breaking the regulations on most or even every trip and the majority reported breaking them on at least half of their trips. The reasons provided for breaking the working hours regulations showed a similar pattern across employment groups. All groups reported most often the desire to get home at the end of a trip and the need to do enough trips to earn a living as motivators for breaking working hours regulations. Tight schedules were also reported as a motivator by many drivers in all subcategories. There were, however, statistically significant differences between the groups on reporting of two motivating factors. Independent owner drivers were most likely to report the need to do enough trips to earn a living as a motivator for breaking regulations and large company drivers were least likely to report this motivator. The employment categories also differed in reporting the need to get in early to get the next load as a motivator. Independent owner drivers, and drivers from small and medium sized companies were most likely to report the pressure of loading schedules as a reason for working contrary to the working hours regulations.

Table 75: Frequency and reasons for breaking working hours regulations for each employment category (%).

Breaking working hours regulations	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
Frequency:					
• Every trip	29.9	25.6	22.1	18.0	26.2
• Most trips	20.6	24.4	14.7	25.8	21.4
• On half the trips	9.6	11.7	10.5	10.2	6.9
• Occasionally	17.0	21.1	27.4	23.4	21.4
• Very rarely	23.0	17.2	25.3	22.7	24.1
Reasons:					
• Tight schedules	34.4	31.8	33.3	24.1	27.1
• Rewards or penalties for being early or late	10.4	6.4	4.4	9.5	4.3
• To get in early to get the next load*	27.6	31.8	16.7	31.9	20.0
• To do enough trips to earn a living*	34.7	37.6	25.6	46.6	38.6
• To return home	46.8	49.1	50.0	39.7	47.1
• To reach adequate rest facilities	26.0	24.9	25.6	28.4	25.7
• To keep your job	26.0	26.0	23.3	17.2	20.0
• Other	9.7	11.6	15.6	16.4	14.3

* Test for group differences significant at $p<0.05$

3.2.8.2 Breaking of road rules

Drivers were also asked about how often they broke road rules when driving. Considerably fewer drivers in all employment categories reported breaking road rules. Most reported that they did so very rarely or just occasionally (see Table 76). No driver in any employment category reported that the effects of alcohol use made them break road rules and a very small percentage reported the influence of stay-awake drugs. Most drivers in all employment categories attributed tight schedules and the need to get enough trips done to earn a living as motivators of breaking road rules. For the independent owner driver group, the pressure of doing trips to earn a living was most often reported, unlike most other groups where drivers reported tight schedules most frequently. Similar to the motivators for breaking working hours regulations, there was a trend for large company employees to report the pressure to get the next load less often than any other subcategory.

Table 76: Frequency and reasons for breaking road rules (%).

Breaking road rules	Employee drivers			Owner drivers	
	≤10 trucks	11-50 trucks	>50 trucks	Indep Owner	Contract Owner
Frequency:					
• Every trip	13.4	16.7	7.4	12.6	13.3
• Most trips	13.4	14.4	9.6	10.9	9.8
• On half the trips	6.8	3.9	7.4	2.5	5.6
• Occasionally	28.3	27.2	22.3	28.6	25.9
• Very rarely	38.2	37.8	53.2	45.4	45.5
Reasons:					
• Tight schedules	37.1	36.5	26.6	27.7	30.6
• Rewards or penalties for being early or late	9.3	10.9	8.9	10.6	6.6
• To get in early to get the next load [#]	27.0	30.1	13.9	26.6	21.5
• To do enough trips to earn a living	32.0	26.3	29.1	38.3	26.4
• Because of fatigue	9.3	9.6	6.3	6.4	3.3
• Because of the effects of alcohol	0.0	0.0	0.0	0.0	0.0
• Because of the after-effects of stay-awake drugs	3.1	3.8	2.5	1.1	1.7
• Because of lack attention	18.9	19.2	16.5	13.8	13.2
• Other	20.8	25.0	25.3	27.7	28.1

[#] test of group differences statistically significant at $p<0.10$

3.2.9 The views of drivers in each employment category about fatigue management policies and practice by their company and the government

Drivers were asked about their perceptions of fatigue management strategies promoted by companies and by government and the results are shown in Tables 77 and 78.

When asked about the strategies companies currently use, around one-quarter of the small and medium company drivers reported that their companies allow more time off between trips, more time for sleeping on the road and more break time during trips. Around one-quarter of small and medium company drivers also reported that their companies were more efficient in loading and unloading. A similar pattern was shown for large company drivers except that approaching half reported that their companies ease tight schedules, allow more time for sleep on road and are more efficient in loading and unloading and around one-third report that their company allows more time off between trips and more breaks on the road. Just over one-third of large company drivers also reported that their company provided information about fatigue,

whereas considerably fewer drivers from the other groups reported that their company did this.

For the owner drivers groups, around one-quarter to one-third of the independent and contracted owner drivers reported allowing more time for sleep and breaks in the trip and more time off between trips as strategies that they use. Easing tight schedules and more efficient loading and unloading were also strategies used by their companies. Overall, therefore, there are many similarities in the company strategies reported by drivers. There were also some clear common features among the groups on strategies that are not currently used by drivers. Very few drivers in any of the groups reported that companies minimise night driving. Similarly, very few company employees and contract owner drivers reported that their company uses two-up driving whereas a slightly higher percentage of independent owners reported using two-up. Staged or changeover driving was mainly reported by medium and large company drivers.

When asked to report which strategies companies should not use, all employment groups reported the same strategies. Most drivers in each subcategory reported that companies should not use two-up driving and that they should not minimise night driving. Approaching half of the drivers in each subcategory reported that their companies should not use staged driving. In addition, around one-third of large company drivers and both owner driver subcategories reported that companies should not allow more time off between trips and a similar percentage of both owner driver categories reported that companies should not allow more breaks during trips. One in three contracted owner drivers also reported that they did not believe companies should allow more time for sleep on road.

There was very strong commonality between the employment subcategories on the strategies that drivers felt companies should adopt. The most common strategies reported by the majority of drivers in all subcategories were more efficient loading and unloading and increasing the rates of pay for drivers. Easing tight schedules was the next most common strategy reported by small and medium company drivers and independent and contract owner drivers. In contrast, providing information about fatigue was the next most common strategy reported by large company drivers, although around half of the drivers in all subcategories also reported that companies should adopt this strategy. Not having to load and unload was also consistently reported by drivers in all subcategories.

Table 77: Drivers views from the second survey regarding fatigue management strategies that their companies currently use, should use or should not use.

Strategies	Company Does					Company Should NOT do					Company Should do				
	≤10	11-50	>50	Indep	Contract	≤10	11-50	>50	Indep	Contract	≤10	11-50	>50	Indep	Contract
More information about fatigue management	*21.6	21.9	36.7	18.1	20.3	23.1	19.9	14.7	22.8	22.9	57.6	59.7	62.4	48.8	56.2
More efficient loading and unloading	*27.4	24.4	43.1	25.2	30.1	*10.7	5.0	6.4	13.4	5.2	71.8	75.6	72.5	69.3	80.4
Not having to load/unload	*18.7	21.9	33.0	18.9	17.6	24.5	21.4	20.2	24.4	28.1	58.2	58.2	57.8	58.3	55.6
Two-up driving	9.2	8.5	6.4	15.7	11.1	*64.3	67.2	79.8	58.3	59.5	18.7	14.9	13.8	20.5	15.7
Changeover or staged driving	*12.1	17.9	28.4	12.6	9.8	*50.7	42.8	32.1	41.7	50.3	*31.7	34.3	51.4	37.8	24.8
Increase rates of pay for drivers	*15.6	10.9	19.3	10.2	7.8	15.0	16.4	16.5	18.1	22.9	69.7	68.2	73.4	68.5	63.4
Ease unreasonably tight schedules	29.7	29.4	42.2	29.1	28.1	13.3	12.4	16.5	13.4	18.3	64.6	60.2	57.8	65.4	58.2
Minimise night driving	8.6	10.0	13.8	9.4	11.8	53.0	50.2	55.0	54.3	51.0	31.1	26.4	30.3	29.1	28.8
Allow more time off between trips	28.0	24.9	37.6	28.3	28.8	*23.1	22.4	32.1	33.9	35.3	*53.9	54.2	47.7	41.7	41.8
Allow more time for sleep on road	28.8	26.9	40.4	32.3	28.8	*16.7	19.4	17.4	21.3	30.7	60.2	58.7	58.7	53.5	50.3
Allow more breaks during trips	26.5	25.9	33.9	29.1	27.5	23.6	25.9	23.9	32.3	30.1	50.1	50.2	51.4	39.4	47.1

* Tests of group differences significant at $p<0.05$

Overall, there was some variation in how each of the employment groups viewed the fatigue management strategies used by their companies, and none of the strategies was selected by more than around one-third of drivers except for the large company driver group for which nearly half of the group reported that their companies are more efficient in loading and unloading and in easing tight schedules. In contrast, there was very little variation in what drivers viewed companies should and should not do and the strategies that were selected were selected by around half or more of the drivers in each subcategory.

The drivers' responses to questions about the strategies used by government showed a great deal of similarity between the employment groups. When asked what the government did to manage driver fatigue, a significant minority of drivers in all groups viewed that the government strictly enforced current driving hours, strictly policed the use of stay-awake drugs and provided slow vehicle lanes. There was also some recognition of the government's role in educating drivers as around one in five large company drivers and independent owner drivers also reported that the government provided information on fatigue management.

There was very clear agreement between the employment subcategories about the strategies the government should not use. Three-quarters or more of drivers in each subcategory reported that the government should not permit use of stay-awake drugs and around half or more in each subcategory reported that they should not move to stricter enforcement of current driving hours and should not shorten driving hours.

With respect to the strategies that drivers think the government should adopt, there was marked agreement between employment groups and between drivers within the employment groups. Almost all drivers in each subcategory reported that the government should improve roads, should allow flexibility to finish trips when over the regulated limit, should allow greater flexibility in driving hours regulations in general, provide better off-road facilities and provide slow vehicle lanes. In addition, most drivers in all employment categories also reported that the government should provide more information about fatigue management. A significant proportion of the drivers in all subcategories also felt that the government should become stricter in policing stay-awake drug use but a large minority in each subcategory opposed this.

Table 78: Drivers views from the second survey regarding fatigue management strategies that governments currently use, should use or should not use.

Strategies	Government Does					Government Should NOT do					Government Should do				
	≤10	11-50	>50	Indep	Contract	≤10	11-50	>50	Indep	Contract	≤10	11-50	>50	Indep	Contract
More information about fatigue management	*12.7	11.4	22.0	18.2	9.3	20.3	18.3	20.2	20.4	18.5	63.1	65.3	66.1	62.8	64.2
Stricter policing to prevent stay-awake drugs	15.8	20.8	25.7	21.9	19.8	39.4	43.1	37.6	41.6	35.8	*47.3	36.1	50.5	42.3	50.0
Stricter (shorter) driving hours	8.7	9.9	9.2	11.7	13.0	74.4	74.8	81.7	78.8	75.9	14.6	12.4	11.0	8.0	11.1
Permit stay-awake drug use	2.5	3.0	2.8	1.5	2.5	51.8	47.0	58.7	53.3	61.1	36.6	40.1	33.9	36.5	29.6
Stricter enforcement of current driving hours	18.6	17.3	28.4	21.9	17.9	65.4	62.4	59.3	62.8	59.3	*19.2	18.8	32.4	17.5	22.8
Better off-road facilities	10.1	13.9	11.0	9.5	6.8	5.6	5.4	3.7	3.6	6.2	85.9	83.7	87.2	83.9	85.2
More flexibility to finish trips when just out of hours	4.2	4.5	5.5	5.8	2.5	3.7	1.5	5.5	5.1	4.9	88.2	89.6	89.0	86.9	87.7
Greater flexibility in driving hours regulations	4.2	3.5	1.8	5.8	4.3	6.5	5.9	9.2	6.6	6.8	87.0	86.1	86.2	84.7	87.0
Improvements to roads	*11.3	13.4	22.0	8.8	12.3	1.1	1.0	2.8	0.7	2.5	92.1	91.6	91.7	94.2	91.4
Slow vehicle lanes	*18.0	17.3	29.4	14.6	17.9	4.5	5.0	2.8	4.4	6.8	80.3	81.2	84.4	81.0	77.8
Depot to depot driving	*8.7	5.4	16.5	3.6	4.3	17.5	14.9	13.8	14.6	22.8	68.5	72.3	77.1	66.4	66.7
Uniform national driving hours and road rules	8.2	10.9	13.8	15.3	8.0	7.3	8.9	9.2	6.6	7.4	84.5	82.2	82.6	78.1	84.6
Make freight schedulers accountable	*7.3	4.5	13.8	8.8	5.6	5.9	5.9	9.2	10.2	8.0	86.5	84.2	83.5	78.1	81.5
Educate public about trucks	6.2	6.4	7.3	6.6	4.3	2.0	1.5	0.9	0.7	1.2	92.4	92.1	94.5	92.0	92.6
Permit industry self-regulation	4.5	4.0	10.1	7.3	3.1	22.3	26.7	28.4	32.1	28.4	61.4	59.9	57.8	49.6	58.6

* Tests of group differences significant at $p<0.05$

3.3 Effects of Type of Driving

Analysis was also conducted of the influence of type of driving on the last trip on the working and fatigue experiences reported by drivers in the second survey. As reported earlier, most drivers participating in this survey worked as single drivers (94%), and only small percentages did the trip with another driver as a two-up operation (5%) or as a staged or changeover operation (1.0%). As the proportions of two-up and staged drivers were very small, only an abbreviated analysis was conducted, mostly focussing on the driving experiences on the last trip.

Table 79 shows the start and finish time on the last trip for each of the driving types. Single drivers were more likely to start work between early morning and late in the afternoon (06:00 to 18:00) and also finish during that time, but a significant percentage ended their trip between midnight and dawn (00:00 to 06:00). Very few single drivers started work in the midnight to dawn period. Two-up drivers were more likely to start work in the morning time and rarely start in the early evening (18:00 to 00:00) whereas they were fairly likely to end their trips at any time period. The few staged drivers in the survey only started their work during the day (06:00 to 18:00) and finished mostly in the midnight to dawn period indicating that they worked during the night period. Driving time showed a similar pattern for staged drivers who started work and started driving at the same time, so indicating that they did not need to do preparative work like loading and unloading. Single drivers and especially two-up drivers, on the other hand, tended to start driving at a later time than they started work indicating that they spent time on preparative work such as loading and unloading.

Table 79: Start and finish time on the last trip for different driving types (%).

	Single driver (n=824)		Two-up driver (n=40)		Staged driver (n=7)	
Time of day	**Start**	**End**	**Start**	**End**	**Start**	**End**
Working time:						
• 00:00-05:59	10.4	20.4	15.0	18.9	0.0	57.1
• 06:00-11:59	41.3	35.9	47.5	29.7	42.9	28.6
• 12:00-17:59	30.6	24.4	27.5	29.7	57.1	0.0
• 18:00-23:59	17.7	18.2	10.0	21.6	0.0	14.3
Driving time:						
• 00:00-05:59	10.3	30.2	12.8	34.2	0.0	57.1
• 06:00-11:59	27.3	28.4	28.2	18.4	42.9	28.6
• 12:00-17:59	38.0	19.6	35.9	18.4	57.1	0.0
• 18:00-23:59	24.4	21.8	23.1	28.9	0.0	14.3

Table 80 shows that the majority of two up drivers did trips longer than 1500 kilometres which was statistically significantly more than the number of single or staged drivers doing such long distances ($\chi^2_{(4)}$= 22.32, p<0.001). Examination of the average distance travelled confirmed the differences between the three driver types, with two-up drivers doing by far the longest trips and staged drivers the shortest trips ($F_{(2,876)}$=21.93, p<0.001).

Examination of the average time taken by the trip showed that two-up drivers spent nearly twice as long on their trip than the other groups ($F_{(2,830)}$= 7.80, p<0.001). The percentage of drivers in each driving type who did trips of different durations, however, did not differ statistically ($\chi^2_{(4)}$= 8.01, p=0.09). Despite this, significantly more two-up drivers fell into the longest driving hours category (≥ 30 hours; $\chi^2_{(4)}$= 13.37, p=0.01) and they also averaged longer driving hours ($F_{(2,840)}$= 3.24, P=0.04). Although two-up drivers as a group clearly did the longest trips, more than one-third of single drivers also did very long trips (>1500kms and ≥30 hours).

Table 80: Distribution of distance covered, trip duration and driving time for the last trip for different driving types (%).

	Single driver (n=787)	Two-up driver (n=37)	Staged driver (n=7)
Distance:			
• < 700 kms	15.7	5.4	14.3
• 700 – 1500 kms	48.1	21.6	71.4
• > 1500 kms	36.2	73.0	14.3
Trip duration:			
• < 12 hours	20.8	8.1	28.6
• 12 – 29:59 hours	43.8	37.8	57.1
• ≥ 30 hours	35.3	54.1	14.3
Driving time:			
• < 12 hours	44.7	33.3	85.7
• 12 – 29:59 hours	40.0	33.3	14.3
• ≥ 30 hours	15.3	33.3	0
Mean (SD):	(n=798)	(n=37)	(n=7)
• Trip distance (kms)	1636.0 *(1422.1)*	3226.4 *(2465.7)*	972.9 *(350.5)*
• Trip duration (hrs)	33:45 *(36:42)*	57:28 *(57:42)*	16:26 (13:22*)*
• Drive duration (hrs)	18:54 *(16:46)*	25:18 (*21:55)*	11:04 *(4:41*

Table 81 shows that despite having shorter overall trips, single drivers spent a greater proportion of their trip time working than two-up drivers ($F_{(2,606)}$=2.9, p=0.056) and two-up drivers spent proportionately longer on nonwork activities in the last trip ($F_{(2,606)}$=2.8, p=0.06).

Table 81: Mean (SD) distance and duration differences between types of driving.

	Single driver	Two-up driver	Staged driver
	(n=584)	(n=16)	(n=7)
• % trip hours spent working	72.4 *(18.4)*	61.2 *(16.1)*	69.9 *(29.8)*
• % trip not worked	27.8 *(18.5)*	38.8 *(16.1)*	30.1 *(29.8)*

3.3.1 Type of freight

Table 82 shows a comparison for the three types of driving of the types of freight carried on the last trip. The results show very little difference between single and two-up drivers; the only notable difference being that more two-up drivers reported carrying manufactured goods than did single drivers. It was not possible to interpret these results for staged drivers as there were so few participants.

3.3.2 Size of company

Table 83 shows that both single and two-up drivers were most likely to work for small companies with fewer than five trucks, however a much larger proportion of two-up drivers worked for very small companies. This was counterbalanced by the fact that none of the two-up drivers worked for large companies of more than 50 trucks, whereas just over one in ten single drivers worked for large companies. The small group of staged drivers mainly worked for small and very small companies which owned 10 trucks or less.

Table 82: Type of freight for last trip for different driving types (%).

Freight	Single driver (n=911)	Two-up driver (n=49)	Staged driver (n=10)
• Livestock	4.5	6.1	0.0
• Refrigerated goods	16.7	16.3	30.0
• Dangerous goods	4.1	8.2	0.0
• Farm produce	10.9	10.2	0.0
• Other bulk	7.5	4.1	20.0
• Machinery	5.7	2.0	0.0
• Building materials	8.0	4.1	0.0
• Groceries	7.0	6.1	10.0
• Manufactured goods	7.7	20.	30.0.
• General/mixed freight	26.0	24.5	40.0
• Car carrying	3.0	6.1	0.0
• Express	6.3	10.2	10.0
• Other (inc. removals)	5.4	10.2	0.0

Table 83: Size of company by type of driving (%).

Company size	Single driver (n=903)	Two-up driver (n=42)	Staged driver (n=10)
• < 5 trucks	51.5	71.4	30.0
• 5 - 10 trucks	15.3	14.3	40.0
• 11 - 50 trucks	21.3	14.3	10.0
• > 50 trucks	12.0	0.0	20.0

3.3.3 Fixed schedule

The three types of driving did not differ in whether they drove to a fixed schedule, since around one-third of each type of driver reported having a fixed schedule (Table 84).

Table 84: Percentage of drivers driving to fixed company schedule (%).

	Single driver (n=917)	Two-up driver (n=49)	Staged driver (n=9)
Driving to a fixed company schedule	34.8	36.7	33.3

3.3.4 Fatigue on the last trip

There were no differences between single and two-up drivers in the proportion who felt fatigue on the last trip (see Table 85). Nor was there any statistically significant difference between the three driving types on how they felt at the beginning of the last trip. More than three-quarters of each group reported feeling fresh or very fresh at the start of the last trip. Around ten percent of each type of driver reported feeling a bit tired.

3.3.5 Activities at the beginning and end of the trip – yard work and loading work

As shown in Table 86, there were no significant differences in the percentage of drivers in each driving type who did yard work at the start or end of their last trip. Although there was a considerably higher percentage of single and two-up drivers who had to load at the start of the trip and end of the trip, the difference was not statistically significantly different. There was no difference between the driver types on the percentage who had to load in the middle of the trip.

Table 85: Fatigue felt on last trip for different driving types (%).

	Single driver (n=915)	Two-up driver (n=49)	Staged driver (n=9)
• Fatigue on last trip	45.2	42.9	33.3
Fatigue at start of last trip:	**(n=905)**	**(n=49)**	**(n=8)**
• Very fresh	44.8	44.9	25.0
• Quite fresh	35.5	38.8	62.5
• A bit tired	14.4	10.2	12.5
• Quite/very tired	5.4	6.1	0.0

Table 86: Activities at the beginning and end of the trip – yard work and loading work on last trip for different driving types (%).

	Single driver	Two-up driver	Staged driver
• **Yard** work at start of trip	19.4 *(n=876)*	27.3 *(n=44)*	22.2 *(n=9)*
• **Yard** work at finish of trip	19.2 *(n=860)*	24.4 *(n=41)*	11.1 *(n=9)*
• **Loading** work at start of trip	56.0 *(n=882)*	58.1 *(n=43)*	33.3 *(n=9)*
• **Loading** work at finish of trip $\chi^2_{(2)} = 5.11, p<0.078$	59.3 *(n=868)*	60.5 *(n=43)*	22.2 *(n=9)*
• **Loading** work elsewhere	24.1 *(n=907)*	31.3 *(n=48)*	22.2 *(n=9)*

Similarly, there was no difference in the reasons drivers in single and two-up operations gave for delays in loading and unloading on the last trip (Table 87). For both single and two-up drivers, waiting for other trucks and freight not being available were reported by the most drivers.

Table 87: Reasons for delays in loading and unloading on last trip for different driving types (%).

	Single driver (n=913)	Two-up driver (n=49)	Staged driver (n=10)
• Depot not open	9.1	6.1	10.0
• Wait on other truck	32.6	24.5	10.0
• Freight not available	16.6	22.4	0.0
• Machinery not available	4.8	6.1	0.0
• Poor booking procedures	7.2	12.2	0.0
• Other	5.1	0.0	40.0

3.3.6 Average speed on last trip

There was no difference between the driving types on the percentage who reported travelling above the speed limit while on their last trip. Around one-fifth of each of the driving groups reported driving above the speed limit at some time on the last trip (Table 88).

Table 88: Percentage of drivers speeding on last trip for different driving types.

	Single driver (n=904)	Two-up driver (n=47)	Staged driver (n=9)
• Above speed limit	18.1	19.1	22.2

3.3.7 Activities in the last 10 hours

Reports from drivers from each driving type on their activities in the ten hours leading up to the last trip are shown in Table 89. Overall there was little difference between the three groups, with the exception of the amount of time being spent on checking and repairing the truck. Two-up drivers spent the longest period compared to single and staged drivers ($F_{(2,812)}$=9.18, p<0.001).

Table 89: Mean (SD) hours spent on activities in the last 10 hours for different driving types.

	Single driver	Two-up driver	Staged driver
	(n=794)	(n=37)	(n=8)
• Total rest and sleep	8:23 *(2:42)*	8:09 *(3:18)*	9:11 *(1:25)*
	(n=769)	(n=36)	(n=8)
• Sleep	5:42 *(3:03)*	5:22 *(3:36)*	5:37 *(1:50)*
• Rest	2:36 *(2:37)*	2:43 *(3:06)*	3:33 *(2:13)*
• Check/repair heavy vehicle	0:12 *(0:40)*	0:44 *(1:40)*	0:00 *(0:00)*
• Un/loading	0:19 *(1:02)*	0:30 *(1:52)*	0:18 *(0:35)*
• Yard work	0:08 *(0:49)*	0:20 *(1:41)*	0:00 *(0:00)*
• Driving light vehicle	0:07 *(0:39)*	0:01 *(0:10)*	0:00 *(0:00)*
• Driving heavy vehicle	0:34 *(1:50)*	0:02 *(0:14)*	0:00 *(0:00)*

3.3.8 Experience of dangerous events on the last trip

Again, there were relatively few differences between the three driving types on their experiences of dangerous events while on the last trip. Table 90 shows that the largest group of responses in each driving group was crossing lanes. Just under ten percent of two-up drivers also reported over or under steering. Only a very small percentage of single and two-up drivers reported falling asleep at some point on their last trip.

Table 90: Experience of dangerous events on the last trip for different driving types (%).

	Single driver (n=824)	Two-up driver (n=40)	Staged driver (n=7)
• Nodding off	5.0	7.3	0.0
• Near miss	5.3	0.0	0.0
• Running off road	2.5	7.5	0.0
• Crossing lanes	11.0	18.6	11.1
• Over/under steering	4.9	9.8	0.0
• Late breaking	3.8	2.5	0.0
• Colliding with something	1.2	0.0	0.0
• Other	2.9	0.0	0.0

4. DISCUSSION

According to the results of this study, fatigue is still a concern in the long distance road transport industry, although there are indications of improvements in some aspects of fatigue management. The results of the current survey showed that fewer drivers reported experiencing fatigue regularly, compared to the earlier survey. Only around one-quarter of the drivers in the new survey reported that they experienced fatigue on at least half of their trips, whereas nearly half of the drivers in the previous survey reported fatigue occurring that frequently. Despite this, drivers reported fatigue occurring earlier in the trip than the drivers in the first survey. In the first survey most drivers reported that they felt fatigue within the first 14 hours of starting work, but in the second survey just over half of the drivers reported fatigue within the first ten hours of starting work. Not only is this considerably earlier than reported in the first survey, it is well within the current working hours regulations in the Eastern states, of 12 to 14 hours of work.

This result might be expected if earlier reporting of fatigue was simply the result of being more aware of fatigue. If this pattern of increased early reporting of fatigue were only due to drivers being more aware of fatigue as a problem, it would be expected that they would report fatigue occurring more often overall. Drivers in the second survey showed less reporting of fatigue as a personal problem. Furthermore, there was a clear relationship between the experience of factors that should increase fatigue, and reported fatigue. Drivers who did longer trips and more night work were more likely to report fatigue. If earlier reporting of fatigue was simply due to more awareness, there should be no, or only very moderate, relationships between these fatigue-producing factors and fatigue experiences. Most saliently, drivers who reported earlier fatigue also reported doing longer trips. These findings indicate that drivers report fatigue in response to their personal experiences of work and not simply their perceptions of fatigue so the propensity to report fatigue earlier cannot be attributed only to greater awareness of fatigue. The results suggest instead that there is a group of drivers who are doing long trips and considerable night work and experiencing fatigue much earlier than in previous years.

Notably, many of the experiences of fatigue were similar for the drivers in both surveys. In both surveys the most common times at which fatigue occurred were at the circadian trough between 2am and 6am and to a lesser extent between 2pm and 3pm. It would be surprising if this pattern was not found as it has been shown in a very wide range of studies. Drivers also shared common experiences in the way fatigue affects their driving. The most common effects of tiredness on drivers in both surveys were being slower to react, driving more slowly and making poorer gear changes. The factors that contributed to fatigue were also shared by drivers in both surveys. All driver groups acknowledged dawn driving, loading and unloading factors, long driving hours and poor roads as contributors to making them tired while driving. The universal nature of the factors that make fatigue worse for most drivers might be expected to inspire them to attempt to modify their exposure to these fatigue-producing factors in order to reduce their fatigue. The drivers' responses to the questions about the strategies they use to manage fatigue indicated that drivers use the strategies that are available to them.

Strategies that have long term effectiveness, such as sleep, were reported by the greater majority of drivers in both surveys but similar percentages of drivers reported using strategies that are only temporarily effective for managing fatigue, but that are the only ones available while driving, such as music and the radio, ventilation and caffeine drinks. In both surveys drivers acknowledged the difference between the types of strategies since of all the strategies,

the long term strategies of sleep and drugs were judged as helpful by the largest proportion of drivers who used them. Sleep was the most common strategy reported by drivers and it was judged to be helpful by most drivers. In contrast, drugs were only reported to be used by just over one-fifth of the drivers, but the of the drivers who used drugs around one-third reported that it was a helpful strategy. The common feature between these strategies is that they have long term effects on fatigue.

Compared to the first survey, drivers in the second survey reported lower use of drugs to manage fatigue. In the first survey nearly one-third of drivers reported using stay-awake drugs at least sometimes and more than half of them rated drugs as a most helpful strategy for managing fatigue. This drop in reported usage is consistent with the finding that drivers seem to be experiencing fatigue less often. If this is the case, then it may be that drivers do not need stay-awake drugs as often as previously.

It should be noted, however, that even though many strategies were reported to be used in both surveys, there was a tendency in the second survey for fewer drivers overall to report that a number of the strategies were helpful. In particular, sleep, eating while driving, drug-use, kicking the tyres and walking around, and using the CB radio were reported to be helpful by a considerably smaller percentage of users. This finding suggests that drivers are finding it more difficult to manage their fatigue in the second survey. Although an even larger percentage reported using sleep as a fatigue management tool in the second survey, a much smaller percentage reported it as helpful. Since sleep should be the most effective method for managing fatigue, these results suggest that other factors are limiting its effectiveness and the effectiveness of a number of other strategies. A range of factors might limit the effectiveness of sleep including when and where it is taken as well as the amount of sleep that drivers are able to take in one stretch. These factors are likely to be playing a role in limiting the effectiveness of sleep for long distance drivers in the second survey.

The work time of these drivers was shown in both surveys to be far longer than the usual work time of most workers in Australia. Based on Australian Bureau of Statistics figures for 1998/99, on average for males, full time employees worked 42.7 hours per week and nonemployees or contracted workers did 44.6 hours per week. In the transport and storage industry, average weekly hours for males was 42.1 hours. These averages are markedly lower than the 55.1 hours per week reported by drivers in this study. The average reported work week for the first survey was marginally longer than for the drivers in the second survey (63 hours per week compared to 55.1 hours per week). There was considerable variation in reporting of working hours across drivers in both surveys. In the first survey, however, the amount of work in the last week was not asked directly, rather working hours were calculated from the lengths of each leg of the trip, which may have resulted in overestimating the overall work time.

Interestingly, drivers in the current survey reported doing longer trips than in the first survey. Overall, drivers in the second survey did trips of roughly eight hours longer duration on average than drivers in the first survey and many more did trips of longer than 30 hours. This finding probably explains in part, the difference in fatigue reporting as second survey drivers tended to report fatigue earlier, although not more or less often than in the first survey. The patterns of longer trips and limited breaks between them is likely to result in drivers having less stamina to manage the fatigue of driving for long periods into a trip. It seems that fatigue was directly affected by the amount of work done since fatigue in the second survey was correlated significantly with the distance and duration of the trip. Fatigue was also affected by night work as fatigue increased with increasing night work when trip duration was held constant. The earlier reporting of fatigue may well be due to an accumulation of fatigue

following long trips especially involving night work. If the break between such long trips is insufficient to dissipate the accumulated fatigue, drivers may begin their next trips feeling fresher, but, because they have not recovered completely from their last trip, they are unable to stave off fatigue for very long into the next trip.

There is considerable research evidence to support this possible explanation. For example, a simulation study of an alternative work rest schedule involving two 16 hour work periods (Williamson, Feyer, Finlay-Brown, and Friswell, 2000) demonstrated that drivers were not able to recover from the first long work period when they had only a break of six hours and as a result reported experiencing fatigue very early in the next work period. Evidence also comes from the first survey, in which staged drivers who did some of the shortest trips of all survey participants, reported fatigue occurring much earlier than any other driver group. This finding was confirmed in an on-road study (Williamson, Feyer, Friswell, and Leslie, 1994) which showed that staged drivers tended to accumulate their fatigue because all of their trips involved overnight work with only day sleep between them which did not allow enough opportunity for recovery. Finally, evidence also comes from an on-road study of two-up drivers (Feyer, Williamson, and Friswell, 1995) which showed that fatigue accumulated very rapidly on long trips where breaks were not long enough to allow recovery. The survey indicates that driving periods of this length are frequent enough for this explanation to apply.

A sizeable percentage of second survey drivers (22.6%) reported doing more than 72 hours work in the last week, but this is a smaller percentage of drivers reporting such long work weeks than found in the first survey (33.5%) indicating a drop in the number of drivers doing extremely long work weeks. Nevertheless, more than 72 hours per week is greater than the hours allowed under the working hours regulations, at least in the eastern states. In addition, more than half of the drivers in both surveys reported breaking working hours regulations on at least half of their trips. Approximately one-quarter of drivers in both surveys also reported that they broke working hours regulations on every trip. The results from both surveys show that a significant number of drivers are not conforming to the working hours regulations and although some improvement is indicated by the second survey, the problem still persists.

When asked about the pressures that make them break working hours, drivers reported factors mainly relating to problems in balancing work and rest, especially in getting home to rest, and the problems in maintaining an adequate level of payment through their work output. Independent owner drivers, in particular, reported that the imperative to do enough trips to earn a living was the main motivator for them to break the working hours rules. The findings on reported breaking of road rules show similar effects so that these pressures seem to exert a general effect on driver performance such as their speed and not just on the hours they work.

Night work was a feature of trips for nearly three-quarters of drivers in the second survey. Work in the midnight to dawn period is clearly a feature common to most drivers in the industry as there was not very much difference in the percentage of drivers doing night driving across the different types of employment or the different types of driving. This is a very important finding as it is well-recognised that this period spans the period of maximal risk of accidents and error in performance (Williamson and Feyer, 1995), especially for tasks like driving (Folkard and Monk, 1979). This means that many drivers will be doing their job at the most risky time. In addition, a clear relationship was found between fatigue and working over the midnight to dawn period such that on their last trip drivers who were required to work at night reported longer periods of feeling fatigue compared to drivers who did not work at this time. As discussed above, this finding is due to night work itself and not just time-on-task as night work was significantly correlated with fatigue even when the trip duration was held constant.

Similar findings can be seen in drivers' reporting of night work over the last week. More than three-quarters of drivers reported doing nearly 10 hours of night work on average over the last week in two to three work periods. There was also not a great deal of difference between the types of employment or types of driving across the work week. Again, there was a significant positive relationship between night work over the last week and fatigue.

These results are further reinforced by the findings of changes in access to sleep for drivers who worked over the night period. Drivers who worked midnight to dawn over the last week reported significantly less sleep compared to those who did not. In addition, their sleep was reported to be more fragmented as sleep was reported to occur in more blocks than if they had not worked in the midnight to dawn period.

All of these results indicate that night work is still one of the major concerns for the long distance road transport industry as it is still a dominant feature of the work of long distance drivers and consequently is clearly exerting a major effect on increasing fatigue experiences for drivers. Minimising night work is therefore one of the prime targets for fatigue management in the industry.

The consequences of lack of sleep for truck drivers is evident in the results of this survey. Nearly half of the drivers reported getting less than six hours sleep in the 10 hours before their last trip and one in eight drivers reported getting no sleep in the 10 hours prior to their last trip. As there is no reason to believe that their reports of the last trip were uncharacteristic of their normal routine, this indicates that most drivers are seriously under-rested even before they begin a trip. This depends to some extent on when the trip begins. Drivers who started their trip in the late afternoon or early evening, for example, may not have had a long sleep in the 10 hours immediately before the trip although they may have taken a short nap sleep. Nevertheless, for many drivers, their main work period, that is their trip, began following a period in which they had obtained little or no sleep. This needs to be accounted for in addition to the length of the trip in making judgements on a driver's work capacity.

Despite this finding, most drivers reported that fatigue while driving is only at worst, a minor problem for them. Nevertheless, a significant percentage of drivers in the second survey, around one in five, reported having a dangerous fatigue-related event on their last trip, mostly in the form of crossing lanes, nodding off, steering problems and near misses. Consequently, it seems that some drivers may be underestimating just how much fatigue affects their performance. This influence can also be seen in the difference between drivers' perceptions of fatigue being a problem for the industry but not a personal problem. It is well-recognised that people tend to underestimate the effect of problems for them in comparison to the problem for others. While it is not possible to know what the real situation is, given that so few drivers rated fatigue as a problem and given the pressures on drivers to complete their trip, it is not surprising that drivers will downplay the influence of fatigue. This tendency to underestimate the effects of fatigue is likely to have effects on the road, however, such that drivers are likely to overestimate their ability to cope with fatigue effects and consequently put themselves at increased risk of fatigue-related crashes. This tendency should be taken into account in designing fatigue countermeasures as it suggests that fatigue management should not be left entirely in the hands of drivers and should be supported by external limits to working time and operational practices that help to minimise fatigue.

The driver participants in both surveys were similar in a number of ways. They had similar family backgrounds although slightly fewer were married in the second survey, they carried similar types of freight and were paid in a similar way. The second survey drivers were slightly older and slightly more experienced than those in the first survey which might be

expected since seven years had elapsed between the two surveys and very few drivers had less than five years driving experience. These results may reflect that drivers in the long distance road transport industry are gradually getting older which is of interest in workforce planning.

The major difference between the participants in the two surveys is that there were considerably more owner drivers in the second survey and more drove for smaller companies in the second survey. In the first survey employees of large companies constituted forty percent of survey participants whereas only ten percent of the second survey were drivers for companies with more than fifty trucks. This difference is likely to have influenced the results of the second survey. Considerably more second survey drivers did long trips and fewer did very short trips of less than 700 km. The analysis showed that large company drivers and, to a lesser extent, drivers contracted to companies did the shortest trips and medium-sized company drivers and independent owners did the longer trips. Large company drivers also tended to drive solely in the eastern states more than the other types of drivers. They also spent less time doing yard work, loading and unloading and checking and repairing their trucks. These characteristics might be expected to reduce the level of fatigue experienced by drivers for large companies. In contrast, large company drivers were less likely than the other types of drivers to have their own reasons for arriving at their destination by a certain time. They also did not differ from drivers in other types of employment in the amount of night driving, the amount of time spent waiting to load and unload, nor on the percentage of their trips spent working. Possibly because of these similarities, the fatigue experiences of large company drivers were not different from the other types of driving.

Independent owner drivers showed a different pattern of work and rest compared to large company drivers. They were characterised by doing trips of considerably longer duration than company drivers although the distance travelled was similar to some other types of drivers. Independent owner drivers also spent relatively more time checking and repairing their vehicle in the period leading up to a trip. They also showed differences from the other driver types in that they hardly ever reported having on-going contracts for their jobs and the greater majority reported being paid by trip rates. This may have influenced the finding that independent owners tended to report the influence of needing to make a living as a reason for breaking the working hours regulations and the road rules. Despite the existence of these factors that might be expected to promote fatigue, independent owner drivers, showed no differences from the other driver employment types in their reported experience of fatigue. As discussed in the previous survey (Williamson et al., 1992), and from the results of the present survey, one of the most likely reasons for the apparent resistance of independent owner drivers to fatigue is that they are allowed greater flexibility in organising their working and resting schedule through such factors as maintaining a good balance between work and rest, even though their trips take much longer. For example, for independent owner drivers in this survey, the proportion of time spent working on a trip was not more than the other types.

The results of the survey show that there are pressures on long distance drivers other than long hours and night work that are likely to increase their fatigue. Pressures of loading and unloading were shown to be important in both the current and earlier survey in terms of being a potential contributor to fatigue and by reports from drivers that improving loading and unloading practices was a strategy that would reduce fatigue. The second survey asked about the specific issue of waiting to load and unload. The results showed clearly that waiting to load and unload was a major problem for drivers by contributing to their fatigue and by being a time pressure on them to arrival at their destination. Around one-third of drivers reported the pressure of waiting to load at the beginning of the trip and around half reported it occurring at the end of the trip. On average waiting added between two to three hours of time

to each trip. Yard work was also seen as a factor that extended drivers' working time, but was not experienced by as many drivers. The most common reasons for delays in loading and unloading were due to poor organisation of the freight forwarding and receiving process; such as the need to wait for other trucks to load and unload, waiting for freight to be ready and the depot not being open.

There has been an increasing acknowledgment of the role of the freight forwarder and the customer in work scheduling for long distance drivers over the past few years (McCabe and Grant, 2000). This study adds weight from a driver point of view to the importance of these sections of the transportation relationship chain in exerting pressures on drivers that are not consistent with fatigue management.

There were some differences in the sorts of pressures experienced by the drivers in different employment relationships. Employee drivers tended to report pressure to get to the end of the trip due to the need to get some sleep ahead of loading and unloading pressures whereas owner drivers tended to report loading problems as their main pressure and did not report the need for sleep as a primary factor. This difference is likely to be due to the greater flexibility of owner drivers, especially independent owner drivers, to schedule shifts to suit them in line with their current personal requirements for rest. This suggestion is partly reinforced by the finding that even though their trips were significantly longer on average, independent owner drivers tended to work for a slightly lower percentage of their trip time, had slightly longer non work hours and the same average work hours per day compared to the other groups. This suggests that at least part of the greater trip length is taken up with extra rest which would as a consequence reduce sleep as a primary motivator for finishing the trip.

The remuneration system is another pressure on drivers that appears, from the survey, to influence drivers' work schedules. Both surveys reveal that payment by results was the predominant method of remuneration for all drivers, even company employees, and this form of payment increased markedly across the period between the two surveys. The second survey showed that a small percentage of employee drivers were paid by the hour, but hardly any owner drivers were paid in this way. A large percentage of owner drivers, especially independent owner drivers had to negotiate their rates for all loads.

Analysis of the relationship between payment type and experience of fatigue demonstrated that drivers who were paid in a payment-by-results mode were more likely to report fatigue as a substantial or major personal problem and to experience fatigue more often than drivers paid under other payment regimes. In addition, a significant percentage of drivers volunteered the strategy of standardising or regulating minimum payment rates as way of managing fatigue.

The pressures exerted by the payment by results system can also be seen in the influences on drivers to break the working hours regulations. The factors that distinguish drivers who frequently break the working hours regulations from those who do not are related to the organisation of work such as the need to do enough trips to earn a living and to get in early to get the next load rather than personal reasons. Where drivers are encouraged to work more and take fewer breaks, such as by payment by results systems (trip rates or per kilometre rates) fatigue will naturally be the result. The relationships between type of payment and fatigue shown in this study reinforce this conclusion. The results of this study provide further evidence that the way drivers are remunerated clearly has adverse effects on the ability to manage fatigue well. This is another factor that should be examined further if fatigue management is to be achieved in this industry.

A major component of the second survey was an investigation of the views of drivers about the strategies used by companies and the government to manage fatigue. As mentioned above, drivers perceived the companies and the industry as not managing fatigue well, especially in comparison with their personal capacity to manage fatigue. There was some variation between drivers in different types of employment on the strategies that companies use to manage fatigue. All employee drivers reported that their company eased tight schedules and allowed sleep on the road and more time between trips. Large company drivers were more likely to report all of these strategies whereas comparatively few small and medium company drivers reported any of them. This is consistent with the finding that large company drivers did shorter trips than other drivers. Owner drivers also reported that companies allow time to rest and recuperate from fatigue through allowing time for sleep and breaks in the trip and more time off between trips.

Significantly, minimising night driving was only rarely reported by drivers in any of the employment groups. As night driving is one of the areas identified from this and the previous survey as likely to contribute to the fatigue experienced by long distance drivers, this is clearly an area in which companies can improve fatigue management. This is not a simple matter, however. The demands of the freight task mean that night driving is a fact of life in the long distance road transport industry. Furthermore, as can be seen from the results of this survey, a significant percentage of drivers felt that minimising night work is not a favoured option for fatigue management by companies or government, possibly because it reduces other forms of stress in driving like negotiating traffic. Nevertheless, this study and many others have identified night work as a potential problem for fatigue management which needs to be considered carefully.

All driver groups were unanimous in the strategies that they felt that companies should and should not do. Two-up and staged driving were reported by the majority of all drivers in each employment type as an approach that companies should not employ. Reducing the amount of night work was also reported by most drivers as a strategy that companies should not adopt. On the other hand, there seem to be some strategies that are liked by a significant number of drivers in each employment group, such as making loading and unloading more efficient and easing tight schedules for drivers and increasing driver pay rates.

Considerably fewer drivers reported any of the suggested strategies that government used for fatigue management. The most commonly mentioned strategies were in the areas of enforcement of working hours regulations, drug use and slow vehicle lanes. All driver groups were in agreement on the strategies they felt that government should and should not adopt to minimise fatigue. Public education about heavy vehicles, and better roads were the most commonly selected categories together with allowing greater flexibility to finish trips in a way that suits the driver and providing better off-road rest facilities. The strategies that were not supported were clamping down on the number of hours drivers can work and enforcing them more strictly. This is not surprising since these sorts of activities by companies or government reduce the driver's flexibility to manage fatigue in a way that suits them. In addition, as has been discussed above, most drivers are remunerated on the basis of the amount of work they can do so strategies that limit their access to work are unlikely to be favoured. There was also a common belief that the government should not permit use of stay awake drugs.

As two collection methods were used in this survey, it is possible that collection method might have influenced the results of the survey. Comparison of the results of the two methods showed that the main differences seem to be a result of the collection method rather than any systematic differences between the drivers sampled using each method. For example, there

was a tendency for higher responding on many items when an interview was used, especially when the questions involved long lists of options such as drivers' beliefs about what companies and governments do and should do to manage fatigue or when asked about which factors might contribute to their fatigue. For both sets of questions, interviewed drivers reported more options. In keeping with this finding, the group of drivers who self-administered the survey were also less likely overall to report any of the strategies as most helpful.

The influence of collection method might be best seen for questions that cover more sensitive areas, where the increased anonymity of the self-administered format might produce less guarded responding. There is some indication in these results that this may be the case. Significantly more drivers in the self-administered group reported using stay-awake drugs to manage fatigue and more reported dangerous events occurring when they drove over the last year. It should be noted, however, that the magnitude of the higher reporting of drug used, for example, is very similar to the magnitude of higher reporting found for all of the other strategies so it seems that drivers are more likely to report all information when the questionnaire was self-administered, not just sensitive information.

Lastly, when the two collection methods are compared on the driving and fatigue experiences reported by the drivers in each, there are very few indicators of systematic differences between them. There were, for example, few differences in the distance or duration of their trips, nor in their beliefs and experiences of fatigue. There was a tendency for drivers in the self-administered group to report needing to do more nondriving work, but not more driving work. They also reported slightly less sleep over the last week and slightly higher levels and frequency of fatigue however, again the magnitude of these differences is relatively small and of relatively little explanatory value for the results overall.

In conclusion, this survey has provided an update on driver views of fatigue, how they manage it and their views of how it is managed by the industry and by government. The survey has also provided insights into some of the pressures on drivers that can promote or reduce driver fatigue. This makes an important contribution to our understanding of the factors that will make the most difference in managing fatigue in the long distance road transport industry.

5. REFERENCES

Arnold, P.K., Hartley, L.R., Penna, F., Hochstadt, D., Corry, A. & Feyer, A.-M. (1996). *Fatigue in the Western Australian transport industry. Part two: The drivers' perspective.* Perth: Institute of Research in Safety and Transport, Murdoch University

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

Feyer, A.-M., Williamson, A.M., & Friswell, R. (1995). *Strategies to combat driver fatigue in the long distance road transport industry. Stage 2: Evaluation of two-up operations.* CR 158. Canberra: Federal Office of Road Transport.

Folkard, S. & Monk, T.H. (1979). Shiftwork and performance. *Human Factors*, *21*, 483-492.

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

Hartley, L.R., Arnold, P.K., Penna, F., Hochstadt, D., Corry, A. & Feyer, A.-M. (1996). *Fatigue in the Western Australian transport industry. Part one: The principle and comparative findings.* Perth: Institute of Research in Safety and Transport, Murdoch University.

Haworth, N.L., Heffernan, C.J., & Horne, E.J. (1989). *Fatigue in truck accidents*. Report 3. Melbourne: Monash University Accident Research Centre.

Hensher, D.A., Battellino, H.C., Gee, J.L., & Daniels, R.F. (1991). *Long distance truck drivers on-road performance and economic reward.* CR 99. Canberra: Federal Office of Road Safety.

Hyyppa, M.T., Kronholm, E., & Mattlar, C.-E. (1991). Mental well-being of good sleepers in a random population sample. *British Journal of Medical Psychology*, *64,* 25-34.

Johns, M.W. (1991). A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. *Sleep*, *14:6,* 540-545.

Johns, M.W. (1992). Reliability and factor analysis of the Epworth Sleepiness Scale. *Sleep*, *15:4*, 376-381.

Johns, M.W. (1993). Daytime sleepiness, snoring, and obstructive sleep apnea: The Epworth Sleepiness Scale. *Chest*, *103*, 30-36.

Johns, M. & Hocking, B. (1997). Excessive daytime sleepiness: Daytime sleepiness and sleep habits of Australian workers. *Sleep*, *20:10*, 844-849.

Krueger, G.P. (1989). Sustained work, fatigue, sleep loss and performance: A review of issues. *Work and Sleep*, *3*, 129-141.

McCabe, T.F. & Grant, C.J. (2000). *FMP logistics management model.* Paper presented at the Fourth International Symposium on Fatigue in Transportation, Fremantle, February 2000.

Monk, T.H. & Folkard, S. (1985). Shiftwork and performance. In S. Folkard & T.H. Monk (Eds.), *Hours of work.* Chichester: John Wiley & Sons. (pp.239-252.).

Moore, B. & Moore, J. (1996). Prescriptive driving hours: The credibility gap. In L. Hartley (Ed.), *Proceedings of the Second International Symposium on fatigue and transportation: Engineering, enforcement and education solutions.* Perth: Promaco. (pp.545-565).

National Road Transport Commission. (1998). *An overview of Australian road transport: Who carries what where?* Melbourne: Author.

NSW RTA. (1998). *Introduction to Road Safety.* Internet site http://www.rta.nsw.gov.au/safety.

Roehrs, T., Shore, E., Papineau, K., Rosenthal, L., & Roth, T. (1996). A two-week sleep extension in sleepy normals. *Sleep*, *19:7*, 576-582.

Williamson, A.M. & Feyer, A.-M. (1995). Causes of accidents and time of day. *Work & Stress*, *9:2/3*, 158-164.

Williamson, A.M., Feyer, A.-M., Coumarelos, C., & Jenkins, T. (1992). *Strategies to combat fatigue in the long distance road transport industry. Stage 1: The industry perspective.* CR 108. Canberra: Federal Office of Road Safety.

Williamson, A.M., Feyer, A.-M., Finlay-Brown, S., & Friswell, R. (2000). *Evaluating a regulated hours regime on-road and an alternative compliance regime under simulated conditions.* CR 190. Canberra: Australian Transport Safety Bureau.

Williamson, A.M., Feyer, A.-M., Friswell, R. & Leslie, D. (1994). *Strategies to combat driver fatigue in the long distance road transport industry. Stage 2: Evaluation of alternative work practices.* CR 144. Canberra: Federal Office of Road Safety.

APPENDIX 1: DATA COLLECTION SITES

Place	Terminal/truck stop	Recommended by*	
		1991 survey	RTF
Sydney NSW	BP Truck stop Rookwood Road Yagoona	X	
Sydney, NSW	Lindsay Brothers, Hoadley Place, Arndel Park		X
Yass, NSW	Ampol Truck stop, Yass Valley Way, Yass		X
Dubbo, NSW	Dubbo Livestock saleyards, Dubbo	X	
Dubbo, NSW	Caltex Truck stop	X	
Tarcutta, NSW	Mobil Truck stops, Hume Hwy		X
Clybucca, NSW	BP Truck stop, Pacific Hwy, Clybucca		X
Guyra, NSW	Ampol Truck stop, New England Hwy		X
Melbourne, VIC	BP Truck stop, Hume Hwy, Cooper street corner, Somerton	X	
Melbourne, VIC	Wholesale markets, Footscray Road		X
Melbourne, VIC	K&S Freighters, Centre Road, Clayton		X
Ballarat, VIC	Sale yards	X	
Shepparton, VIC	Yarroweyah Truck stop, Murray Valley Hwy		
Shepparton, VIC	Wahring Cottage		
Brisbane, QLD	Ampol Truck stop, Rocklea, Ipswich Road		
Brisbane, QLD	Shell Truck stop, Rocklea	X	
Brisbane, QLD	Wholesale Markets, Brisbane		X
Mackay, QLD	Mackay Mac's Truckstop, Bruce Hwy, Mackay		X
Bohle, QLD	Caltex Truck stop, 900 Ingham Rd, Bohle		X
Adelaide, SA	BP Truck stop, Wingfield	X	
Port Augusta, SA	Truck stop, Hwy One, Port Augusta		X
Darwin, NT	Shell Truck City, 37 Daly St	X	

- "1991 survey" = Williamson et al (1992)
  "RTF" = Road Transport Forum (now the Australian Trucking Association or ATA)

APPENDIX 2: SELF ADMINISTERED SURVEY FORM

THE UNIVERSITY OF
NEW SOUTH WALES

SURVEY OF LONG DISTANCE ROAD TRANSPORT DRIVERS

1998

PROJECT TEAM

Ann Williamson

Anne-Marie Feyer

Rena Friswell

Samantha Finlay-Brown

ABOUT THIS QUESTIONNAIRE

A lot has been said about fatigue in long distance drivers. We are an independent research group at the University of New South Wales which has been asked by the National Road Transport Commission to do a survey of long distance drivers about issues to do with fatigue.

To do this, we have prepared this questionnaire to find out what long distance drivers think about fatigue. We want to know what you think about fatigue, how often and when you experience it and what you think could and should be done about it.

At the end of this study the results will be summarised and a report will go to the National Road Transport Commission on what the industry currently thinks about fatigue and how it can be managed in your industry. THIS IS YOU CHANCE TO HAVE YOUR SAY AND TO INFLUENCE YOUR FUTURE WORKING CONDITIONS.

Everything you tell us will be kept CONFIDENTIAL. We do NOT want your name or company.

Completion of this questionnaire is entirely voluntary. We would like you to answer all questions, but if you come to any you do not want to answer, leave it and move on.

The questionnaire will take about 30 minutes to complete.

When you have finished with the questionnaire, please hand it back to the interviewer. If you don't have time to complete the questionnaire now please finish it as soon as you have a chance and place it in the prepaid, self-addressed envelope the interviewer will give you, and put it in the mail.

Thank you for your participation.

If you have any questions about this questionnaire, or the study, please feel free to call Ann Williamson on 02 9385 3806 or Rena Friswell on 02 9385 1646 or Samantha Finlay-Brown on 02 9385 1643.

If you wish to complain about any aspect of this conduct of this research project please contact Mrs Margaret Wright, Executive Officer, Ethics Secretariat, University of New South Wales on 9385 4234.

Interviewer:…… *Location Code:……*

SECTION 1: DRIVER & VEHICLE INFORMATION

In this section we ask some questions about yourself and your truck. Please remember that all information you supply is confidential.

1. What sex are you? Male ( ) Female ( )

2. How old are you? _____ years

3. Which best describes you?

- Single ( )
- In a defacto relationship ( )
- Married ( )
- Separated, not living with partner ( )
- Divorced ( )
- Widowed ( )

4. Do you have any children? Yes ( ) No ( )

If you do have children:

How many?

_____

Please list their ages _____ _____ _____

_____ _____ _____

5. Are you an employee driver? Yes ( ) No ( )

If yes, how many trucks does your company operate?

Fewer than 5 trucks	( )
Between 5 and 10 trucks	( )
Between 11 and 50 trucks	( )
More than 50 trucks	( )
Don't know	( )

6. Are you an owner-driver? Yes ( ) No ( )

7. Are you an owner-operator? Yes ( ) No ( )

If you are an owner-driver or owner operator, how many trucks do you own? _____ trucks

If you are an owner-driver or owner operator, are you a :

Prime contractor	( )
Subcontractor in company colours	( )
Freelance subcontractor	( )
Other (please describe)	

_____

_____

8. Is your business: *You may tick more than one option*

Carrying goods for other people	( )
Transporting it's own products	( )

9. How many years have you been driving heavy vehicles for a living? _____ years

10. Where is your home base? Please tell us your home postcode. ….. ….. ….. …..

11. What are the MAIN types of freight you usually transport?

	You may tick more than one option		
Livestock	( )		
Refrigerated or temperature controlled	( )		
Dangerous materials *eg, fuel, chemicals*	( )		
Farm produce	( )		
Other bulk *eg, grain, coal, quarry materials*	( )	What type of bulk?	_____
Machinery	( )		
Building materials	( )		
Groceries	( )		
Manufactured goods *eg clothing*	( )	What type of goods?	_____
General/ mixed freight	( )		
Car carrying	( )		
Express freight	( )		
Other (please describe)			

_____

_____

12. Do you negotiate your rate of pay for each load?

Yes ( ) No ( )

If No, do you have an ongoing contract for any of your loads?

Yes, for all my loads	( )
Yes, for some of my loads	( )
No	( )

13. How are you usually paid?

Hourly rate	( )
Flat day rate	( )
Day rate with overtime	( )
Weekly rate with overtime	( )
Flat rate for every truck load carried	( )
Rate for each trip based on kms travelled and/or tonnage carried	( )
Other (please describe)	_____

14. At what rate are you usually paid?

Award rate	( )
Less than the award rate	( )
More than the award rate	( )
Don't know	( )

15. What sort of vehicle do you USUALLY drive?

Rigid - 2 axle	( )
Rigid - 3 axle	( )
Rigid - 4 axle	( )
Articulated - 3 axle	( )
Articulated - 4 axle	( )
Articulated - 5 axle	( )
Articulated - 6 axle	( )
B-Double	( )
Road train - double	( )
Road train - triple	( )
Other (please describe)	
	_____
	_____

SECTION 2: FATIGUE

16. How likely are you to **DOZE OFF OR FALL ASLEEP,** in contrast to just feeling tired in the following situations?

These situations refer to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **MOST APPROPRIATE NUMBER** for indicating how likely it is you would have dozed off in each situation

0	Would **never** doze
1	**Slight** chance of dozing
2	**Moderate** chance of dozing
3	**High** chance of dozing

Situation	Chance of Dozing
Sitting and reading	_____
Watching TV	_____
Sitting inactive in a public place (eg. In a movie theatre or at a meeting)	_____
As a passenger in a car for an hour without a break	_____
Lying down to rest in the afternoon when circumstances permit	_____
Sitting and talking to someone	_____
Sitting quietly after a lunch without alcohol	_____
In a car, while stopped for a few minutes in traffic	_____

The following questions are about fatigue you may experience when driving.

✯ 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.

17. In your opinion how much of a problem is fatigue in the long-distance road transport *INDUSTRY*?

A major problem ( )

A substantial problem ( )

A minor problem ( )

Not a problem at all ( )

18. How much of a problem is fatigue to *YOU PERSONALLY* in your job?

A major problem ( )

A substantial problem ( )

A minor problem ( )

Not a problem at all ( )

19. How often do you become fatigued while driving?

On every trip ( )

On most trips ( )

On about half your trips ( )

Occasionally ( )

Very rarely ( )

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

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

21. Do you think that AWARENESS of driver fatigue has CHANGED over that last 5 years, *FOR YOU*?

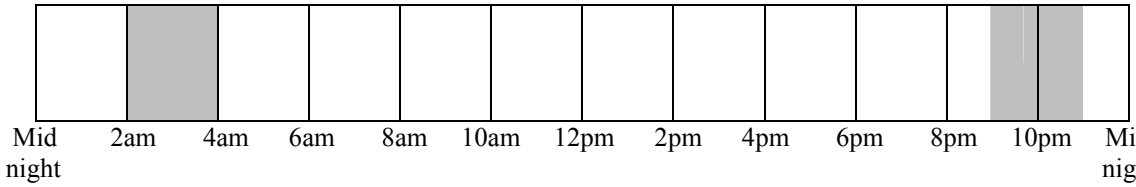
Has increased a lot	( )
Has increased	( )
No change	( )
Has decreased	( )
Has decreased a lot	( )

22. How many hours after STARTING WORK do you usually BEGIN to feel fatigue? (Include loading and waiting to load as work)

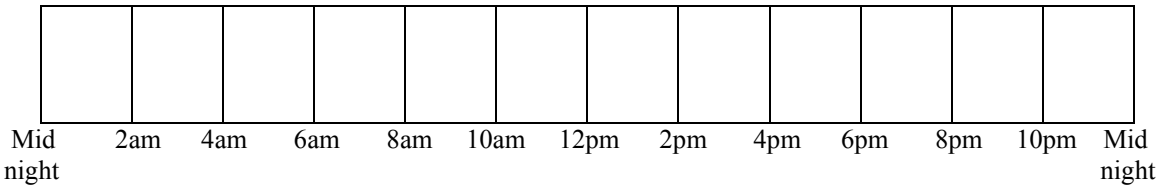
_____ hours

23. At what times of the day or night are you most likely to feel fatigued WHILE WORKING?

LOOK AT THIS EXAMPLE. *Let's say that, while working, a driver is most likely to be fatigued from 2am to 4am and from 9pm to 11pm. This driver would shade like this:*



NOW YOU GO AHEAD and shade in those times when YOU are most fatigued WHILE WORKING



24. In general is your driving WORSE when you are fatigued?

Yes ( ) No ( )

If YES, HOW is it worse?

	You may tick more than one option
Slower to react	( )
Poorer steering (eg, crossing lane lines, under/over steering)	( )
Poorer braking	( )
Poorer gear changing	( )
Poorer overtaking	( )
Speeding	( )
Driving too slowly	( )
Poorer signalling	( )
Poorer attention to traffic signs	( )
Poorer awareness of other traffic/ road users	( )
Other (please describe) _____	

25. Which of the following can contribute to YOUR fatigue while driving?

Firstly, TICK as many options as you feel contribute to your fatigue.

Then, CIRCLE the ones which are most important in contributing to YOUR driver fatigue.

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

PLEASE REMEMBER to CIRCLE the ones which are most important in contributing to YOUR driver fatigue.

26. Please indicate how often you use the strategies listed below in an attempt to deal with YOUR driver fatigue during trips.

Do this by TICKING <u>one</u> of the options next to <u>each</u> strategy.

Then CIRCLE those strategies you find most helpful.

	Often	*Sometimes*	*Rarely*	*Never*
Stopping to eat	( )	( )	( )	( )
Stopping to rest	( )	( )	( )	( )
Stopping to sleep	( )	( )	( )	( )
Stopping for a meal	( )	( )	( )	( )
Eating while driving	( )	( )	( )	( )
Having a drink containing caffeine (eg. coffee, tea, Coca-cola)	( )	( )	( )	( )
Having a non-caffeine drink	( )	( )	( )	( )
Smoking	( )	( )	( )	( )
Taking stay-awake drugs	( )	( )	( )	( )
Ignoring driving hours regulations to finish a trip, when close to home	( )	( )	( )	( )
Kicking the tyres or walking around	( )	( )	( )	( )
Taking a shower	( )	( )	( )	( )
Listening to music/radio	( )	( )	( )	( )
Using the CB radio	( )	( )	( )	( )
Singing	( )	( )	( )	( )
Adjusting the ventilation (eg, windows, heater, air conditioning)	( )	( )	( )	( )
Other (please describe)				

PLEASE REMEMBER to CIRCLE those strategies you find most helpful.

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

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

28. How well do you feel that YOU can manage fatigue NOW?

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

29. The following are some things your company might or should do to help manage fatigue.

What things do you think your company DOES DO, SHOULD DO or SHOULD NOT DO to keep your fatigue to a minimum?

(Please tick those strategies that you think could be helpful).

	Does	*Should*	*Should Not*
More information and training about how to manage fatigue	( )	( )	( )
More efficient loading and unloading	( )	( )	( )
Not having to do loading/unloading	( )	( )	( )
Two-up driving	( )	( )	( )
Changeover/staged driving	( )	( )	( )
Increasing rates of pay for drivers	( )	( )	( )
Easing unreasonably tight schedules	( )	( )	( )
Arrange driving schedules to minimise night driving	( )	( )	( )
Allow more time off between trips	( )	( )	( )
Allow more time for sleep on the road	( )	( )	( )
Allow more breaks during trips	( )	( )	( )
There aren't any things the company should do	( )		

30. The following are some things the government might or should do to help manage fatigue.

What things do you think the government DOES DO, SHOULD DO or SHOULD NOT DO to keep your fatigue to a minimum?

(Please tick those strategies that you think could be helpful).

	Does	*Should*	*Should Not*
More information and training about how to manage fatigue	( )	( )	( )
Stricter policing to prevent the use of stay-awake drugs	( )	( )	( )
Introduction of stricter driving hours (shorter driving hours)	( )	( )	( )
Permitting the use of stay-awake drugs	( )	( )	( )
Stricter enforcement of current driving hours	( )	( )	( )
Better off-road facilities	( )	( )	( )
More flexibility to finish a trip when just out of hours	( )	( )	( )
Greater flexibility in driving hours regulations	( )	( )	( )
Improvements to the roads	( )	( )	( )
Slow vehicle lanes	( )	( )	( )
Depot to depot driving	( )	( )	( )
Uniform driving hours and road rules nationally	( )	( )	( )
Making freight schedulers accountable	( )	( )	( )
Educating public about trucks	( )	( )	( )
Permit industry self-regulation	( )	( )	( )
There aren't any things the government should do	( )		

31. **If you have any other ideas about strategies that may be useful in dealing with driver fatigue in the long-distance road transport industry, please describe them below.**

_____

_____

_____

SECTION 3: DETAILS OF LAST TRIP

These questions are about your LAST LONG DISTANCE TRIP.

✯ *LONG DISTANCE means at least 300kms.*

32. Please fill in the details of LAST LONG DISTANCE TRIP on the **table below.**

Trip Start:		***If you can't remember these details, tick here***
Place where trip started	_____ *(suburb/town & state)*	**( )**
Date when trip started	_____ *(day/month/year)*	**( )**
Time starting work *(including loading time)*	_____ *(please specify am or pm)*	**( )**
Time starting driving	_____ *(please specify am or pm)*	**( )**
Trip finish:		
Place where trip finished	_____ *(suburb/town & state)*	**( )**
Date when trip finished	_____ *(day/month/year)*	**( )**
Time finishing driving	_____ *(please specify am or pm)*	**( )**
Time finishing work *(including unloading)*	_____ *(please specify am or pm)*	**( )**
Trip length:		
Total trip distance	_____ *(kilometres)*	**( )**
Total trip duration	_____ *(hours)*	**( )**
Total driving duration	_____ *(hours)*	**( )**

33. What type of freight did you carry on this trip?

	You may tick more than one option		
Livestock	( )		
Refrigerated or temperature controlled	( )		
Dangerous materials *eg, fuel, chemicals*	( )		
Farm produce	( )		
Other bulk *eg, grain, coal, quarry materials*	( )	What type of bulk?	_____
Machinery	( )		
Building materials	( )		
Groceries	( )		
Manufactured goods *eg clothing*	( )	What type of goods?	_____
General/ mixed freight	( )		
Car carrying	( )		
Express freight	( )		
Other (please describe)	_____		

34. What sort of driving operation was it?

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

35. Were you driving to a fixed company schedule?

Yes	( )
No	( )

36. Regardless of whether you had an ETA, did you have any other reasons for wanting to arrive by a particular time (eg, avoiding peak-hour traffic, getting in early for another load)?

Yes ( )

No ( )

If Yes, why? _____

_____

37. Did you feel fatigued at any stage on your last trip?

Yes ( )

No ( )

38. How did you feel at the start of your trip?

Very fresh ( )

Quite fresh ( )

A bit tired ( )

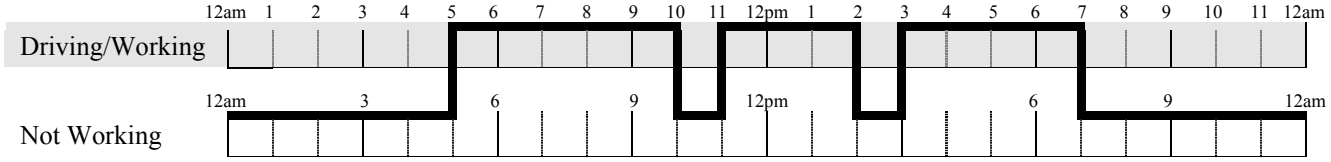
Quite tired ( )

Very tired ( )

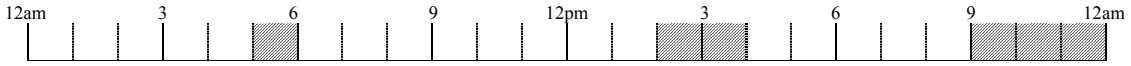
Don't remember ( )

39. Please describe your LAST TRIP in the table below. We would like to know when you were working, when you were on a break and when you felt fatigued on the trip.

LOOK AT THIS EXAMPLE. *Let's say that a driver began his trip at 5am and finished at 7pm, taking breaks from 10am-11am and 2pm-3pm. He would draw a line in the following way to indicate when he was working and when he was sleeping or on breaks*



If he felt fatigued between the hours of 5am-6am, 2pm-4pm and 9pm -12am, he would shade this section as follows:

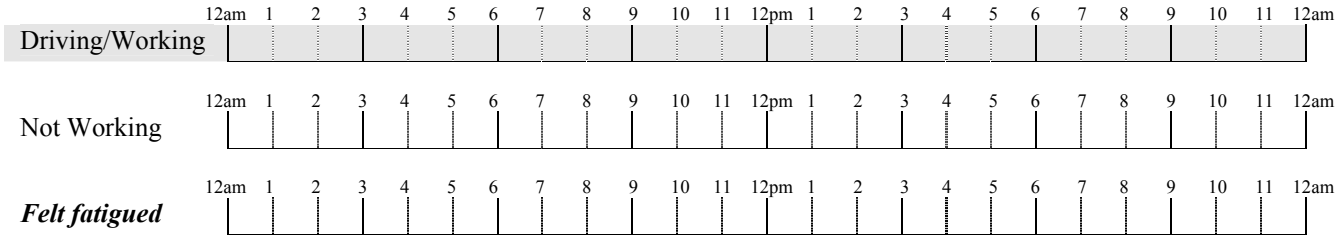


NOW YOU GO AHEAD and draw a line to show when you were working and when you were not. Please shade on the third timeline the times when you felt fatigued.

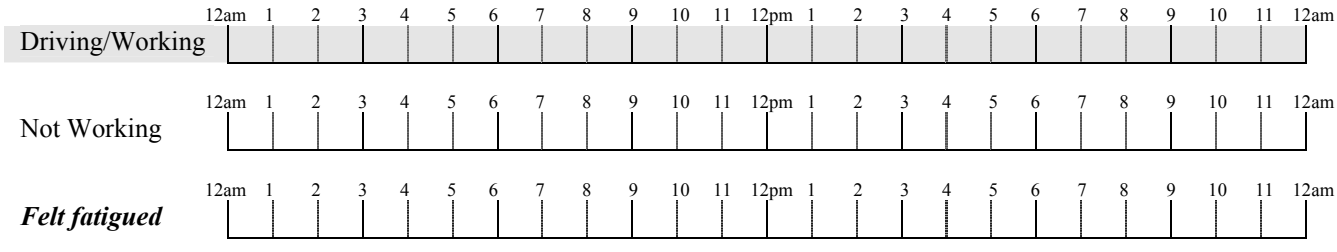
Keep filling out the table for as long as your trip took.

TRIP START

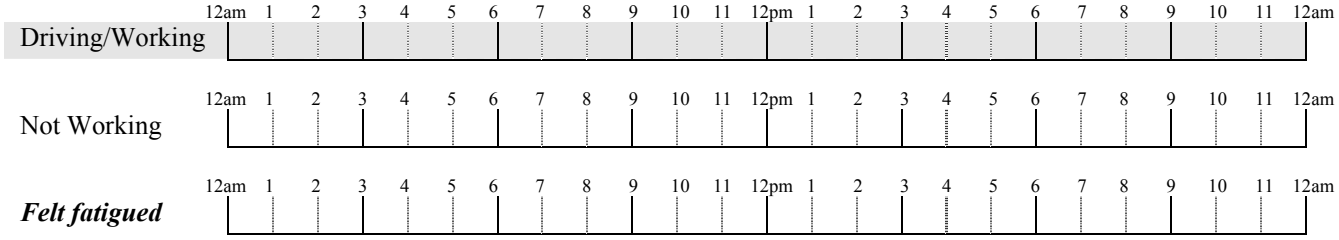
Day 1 -



DAY 2 -

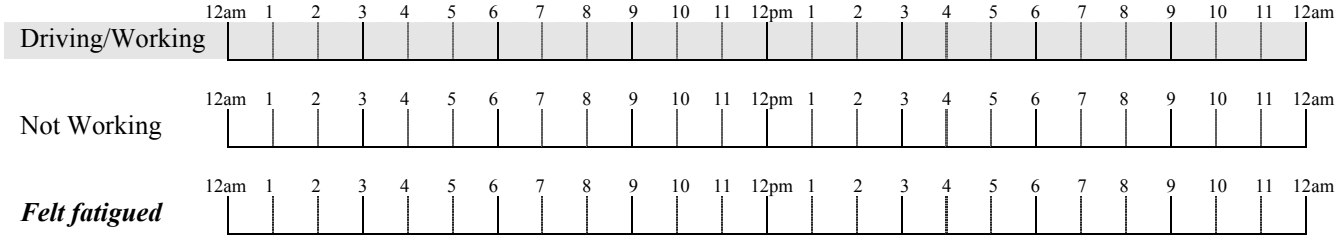


DAY 3 -

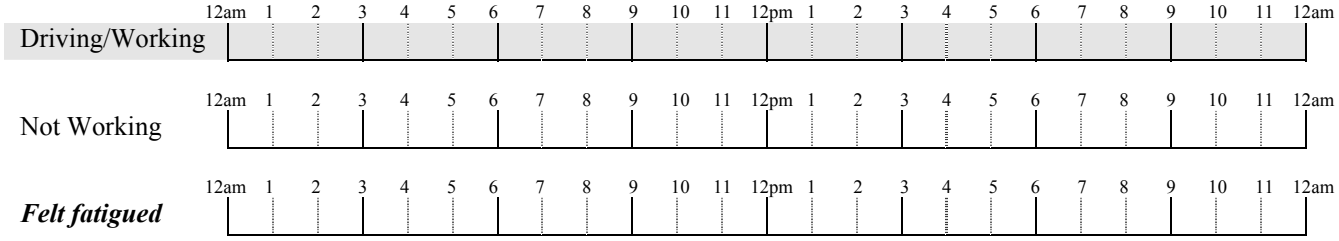


DAY 4 -

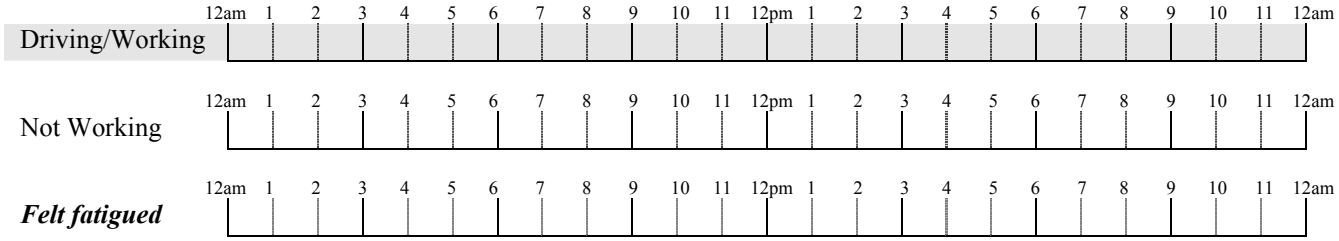
DAY 5 -



DAY 6 -



DAY 7 -



40. We would now like to find out more about NON-DRIVING YARD WORK (other than loading) that you might have been involved in on your LAST trip. Please tell us about YARD WORK at your STARTING POINT and your FINISH POINT.

	Did you do any YARD WORK? *(Please tick "Yes" or "No")*	How much time did you spend in YARD WORK? *(In mins or hours)*
YARD WORK At STARTING POINT	Yes ( ) No ( )	
YARD WORK At FINISHING POINT	Yes ( ) No ( )	

41. We would now like to find out more about the LOADING AND UNLOADING on your LAST trip. Please tell us about LOADING at your STARTING POINT and about UNLOADING at your FINISH POINT.

	Did you do any of the LOADING/ UNLOADING or TARPING? *(Please tick "Yes" or "No")*	How long were you WAITING BEFORE your truck could be LOADED/ UNLOADED? *(In mins or hrs)*	How long did it take to LOAD/UNLOAD your truck? *(In mins or hrs)*
LOADING at STARTING POINT	Yes ( ) No ( )		
UNLOADING at FINISHING POINT	Yes ( ) No ( )		

42. Did you stop to load/unload anywhere else on your trip other than at the starting and finishing points?

Yes ( )

No ( )

If Yes, how many other times did you load/unload?

_____

43. If you had to wait before your truck could be loaded/unloaded at any point on your LAST trip, what were the MAIN delays?

The depot was not open ( )

Waiting for other trucks to be loaded/unloaded ( )

Freight was not available ( )

Machinery was not available for loading/unloading ( )

No/poor booking procedures for loading/unloading time slots ( )

Other (please describe)

_____

_____

44. What was your cruising speed on the OPEN ROAD?

Below the speed limit ( )

At the speed limit ( )

Less than 15km/hr above the speed limit ( )

At least 30km/hr above the speed limit ( )

45. In the 10 hours before your LAST trip, roughly how much time did you spend on each of the following activities?

Sleeping	_____ hours
Resting/relaxing but not sleeping	_____ hours
Checking/repairing heavy vehicle	_____ hours
Loading/unloading heavy vehicle	_____ hours
Other yard work	_____ hours
Driving a light vehicle	_____ hours
Driving heavy vehicle	_____ hours

46. Did any potentially dangerous things due to fatigue happen to you on this trip like:

	Yes	***No***
Nodding off/ falling asleep	( )	( )
Having a near miss	( )	( )
Running off the road	( )	( )
Crossing lane lines	( )	( )
Over/under steering	( )	( )
Late braking	( )	( )
Colliding with something	( )	( )
Other	( )	( )

(please describe)

_____

_____

SECTION 4: FATIGUE-RELATED DANGERS

All drivers may encounter potentially dangerous things due to fatigue eg, nodding off, near miss, run off road, collide with something.

47. How often have these things happened to you this year (ie from January on)?

Please circle the most appropriate frequency.

Nodding off/falling asleep	*Often*	*Sometimes*	*Rarely*	*Never*
Having a near miss	*Often*	*Sometimes*	*Rarely*	*Never*
Running off the road	*Often*	*Sometimes*	*Rarely*	*Never*
Colliding with something	*Often*	*Sometimes*	*Rarely*	*Never*
Other	*Often*	*Sometimes*	*Rarely*	*Never*

(please describe) _____

_____

48. Have you had any accidents in the last 12 months?

Yes ( )

No ( )

If Yes, how many accidents did you have:

WITH *property damage or injury?* _____

WITHOUT *property damage or injury?* _____

Do you think FATIGUE was a factor in any of these accidents?

Yes ( )

No ( )

SECTION 5: BREAKING THE RULES

49. How often do you work contrary to the driving/work hour regulations?

(eg, Working more hours than permitted, taking fewer rest breaks than required).

On every trip	( )
On most trips	( )
On about half your trips	( )
Occasionally	( )
Very rarely	( )

If you do work contrary to the driving/work hours regulations, why do you?

	You may tick more than one option
Because of your tight schedule	( )
Because of rewards or penalties associated with arriving early or late	( )
To get in early to get the next load	( )
In order to do enough trips to earn a living	( )
In order to return home	( )
In order to reach adequate rest facilities	( )
In order to keep your job	( )
Other (please describe)	_____
	_____

50. How often do you drive contrary to the road rules? (eg, Speeding, illegal overtaking, crossing unbroken lines, disobeying traffic signs.)

On every trip	( )
On most trips	( )
On about half your trips	( )
Occasionally	( )
Very rarely	( )

If you do work contrary to the road rules, why do you?

	You may tick more than one option
Because of your tight schedule	( )
Because of rewards or penalties associated with arriving early or late	( )
To get in early to get the next load	( )
In order to do enough trips to earn a living	( )
Because you are fatigued	( )
Because of the effects of alcohol	( )
Because of the after effects of using stay-awake drugs	( )
Because of lack of attention	( )
Other (please describe)	

_____

_____

SECTION 6: WEEKLY WORK/REST SCHEDULE

In this section we want to find out about your work in the SEVEN DAYS IMMEDIATELY BEFORE THE LAST TRIP you just described.

51. Did you work LAST WEEK?

Yes ( )

No ( )

If Yes, please complete the following table.

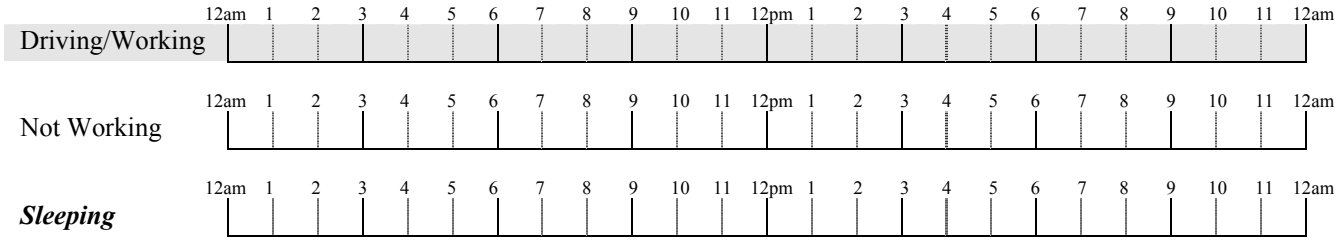
If No, GO TO Comments section.

We are interested in your work and rest LAST WEEK.

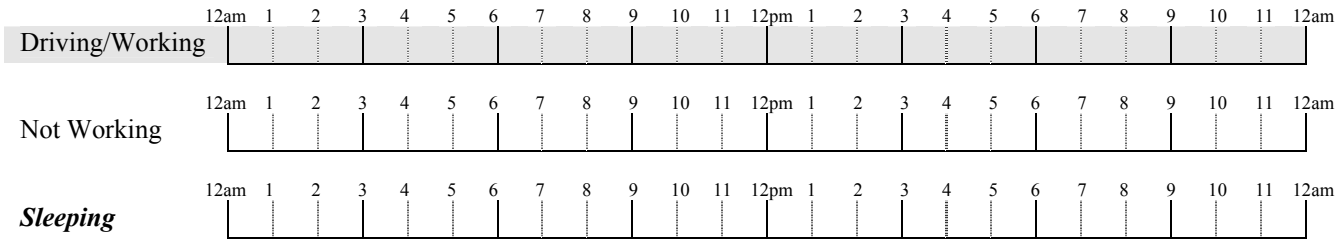
Please mark on the lines when you were working and when you were not.
Please shade the lines for the times when you were sleeping.

Keep filling out the table for all 7 days.

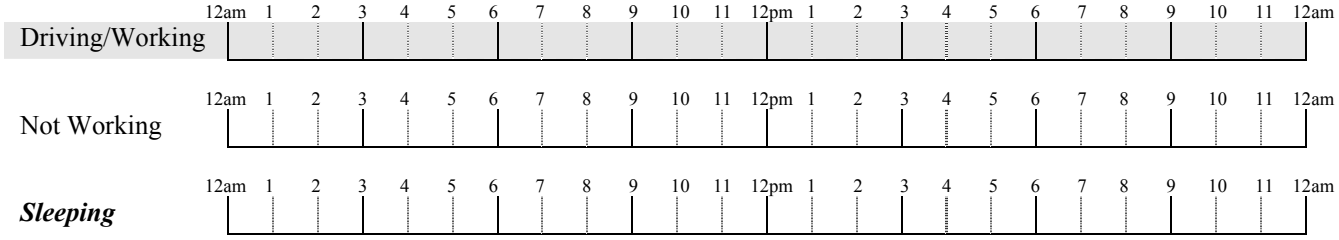
DAY 1 - *(7 days ago)*



DAY 2 - *(6 days ago)*

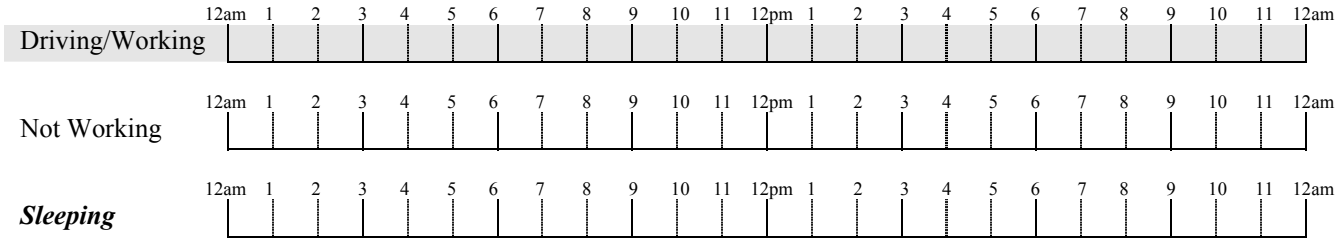


DAY 3 - *(5 days ago)*



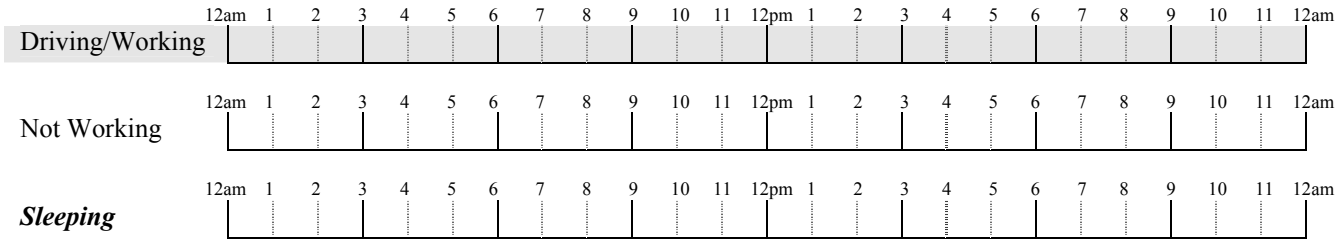
DAY 4 - *(4 days ago)*

DAY 5 - *(3 days ago)*



DAY 6 - *(2 days ago)*

DAY 7 - *(Yesterday)*



COMMENTS

We're interested in any other comments or suggestions you may have about truck driver fatigue that haven't been covered by the questionnaire.

Please write any comments or suggestions below.

_____

_____

_____

_____

_____

_____

THANK YOU VERY MUCH FOR YOUR CO-OPERATION

APPENDIX 3: DISTRIBUTIONS OF WORK AND REST ON THE LAST TRIP AND THE LAST WORKING WEEK

Distributions for the last trip

Total trip duration on last trip

Trip duration (hours)	Direct question (n=836) %	Diary estimate (n=611) %
≤24	56.2	54.8
>24 - ≤48	24.5	27.5
>48 - ≤72	7.6	8.7
>72 - ≤96	5.5	3.1
>96 - ≤120	1.9	2.6
>120 - ≤144	2.3	2.2
>144 - ≤168 (7 days)	0.9	1.1
>168 - ≤192	0.4	
>192 - ≤216	0.0	
>216 - ≤240	0.5	
>240 - ≤264	0.1	
>264 - ≤288	0.0	
>288 - ≤312	0.0	
>312 - ≤336	0.0	
>336 - ≤360	0.0	
>360 - ≤384	0.0	
>384 - ≤408	0.1	

Work and nonwork time on last trip

	Nonwork hours Diary estimate (n=616)	Work hours Diary estimate (n=616)	Driving hours Direct question (n=846)
Hours	**%**	**%**	**%**
≤14	75.5	48.4	55.9
>14 - ≤28	12.5	33.1	27.6
>28 - ≤42	5.8	10.2	7.0
>42 - ≤56	2.6	4.2	5.1
>56 - ≤70	1.8	2.0	2.6
>70 - ≤84	1.2	0.8	1.0
>84 - ≤98	0.4	0.8	0.2
>98 - ≤112	0.2	0.3	0.1
>112 - ≤126		0.2	0.3
>126 - ≤140			0.1
>140 - ≤154			0.1

Night work on last trip

Diary estimates (n=440)			
Work hours between 00:00-06:00	**%**	**% of work done between 00:00-06:00**	**%**
≤3	42.0	≤10	20.7
>3 - ≤6	44.6	>10 - ≤20	24.5
>6 - ≤9	6.8	>20 - ≤30	25.9
>9 - ≤12	3.0	>30 - ≤40	13.2
>12 - ≤15	2.0	>40 - ≤50	11.4
>15 - ≤18	1.4	>50 - ≤60	2.7
>18 - ≤21	0.2	>60 - ≤70	1.1
		>70 - ≤80	0.3
		>80 - ≤90	0.0
		>90 - ≤100	0.2

Distributions for the last working week

Total work hours in last working week

Work hours	% drivers with complete work data (n=252)	% drivers with complete work and sleep data (n=149)	Number of work blocks	% drivers with complete work data (n=252)	% drivers with complete work and sleep data (n=149)
≤14	1.2	1.3	≤3	4.4	2.7
>14 - ≤28	9.1	8.1	>3 - ≤6	15.8	12.1
>28 - ≤42	21.0	16.1	>6 - ≤9	22.3	18.8
>42 - ≤56	24.3	26.2	>9 - ≤12	23.8	22.8
>56 - ≤70	20.6	20.8	>12 - ≤15	16.2	19.4
>70 - ≤84	13.9	15.4	>15- ≤18	10.0	12.8
>84 - ≤98	5.5	6.7	>18 - ≤21	5.5	9.4
>98 - ≤112	3.2	3.4	>21 - ≤24	1.6	2.0
>112 - ≤126	0.8	1.3	>24 - ≤27	0.0	
>126 - ≤140	0.4	0.7	>27 - ≤30	0.4	

Total night work in last working week

Work hours between 00:00-06:00	% drivers with complete work data (n=195)	% drivers with complete work and sleep data (n=115)	% of work done between 00:00-06:00	% drivers with complete work data (n=195)	% drivers with complete work and sleep data (n=115)
≤6	43.6	46.1	≤10	35.4	36.5
>6 - ≤12	31.3	31.3	>10 - ≤20	32.8	38.3
>12 - ≤18	13.3	13.0	>20 - ≤30	22.1	17.4
>18 - ≤24	8.2	7.0	>30 - ≤40	6.1	6.1
>24 - ≤30	1.5	0.0	>40 - ≤50	2.6	0.8
>30 - ≤36	2.1	2.6	>50 - ≤60	1.0	0.9

Total sleep in last working week

Sleep hours	% drivers with complete work data (n=227)	% drivers with complete work and sleep data (n=149)	Number of sleep blocks	% drivers with complete work data (n=226)	% drivers with complete work and sleep data (n=149)
≤6	3.1		≤2	3.5	
>6 - ≤12	2.2		>2 - ≤4	14.2	1.3
>12 - ≤18	4.0	1.3	>4 - ≤6	13.7	6.1
>18 - ≤24	4.8	0.7	>6 - ≤8	47.8	66.4
>24 - ≤30	5.7	0.7	>8 - ≤10	15.9	21.5
>30 - ≤36	6.2	5.4	>10- ≤12	3.1	4.0
>36 - ≤42	9.7	8.0	>12 - ≤14	1.4	0.7
>42 - ≤48	9.7	7.4	>14 - ≤16	0.0	
>48 - ≤54	14.5	19.5	>16 - ≤18	0.0	
>54 - ≤60	17.6	24.1	>18 - ≤20	0.4	
>60 - ≤66	14.1	20.8			
>66 - ≤72	6.2	9.4			
>72 - ≤78	1.8	2.7			
>78 - ≤84	0.4				

Work hours per day in last working week

Percent of drivers with complete work data (n=252)							
	Days of the last week						
Hours	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	24.2	21.8	23.8	22.6	22.2	24.2	23.4
>0 - ≤3	4.0	6.0	4.4	5.6	5.2	2.8	6.8
>3 - ≤6	12.7	13.1	8.3	7.5	11.9	10.3	13.5
>6 - ≤9	19.0	11.1	14.3	16.3	14.3	15.9	17.0
>9 - ≤12	22.6	26.2	22.6	24.6	23.8	23.4	22.2
>12 - ≤15	8.8	12.3	14.3	13.1	13.1	11.9	9.6
>15 - ≤18	5.1	6.7	8.7	7.5	6.7	7.5	4.7
>18 - ≤21	2.8	2.8	2.0	1.6	2.0	2.4	2.4
>21 - ≤24	0.8		1.6	1.2	0.8	1.6	0.4
Mean	7.46	7.96	8.28	8.09	7.90	8.07	7.29
SD	5.69	5.76	6.14	5.85	5.79	5.97	5.62
Percent of drivers with complete work and sleep data (n=149)							
	Days of the last week						
Hours	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	16.8	20.1	19.5	20.1	20.8	22.8	19.5
>0 - ≤3	4.7	4.7	4.0	4.7	4.0	2.0	7.3
>3 - ≤6	12.7	14.1	8.7	6.7	12.8	11.4	12.1
>6 - ≤9	20.8	8.1	12.1	18.2	14.7	16.1	18.1
>9 - ≤12	25.5	28.2	22.8	26.1	24.2	25.6	27.2
>12 - ≤15	8.8	13.4	19.5	14.8	14.1	10.0	9.4
>15 - ≤18	6.0	8.7	9.4	6.7	8.7	8.7	4.0
>18 - ≤21	3.4	2.7	2.7	2.0	0.7	2.7	1.3
>21 - ≤24	1.3		1.3	0.7		0.7	0.7
Mean	8.30	8.39	9.00	8.40	8.01	8.07	7.63
SD	5.55	5.76	6.07	5.64	5.48	5.74	5.42

Sleep hours per day in last working week

Percent of drivers with complete work data							
	Days of the last week						
Hours	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	3.9	0.5	4.0	1.5	1.5	3.0	3.6
>0 - ≤3	11.2	10.5	7.0	10.2	6.8	6.9	6.8
>3 - ≤6	17.9	20.5	23.5	16.1	12.3	16.2	18.2
>6 - ≤9	48.0	42.5	44.5	46.3	52.4	50.3	47.4
>9 - ≤12	17.9	23.5	18.5	22.0	22.1	17.7	20.9
>12 - ≤15	1.1	1.0	2.0	2.9	4.4	4.4	2.6
>15 - ≤18		0.5	0.0	1.0	0.5	0.0	0.0
>18 - ≤21		0.5	0.5			0.5	0.5
>21 - ≤24		0.5				1.0	
n	179	200	200	205	204	203	192
Mean	7.10	7.61	7.30	7.67	7.92	7.83	7.64
SD	3.04	3.14	2.99	3.03	2.96	3.37	3.00
Percent of drivers with complete work and sleep data (n=149)							
	Days of the last week						
Hours	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	3.4	0.7	3.4	0.7	0.7	1.3	2.7
>0 - ≤3	11.4	8.0	5.3	8.0	6.7	4.1	3.3
>3 - ≤6	13.4	20.2	22.8	15.5	12.1	15.4	17.5
>6 - ≤9	51.7	42.9	47.7	49.6	55.7	55.0	48.3
>9 - ≤12	20.1	26.9	20.1	22.8	21.4	18.8	25.5
>12 - ≤15		0.6	0.7	2.7	3.4	4.1	2.0
>15 - ≤18		0.0		0.7		0.0	0.0
>18 - ≤21		0.0				0.0	0.7
>21 - ≤24		0.7				1.3	
Mean	7.26	7.78	7.37	7.80	7.85	8.18	8.05
SD	2.97	2.84	2.57	2.76	2.69	3.04	2.74

APPENDIX 4: COMPARISONS OF INTERVIEWED AND SELF-ADMINISTERED SURVEY RESPONSES

Note: 'ns' = not statistically significant at $p<0.05$.

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
Sex	Male (%)	99.6	97.5	$\chi^2_{(1)}=8.06$, $p=0.005$
Age (Yrs)	Mean *(SD)*	40.98 *(9.63)*	38.45 *(9.30)*	$t_{(999)}=4.23$, $p<0.001$
Marital status	%	x	x	ns
Has children	%	x	x	ns
No. children	Mean *(SD)*	x	x	ns
Children's ages	All > 18 (%)	25.8	18.0	$\chi^2_{(1)}=7.10$, $p=0.008$
Home state	%	x	x	ns
Experience (Yrs)	Mean *(SD)*	18.72 *(10.16)*	16.33 *(9.37)*	$t_{(994)}=3.85$, $p<0.001$
Employment	Employee (%)	67.8	70.7	$\chi^2_{(2)}=25.15$, $p<0.001$
	Owner Driver	24.7	28.2	
	Owner Operator	7.5	1.0	
Fleet size	%	x	x	ns
Type of owner	%	x	x	ns
Employment & fleet size	Employee, ≤ 10 trucks (%)	33.5	41.2	$\chi^2_{(4)}=10.14$, $p=0.04$
	Employee, 11-50 trucks	21.1	20.5	
	Employee >50 trucks	13.5	8.7	
	Independent owner	14.0	14.7	
	Contracted owner	17.9	14.9	
Cart others' freight	%	x	x	ns
Cart own produce	%	x	x	ns
Usual freight	Livestock (%)	x	x	ns
	Refrigerated	x	x	ns
	Dangerous goods	8.4	14.1	$\chi^2_{(1)}=8.22$, $p=0.004$
	Farm produce	16.3	24.5	$\chi^2_{(1)}=10.55$, $p=0.001$
	Other bulk	10.0	15.2	$\chi^2_{(1)}=6.24$, $p=0.01$
	Machinery	8.0	21.6	$\chi^2_{(1)}=37.09$, $p<0.001$
	Building materials	7.5	22.0	$\chi^2_{(1)}=42.95$, $p<0.001$
	Groceries	7.5	28.7	$\chi^2_{(1)}=77.56$, $p<0.001$

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
	Manufactured	7.5	16.4	$\chi^2_{(1)}$=19.33, p<0.001
	General/mixed	42.9	57.8	$\chi^2_{(1)}$=22.18, p<0.001
	Cars	x	x	ns
	Express	8.8	29.1	$\chi^2_{(1)}$=68.25, p<0.001
	Other	x	x	ns
No. freight classes	Mean *(SD)*	1.54 *(1.08)*	2.72 *(2.08)*	$t_{(706.7)}$=11.09, p<0.001
Rate negotiated per load	%	x	x	ns
Ongoing contracts	All loads (%)	20.2	31.1	$\chi^2_{(2)}$=21.57, p<0.001
	Some loads	15.9	21.6	
	No loads	63.9	47.3	
Pay rate	Hourly (%)	x	x	ns
	Day	x	x	ns
	Day + overtime	x	x	ns
	Week + overtime	x	x	ns
	Flat per load	x	x	ns
	Trip rate	x	x	ns
	Other	3.1	6.8	$\chi^2_{(1)}$=7.59, p=0.006
No. pay types	1 only (%)	100.0	92.9	$\chi^2_{(1)}$=38.27, p<0.001
Pay re award	< award (%)	14.1	20.4	$\chi^2_{(3)}$=8.02, p=0.046
	= award	38.5	35.6	
	> award	28.1	23.9	
	Don't know	19.3	20.2	
Usual vehicle type	Rigid 2 axle (%)	1.9	4.3	$\chi^2_{(1)}$=4.96, p=0.03
	Rigid 3 axle	x	x	ns
	Rigid 4 axle	x	x	ns
	Articulated 3 axle	x	x	ns
	Articulated 4 axle	x	x	ns
	Articulated 5 axle	x	x	ns
	Articulated 6 axle	x	x	ns
	B Double	x	x	ns
	Double road train	6.9	14.3	$\chi^2_{(1)}$=14.64, p<0.001
	Triple road train	1.9	4.1	$\chi^2_{(1)}$=4.30, p=0.04
Epworth score	Mean *(SD)*	6.68 *(3.67)*	7.47 *(3.82)*	$t_{(943)}$=3.24, p=0.001
Categorised epworth	%	x	x	ns
Industry fatigue problem	%	x	x	ns

Characteristic	Value	Type of administration		
		Interview	**Self administered**	**Statistical test result**
Personal fatigue problem	Major (%)	5.6	6.9	$\chi^2_{(3)}$=20.09, p<0.001
	Substantial	13.6	16.8	
	Minor	44.8	53.8	
	None	36.0	23.1	
Frequency of fatigue	Every trip (%)	8.8	6.1	$\chi^2_{(4)}$=14.29, p=0.006
	Most trips	7.6	13.4	
	Half of trips	13.4	12.6	
	Occasionally	42.4	45.7	
	Very rarely	27.8	22.2	
Change in industry awareness	%	x	x	ns
Change in personal awareness	%	x	x	ns
Usual fatigue onset lag (hrs)	Mean *(SD)*	11.42 *(7.74)*	12.72 *(10.57)*	$t_{(702.0)}$=2.00, p=0.045
	<10 hours (%)	36.9	37.6	$\chi^2_{(2)}$=6.49, p=0.039
	10-14 hours	41.2	34.0	
	>14 hours	21.9	28.4	
Usual time at onset of earliest fatigue prone period	00:00-05:59(%)	71.3	78.5	$\chi^2_{(3)}$=10.99, p=0.01
	06:00-11:59	6.7	6.2	
	12:00-17:59	14.1	7.5	
	18:00-23:59	7.9	7.8	
Usual duration of earliest fatigue prone period	Mean *(SD)*	2.23 *(1.29)*	2.65 *(1.14)*	$t_{(916.8)}$=4.72, p<0.001
Usual duration of second fatigue prone period	Mean *(SD)*	1.81 *(0.75)*	2.12 *(0.85)*	$t_{(364)}$=3.59, p<0.001
No. of usual fatigue prone periods	Mean *(SD)*	1.33 *(0.52)*	1.42 *(0.56)*	$t_{(923.9)}$=4.42, p<0.001
Fatigue effects on driving	Slow reaction time (%)	x	x	ns
	Poor steering	x	x	ns p=0.056
	Poor braking	x	x	ns
	Poor gearing	x	x	ns p=0.059
	Poor overtaking	x	x	ns
	Speeding	x	x	ns
	Slow driving	x	x	ns
	Poor signalling	13.2	8.4	$\chi^2_{(1)}$=4.16, p=0.04

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
	Poor attention to signs	x	x	ns
	Poor awareness of other road users	ns	ns	ns
Contributors to fatigue	Long hours (%)	x	x	ns
	Nondriving work	x	x	ns
	Insufficient breaks	26.8	19.2	$\chi^2_{(1)}$=8.00, p=0.005
	Un/loading	x	x	ns p=0.053
	Waiting to un/load	x	x	ns
	Checking load	4.8	2.1	$\chi^2_{(1)}$=5.34, p=0.02
	Rest away from home	x	x	ns
	Poor trip sleep	35.1	41.6	$\chi^2_{(1)}$=4.44, p=0.04
	Poor pretrip sleep	x	x	ns
	Little night sleep	x	x	ns
	Night driving	x	x	ns p=0.054
	Dawn driving	x	x	ns
	Dusk driving	x	x	ns
	Afternoon driving	20.8	15.4	$\chi^2_{(1)}$=4.86, p=0.03
	Road conditions	x	x	ns
	Boring route	x	x	ns
	Highway traffic	16.2	10.8	$\chi^2_{(1)}$=6.20, p=0.01
	City traffic	x	x	ns
	Poor weather	x	x	ns
	Poor cab design	x	x	ns
	Poor ventilation	x	x	ns
	Vibration	12.9	8.9	$\chi^2_{(1)}$=4.15, p=0.04
	Family problems	x	x	ns
	Poor diet	x	x	ns
	Drug after effects	x	x	ns
	Alcohol	x	x	ns
	Other	x	x	ns
Important fatigue contributors	Long hours (%)	45.1	27.9	$\chi^2_{(1)}$=14.88, p<0.001
	Nondriving work	x	x	ns
	Insufficient breaks	x	x	ns
	Un/loading	46.2	31.0	$\chi^2_{(1)}$=8.69, p=0.003
	Waiting to un/load	55.2	41.7	$\chi^2_{(1)}$=10.12, p=0.001

Characteristic	Value	Type of administration		
		Interview	**Self administered**	**Statistical test result**
	Checking load	x	x	ns
	Rest away from home	x	x	ns
	Poor trip sleep	x	x	ns
	Poor pretrip sleep	x	x	ns p=0.058
	Little night sleep	x	x	ns
	Night driving	x	x	ns
	Dawn driving	47.3	27.2	$\chi^2_{(1)}$=25.13, p<0.001
	Dusk driving	29.9	16.5	$\chi^2_{(1)}$=5.65, p=0.02
	Afternoon driving	27.8	11.0	$\chi^2_{(1)}$=7.43, p=0.006
	Road conditions	x	x	ns
	Boring route	x	x	ns p=0.058
	Highway traffic	28.6	11.8	$\chi^2_{(1)}$=5.19, p=0.02
	City traffic	32.7	20.8	$\chi^2_{(1)}$=4.17, p=0.04
	Poor weather	38.4	27.5	$\chi^2_{(1)}$=5.04, p=0.03
	Poor cab design	x	x	ns
	Poor ventilation	x	x	ns
	Vibration	x	x	ns
	Family problems	x	x	ns
	Poor diet	x	x	ns
	Drug after effects	x	x	ns
	Alcohol	32.5	6.5	$\chi^2_{(1)}$=7.11, p=0.008
	Other	x	x	ns
No. of contributors	Mean *(SD)*	x	x	ns
No. of important contributors	Mean *(SD)*	2.33 *(2.11)*	1.60 *(1.86)*	$t_{(989)}$=5.77, p<0.001
% of contributors seen as important	Mean *(SD)*	42.54 *(30.59)*	25.32 *(26.53)*	$t_{(986.4)}$=9.49, p<0.001
Driver strategies				
Stop to eat	At least sometimes (%)	65.0	74.2	$\chi^2_{(1)}$=8.85, p=0.003
Stop to rest	At least sometimes (%)	x	x	ns
Stop to sleep	At least sometimes (%)	x	x	ns
Stop for a meal	At least sometimes (%)	x	x	ns
Eat and drive	At least sometimes (%)	42.3	51.1	$\chi^2_{(1)}$=6.54, p=0.01

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
Caffeine drinks	At least sometimes (%)	x	x	ns
Noncaffeine drinks	At least sometimes (%)	x	x	ns
Smoking	At least sometimes (%)	45.6	52.7	$\chi^2_{(1)}$=4.42, p=0.04
Stay-awake drugs	At least sometimes (%)	18.0	28.5	$\chi^2_{(1)}$=13.60, p<0.001
Ignore regulations to get home	At least sometimes (%)	63.3	70.9	$\chi^2_{(1)}$=5.23, p=0.02
Kick tyres & walk around	At least sometimes (%)	x	x	ns
Shower	At least sometimes (%)	x	x	ns
Music/radio	At least sometimes (%)	80.4	87.3	$\chi^2_{(1)}$=7.94, p=0.005
CB	At least sometimes (%)	61.9	70.5	$\chi^2_{(1)}$=7.12, p=0.008
Singing	At least sometimes (%)	30.7	40.4	$\chi^2_{(1)}$=8.75, p=0.003
Adjust ventilation	At least sometimes (%)	x	x	ns
Other	At least sometimes (%)	x	x	ns
Helpful driver strategies	Stop to eat	x	x	ns
	Stop to rest	x	x	ns
	Stop to sleep	x	x	ns
	Stop for a meal	21.9	12.7	$\chi^2_{(1)}$=8.61, p=0.003
	Eat and drive	x	x	ns
	Caffeine drinks	24.2	17.3	$\chi^2_{(1)}$=5.56, p=0.02
	Noncaffeine drinks	x	x	ns
	Smoking	28.1	14.0	$\chi^2_{(1)}$=12.92, p<0.001
	Stay-awake drugs	x	x	ns
	Ignore regulations to get home	x	x	ns
	Kick tyres & walk around	x	x	ns
	Shower	x	x	ns
	Music/radio	x	x	ns
	CB	x	x	ns
	Singing	11.4	4.8	$\chi^2_{(1)}$=4.45, p=0.04

Characteristic	Value	Type of administration		
		Interview	**Self administered**	**Statistical test result**
	Adjust ventilation	19.5	10.1	$\chi^2_{(1)}$=11.12, p=0.001
	Other	x	x	ns
No. strategies used	Mean *(SD)*	9.86 *(2.83)*	8.83 *(3.41)*	$t_{(922.7)}$=5.14, p<0.001
No. helpful strategies	Mean *(SD)*	1.82 *(2.02)*	1.31 *(1.88)*	$t_{(991)}$=4.45, p=0.04
% used strategies that are helpful	Mean *(SD)*	19.65 *(21.96)*	15.81 *(22.65)*	$t_{(989)}$=2.71, p=0.007
Industry fatigue management	Bad (%)	51.2	55.8	$\chi^2_{(2)}$=8.93, p=0.01
	Well	38.0	29.6	
	No opinion	10.7	14.6	
Personal fatigue management	Bad (%)	4.2	7.1	$\chi^2_{(2)}$=17.27, p<0.001
	Well	94.8	88.2	
	No opinion	1.0	4.6	
Strategies company should use	Information and training (%)	62.7	50.1	$\chi^2_{(1)}$=15.40, p<0.001
	Efficient loading	81.8	64.0	$\chi^2_{(1)}$=39.07, p<0.001
	No un/loading	62.9	52.1	$\chi^2_{(1)}$=11.34, p=0.001
	Two-up driving	x	x	ns
	Staged driving	40.8	27.1	$\chi^2_{(1)}$=19.99, p<0.001
	Increase pay rates	75.0	61.5	$\chi^2_{(1)}$=20.17, p<0.001
	Ease tight schedules	71.9	51.0	$\chi^2_{(1)}$=44.18, p<0.001
	Decrease night driving	x	x	ns
	Increase breaks between trips	55.7	42.3	$\chi^2_{(1)}$=17.10, p<0.001
	Increase sleep on the road	64.1	49.7	$\chi^2_{(1)}$=20.23, p<0.001
	More trip breaks	55.0	42.1	$\chi^2_{(1)}$=16.19, p<0.001
Strategies company should not use	Information and training (%)	29.3	12.8	$\chi^2_{(1)}$=38.60, p<0.001
	Efficient loading	12.5	4.0	$\chi^2_{(1)}$=21.91, p<0.001
	No un/loading	31.4	15.0	$\chi^2_{(1)}$=35.66, p<0.001
	Two-up driving	76.8	51.5	$\chi^2_{(1)}$=67.13, p<0.001
	Staged driving	53.9	36.0	$\chi^2_{(1)}$=30.79, p<0.001
	Increase pay rates	22.3	11.0	$\chi^2_{(1)}$=21.61, p<0.001
	Ease tight schedules	20.9	6.5	$\chi^2_{(1)}$=40.72, p<0.001

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
	Decrease night driving	65.8	37.1	$\chi^2_{(1)}$=78.73, p<0.001
	Increase breaks between trips	39.3	13.9	$\chi^2_{(1)}$=77.28, p<0.001
	Increase sleep on the road	29.1	9.6	$\chi^2_{(1)}$=56.57, p<0.001
	More trip breaks	38.5	11.9	$\chi^2_{(1)}$=87.74, p<0.001
Strategies company does use	Information and training (%)	29.9	14.3	$\chi^2_{(1)}$=33.03, p<0.001
	Efficient loading	33.4	23.3	$\chi^2_{(1)}$=11.98, p=0.001
	No un/loading	25.8	15.7	$\chi^2_{(1)}$=14.70, p<0.001
	Two-up driving	x	x	ns
	Staged driving	18.0	11.0	$\chi^2_{(1)}$=9.34, p=0.002
	Increase pay rates	15.2	10.3	$\chi^2_{(1)}$=5.18, p=0.02
	Ease tight schedules	x	x	ns
	Decrease night driving	x	x	ns
	Increase breaks between trips	33.4	22.8	$\chi^2_{(1)}$=13.12, p<0.001
	Increase sleep on the road	34.4	25.3	$\chi^2_{(1)}$=9.38, p=0.002
	More trip breaks	31.1	23.0	$\chi^2_{(1)}$=7.72, p=0.005
No. strategies company should use	Mean *(SD)*	6.19 *(2.43)*	4.84 *(3.04)*	$t_{(852.2)}$=7.50, p<0.001
No. strategies company should not use	Mean *(SD)*	4.20 *(2.33)*	2.09 *(2.15)*	$t_{(953.9)}$=14.55, p<0.001
No. strategies company does use	Mean *(SD)*	2.76 *(2.52)*	1.92 *(2.42)*	$t_{(957)}$=5.29, p<0.001
Strategies governments should use	Information and training (%)	68.3	59.4	$\chi^2_{(1)}$=8.41, p=0.004
	Police drug use	51.3	38.5	$\chi^2_{(1)}$=16.51, p<0.001
	Shorter work hours	x	x	ns
	Permit drug use	x	x	ns
	Enforce regulations	24.2	17.1	$\chi^2_{(1)}$=7.51, p=0.006
	Off-road facilities	89.6	79.9	$\chi^2_{(1)}$=18.20, p<0.001
	Flexible working hours at trip end	93.3	82.7	$\chi^2_{(1)}$=26.59, p<0.001
	Flexible working hours	88.5	84.2	$\chi^2_{(1)}$=3.84, p=0.050
	Improve roads	96.3	87.4	$\chi^2_{(1)}$=27.15, p<0.001
	Provide slow lanes	90.6	70.1	$\chi^2_{(1)}$=66.86, p<0.001

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
	Depot to depot driving	74.8	63.9	$\chi^2_{(1)}$=13.89, p<0.001
	National uniformity	91.2	73.7	$\chi^2_{(1)}$=52.81, p<0.001
	Freight schedulers accountable	87.9	78.8	$\chi^2_{(1)}$=14.68, p<0.001
	Educate public about trucks	96.9	87.8	$\chi^2_{(1)}$=29.83, p<0.001
	Self regulation	63.5	53.8	$\chi^2_{(1)}$=9.41, p=0.002
Strategies governments should not use	Information and training (%)	27.3	11.3	$\chi^2_{(1)}$=39.72, p<0.001
	Police drug use	44.0	35.0	$\chi^2_{(1)}$=8.32, p=0.004
	Shorter work hours	83.5	68.4	$\chi^2_{(1)}$=31.01, p<0.001
	Permit drug use	61.5	43.8	$\chi^2_{(1)}$=31.11, p<0.001
	Enforce regulations	70.4	54.6	$\chi^2_{(1)}$=26.26, p<0.001
	Off-road facilities	7.5	2.6	$\chi^2_{(1)}$=12.26, p<0.001
	Flexible working hours at trip end	x	x	ns
	Flexible working hours	9.8	3.0	$\chi^2_{(1)}$=18.62, p<0.001
	Improve roads	2.7	0.0	$\chi^2_{(1)}$=12.78, p<0.001
	Provide slow lanes	7.1	1.9	$\chi^2_{(1)}$=14.96, p<0.001
	Depot to depot driving	21.3	12.2	$\chi^2_{(1)}$=14.67, p<0.001
	National uniformity	x	x	ns p=0.056
	Freight schedulers accountable	9.8	4.1	$\chi^2_{(1)}$=12.36, p<0.001
	Educate public about trucks	2.1	0.6	$\chi^2_{(1)}$=3.83, p=0.050
	Self regulation	31.2	20.1	$\chi^2_{(1)}$=15.72, p<0.001
Strategies governments do use	Information and training (%)	17.3	9.8	$\chi^2_{(1)}$=11.61, p<0.001
	Police drug use	27.3	10.3	$\chi^2_{(1)}$=46.11, p<0.001
	Shorter work hours	16.0	3.6	$\chi^2_{(1)}$=41.16, p<0.001
	Permit drug use	x	x	ns
	Enforce regulations	31.5	6.8	$\chi^2_{(1)}$=94.50, p<0.001
	Off-road facilities	15.2	5.6	$\chi^2_{(1)}$=24.08, p<0.001
	Flexible working hours at trip end	x	x	ns
	Flexible working hours	x	x	ns

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
	Improve roads	19.0	5.8	$\chi^2_{(1)}$=38.98, p<0.001
	Provide slow lanes	25.2	11.1	$\chi^2_{(1)}$=32.36, p<0.001
Strategies governments do use	Depot to depot driving	9.4	5.3	$\chi^2_{(1)}$=5.92, p=0.02
	National uniformity	15.2	4.9	$\chi^2_{(1)}$=28.10, p<0.001
	Freight schedulers accountable	9.4	5.3	$\chi^2_{(1)}$=5.92, p=0.02
	Educate public about trucks	x	x	ns
	Self regulation	7.5	3.0	$\chi^2_{(1)}$=9.86, p=0.002
No. strategies governments should use	Mean *(SD)*	10.64 *(2.14)*	9.26 *(3.24)*	$t_{(796.2)}$=7.81, p<0.001
No. strategies governments should not use	Mean *(SD)*	3.89 *(1.89)*	2.70 *(1.82)*	$t_{(986)}$=9.85, p<0.001
No. strategies governments do use	Mean *(SD)*	2.10 *(2.16)*	0.89 *(2.03)*	$t_{(984.4)}$=9.13, p<0.001
Last trip				
Type of operation	%	x	x	ns
Trip distance	<700km (%)	17.6	11.9	$\chi^2_{(2)}$=5.94, p=0.051
	700-1500km	44.8	50.4	
	>1500km	37.6	37.7	
	Mean *(SD)*	x	x	ns
Start work time	%	x	x	ns
Start driving time	%	x	x	ns
End driving time	%	x	x	ns
End work time	%	x	x	ns
Trip duration (hrs; direct question)	%	x	x	ns
	Mean *(SD)*	x	x	ns p=0.053
Trip duration (hrs; diary estimate)	Mean *(SD)*	x	x	ns
Days in trip	Mean *(SD)*	x	x	ns
Total driving hours (direct question)	%	x	x	ns
	Mean *(SD)*	x	x	ns
Total work hours (diary estimate)	Mean *(SD)*	x	x	ns
Total nonwork hours	Mean *(SD)*	x	x	ns
Total work blocks	Mean *(SD)*	x	x	ns

Characteristic	Value	Type of administration		
		Interview	**Self administered**	**Statistical test result**
Total nonwork blocks	Mean *(SD)*	x	x	ns
% trip spent working	Mean *(SD)*	x	x	ns
Work hours per day	Mean *(SD)*	x	x	ns
Nonwork hours per day	Mean *(SD)*	x	x	ns
Night work (00:00-06:00)	%	x	x	ns
Total night hours	Mean *(SD)*	x	x	ns
% work done at night	Mean *(SD)*	x	x	ns
Experienced fatigue	%	41.2	49.3	$\chi^2_{(1)}$=6.56, p=0.01
Total fatigue hours (including 0)	Mean *(SD)*	1.56 *(3.21)*	2.63 *(5.10)*	$t_{(307.1)}$=2.78, p=0.006
Total fatigue hours (excluding 0)	Mean *(SD)*	x	x	ns
Total fatigue blocks (including 0)	Mean *(SD)*	0.73 *(1.16)*	1.14 *(1.68)*	$t_{(323.6)}$=3.19, p=0.002
Total fatigue block (excluding 0)	Mean *(SD)*	1.67 *(1.21)*	2.08 *(1.79)*	$t_{(188.8)}$=2.16, p=0.03
% trip spent fatigued (including 0)	Mean *(SD)*	5.49 *(10.22)*	7.79 *(12.19)*	$t_{(377.8)}$=2.35, p=0.02
% trip spent fatigued (excluding 0)	Mean *(SD)*	x	x	ns
Fatigue hours per day (including 0)	Mean *(SD)*	0.66 *(1.19)*	1.06 *(1.83)*	$t_{(313.1)}$=2.91, p=0.004
Fatigue hours per day (excluding 0)	Mean *(SD)*	x	x	ns
Fatigue level at start	%	x	x	ns
In 10 hours before trip				
Sleep hours	Mean *(SD)*	5:56 *(2:59)*	5:16 *(3:11)*	$t_{(598.8)}$=2.95, p=0.003
Rest hours	Mean *(SD)*	x	x	ns
Hours truck check & repair	Mean *(SD)*	0:09 *(0:34)*	0:20 *(0:58)*	$t_{(425.9)}$=3.00, p=0.003
Hours un/loading	Mean *(SD)*	0:14 *(0:57)*	0:28 *(1:16)*	$t_{(503.7)}$=2.80, p<0.001
Hours yardwork	Mean *(SD)*	0:05 *(0:31)*	0:15 *(1:16)*	$t_{(362.6)}$=2.16, p=0.03
Hours drive light vehicle	Mean *(SD)*	x	x	ns
Hours drive heavy vehicle	Mean *(SD)*	0:41 *(2:02)*	0:18 *(1:14)*	$t_{(812.2)}$=3.26, p=0.001
Total hours reported	Mean *(SD)*	9:58 *(0:23)*	9:16 *(1:48)*	$t_{(317.3)}$=6.59, p<0.001

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
During trip				
Yardwork at start	%	14.0	27.9	$\chi^2_{(1)}$=27.78, p<0.001
Hours yardwork at start	Mean *(SD)*	x	x	ns
Yardwork at end	%	14.5	26.3	$\chi^2_{(1)}$=19.92, p<0.001
Hours yardwork at end	Mean *(SD)*	x	x	ns
Loading at start	%	52.9	59.9	$\chi^2_{(1)}$=4.57, p=0.03
Hours waiting at start	Mean *(SD)*	x	x	ns
Hours loading at start	Mean *(SD)*	x	x	ns
Unloading at end	%	53.7	65.6	$\chi^2_{(1)}$=13.40, p<0.001
Hours waiting at end	Mean *(SD)*	x	x	ns
Hours unloading at end	Mean *(SD)*	x	x	ns p=0.052
Un/loading during	%	x	x	ns
No. of times during	Mean *(SD)*	x	x	ns
Delays due to	Depot shut (%)	5.8	12.6	$\chi^2_{(1)}$=13.72, p<0.001
	Loading queues	26.0	38.9	$\chi^2_{(1)}$=18.67, p<0.001
	Freight unavailable	12.5	21.6	$\chi^2_{(1)}$=14.36, p<0.001
	Machinery unavailable	x	x	ns
	No/poor loading booking	4.4	11.0	$\chi^2_{(1)}$=15.10, p<0.001
	Other	x	x	ns
Fixed company schedule	%	x	x	ns
Own ETA	%	30.9	44.4	$\chi^2_{(1)}$=18.62, p<0.001
ETA reason	%	x	x	ns
Cruising speed	%	x	x	ns
Dangerous events	Nodding off (%)	3.9	7.0	$\chi^2_{(1)}$=4.42, p=0.04
	Near miss	x	x	ns
	Run off road	x	x	ns
	Cross lane lines	8.8	14.5	$\chi^2_{(1)}$=7.39, p=0.007
	Over/under steer	3.1	7.5	$\chi^2_{(1)}$=8.82, p=0.003
	Late braking	x	x	ns
	Collision	x	x	ns
	Other	x	x	ns
No. dangerous events	Mean *(SD)*	x	x	ns
Freight	Livestock (%)	x	x	ns
	Refrigerated	x	x	ns

Characteristic	Value	Type of administration		
		Interview	**Self administered**	**Statistical test result**
	Dangerous goods	x	x	ns
	Farm produce	x	x	ns
	Other bulk	x	x	ns
	Machinery	x	x	ns
	Building materials	6.2	9.5	$\chi^2_{(1)}$=3.83, p=0.05
	Groceries	x	x	ns
	Manufactured goods	x	x	ns
	General/mixed	x	x	ns
	Cars	x	x	ns
	Express	4.2	9.1	$\chi^2_{(1)}$=9.35, p=0.002
	Other	x	x	ns
No. freight types	Mean *(SD)*	1.06 *(0.27)*	1.20 *(0.51)*	$t_{(664.4)}$=5.31, p<0.001
Last week				
Worked	%	x	x	ns
Total work hours (complete work data)	Mean *(SD)*	51.74 *(21.83)*	61.00 *(23.20)*	$t_{(250)}$=3.16, p=0.002
	<39 (%)	29.0	16.7	$\chi^2_{(2)}$=9.37, p=0.009
	30-72	53.7	51.1	
	>72	17.3	32.2	
(complete work and sleep data)	Mean *(SD)*	53.87 *(22.61)*	66.57 *(22.51)*	$t_{(147)}$=3.17, p=0.002
	<39 (%)	23.3	10.9	$\chi^2_{(2)}$=8.87, p=0.01
	30-72	57.3	47.8	
	>72	19.4	41.3	
Total nonwork hours (complete work data)	Mean *(SD)*	116.26 *(21.83)*	107.00 *(23.20)*	$t_{(250)}$=3.16, p=0.002
(complete work and sleep data)	Mean *(SD)*	114.13 *(22.61)*	101.43 *(22.51)*	$t_{(147)}$=3.17, p=0.002
Total hours slept (complete work data)	Mean *(SD)*	x	x	ns
(complete work and sleep data)	Mean *(SD)*	x	x	ns
Night work (00:00-06:00) (complete work data)	%	x	x	ns
(complete work and sleep data)	%	x	x	ns
Total night hours (complete work data)	Mean *(SD)*	x	x	ns
(complete work and sleep data)	Mean *(SD)*	x	x	ns

Characteristic	Value	Type of administration		
		Interview	Self administered	Statistical test result
% work done at night (complete work data)	Mean *(SD)*	x	x	ns
(complete work and sleep data)	Mean *(SD)*	x	x	ns
Dangerous events in last year				
Nodding off	Never (%)	57.3	44.5	$\chi^2_{(2)}$=15.25, p<0.001
	Rarely	26.5	35.0	
	At least sometimes	16.2	20.5	
Near miss	Never (%)	59.0	53.5	$\chi^2_{(2)}$=8.33, p=0.02
	Rarely	26.6	35.1	
	At least sometimes	14.5	11.4	
Run off road	Never (%)	75.2	61.1	$\chi^2_{(2)}$=21.15, p<0.001
	Rarely	17.9	27.2	
	At least sometimes	6.9	11.6	
Collision	(%)	x	x	ns
Other	Never (%)	93.6	85.4	$\chi^2_{(2)}$=10.29, p=0.006
	Rarely	2.8	5.3	
	At least sometimes	3.7	9.3	
Accidents	%	x	x	ns
Fatigue a factor in accidents	%	x	x	ns
No. accidents	Mean *(SD)*	x	x	ns
No. with damage or injury	Mean *(SD)*	x	x	ns p=0.058
No. without damage of injury	Mean *(SD)*	x	x	ns
Compliance				
Frequency break hours regulations	%	x	x	ns
Reasons	Tight schedules (%)	x	x	ns
	Rewards & penalties	x	x	ns p=0.053
	In early for next load	21.1	32.0	$\chi^2_{(1)}$=12.96, p<0.001
	Do enough trips to earn a living	27.4	46.4	$\chi^2_{(1)}$=32.68, p<0.001
	Return home	43.3	50.6	$\chi^2_{(1)}$=4.52, p=0.03
	Reach OK rest facilities	22.9	29.8	$\chi^2_{(1)}$=5.15, p=0.02
	Keep job	18.1	29.8	$\chi^2_{(1)}$=15.77, p<0.001
	Other	x	x	ns

Characteristic	Value	Type of administration		
		Interview	**Self administered**	**Statistical test result**
Frequency breach road rules	%	x	x	ns
Reasons	Tight schedules (%)	30.3	38.1	$\chi^2_{(1)}$=4.90, p=0.03
	Rewards & penalties	x	x	ns
	In early for next load	21.5	29.1	$\chi^2_{(1)}$=5.52, p=0.02
	Do enough trips to earn a living	22.5	39.3	$\chi^2_{(1)}$=24.07, p<0.001
	Fatigue	x	x	ns
	Effects of alcohol	x	x	ns
	Drug after effects	1.3	4.3	$\chi^2_{(1)}$=6.64, p=0.01
	Lack of attention	x	x	ns
	Other	x	x	ns