WorkCover Assist Grants Program

FINAL REPORT

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External Influences on health and safety outcomes in NSW long distance trucking

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Isabelle Wolf, Jenny La, Belinda Hua, Naomi Dunn, Jonathan Tsang and Sui Fong Li distributed surveys and conducted the driver interviews.

EXECUTIVE SUMMARY

The purpose of this research project was to explore the effects on long distance truck drivers of waiting to queue to load or unload. It is believed that the need to wait in queues combined with the widespread use of incentive-based remuneration systems for long distance truck drivers increases the work pressures on drivers and consequently increases their experiences of fatigue. It is also argued that these pressures adversely affect long distance drivers' ability to manage the often competing demands of time for work and family responsibilities as well as increasing the risk of adverse safety outcomes such as dangerous occurrences on road and even injury.

The project involved surveys through self-administered questionnaire and interviews of long distance truck drivers doing trips on the major transport corridors within NSW. Drivers were recruited at eight truck rest stops over two periods: November to December, 2009 and in February, 2010. The survey covered demographics, including perceived work-life balance, characteristics of usual working arrangements, details of the last trip undertaken and safety outcomes including fatigue experiences. Additional interview questions were constructed to provide some in-depth information about driver experiences. These included more details about fatigue experiences, the impact of legislative changes and details of crashes and injuries where they were reported. A total of 1,597 drivers were approached to participate in the study with 477 completed returns; a response rate of 30 percent. The majority of returns were by self-administered questionnaire (67.3%) with the remainder by interview. In-depth interviews were conducted with just under ten percent of participants (8.6%).

The results showed a high level of work pressure in this industry as demonstrated by average weekly working hours just under the legal limit of 72 hours per week. This is markedly higher than seen in previous surveys of long distance truck drivers and suggests that changes to working hours limits over the last few years have done little to reduce the overall amount of work being done by long distance truck drivers. Analysis of the effects of waiting in queues and of incentive based payment highlighted the significant impact of waiting on driver fatigue and family life for drivers. As shown in a number of previous studies incentive payments were associated with longer working hours, greater distances driven and higher fatigue for more drivers. The study showed, however, that the impact of waiting to queue was even greater. Drivers required to wait in queues did significantly more non-driving work and experienced fatigue more often than those who did not. Drivers who were not paid to wait did the longest trips with average weekly hours above the legal working hours limits, had the highest levels of fatigue and the highest levels of interference by work with family life. In contrast drivers who were paid to wait did significantly less work with shorter usual hours and shorter last trips.

The findings suggest that mandating payment of drivers for non-driving work would reduce the amount of non-driving work required for drivers and reduce weekly hours of work. This would have the effect of addressing driver fatigue and helping drivers to balance work and family life as well as enhancing the efficiency of the long distance road transport industry.

1 INTRODUCTION

1.1 Background

The aim of this research is to investigate the relationships between external non-driving factors and adverse health and safety outcomes for long distance truck drivers in NSW. Specifically, the non-driving factors to be examined in this study include waiting time for loading and unloading and remuneration systems for drivers. The health and safety outcomes include long working hours, experiences of fatigue and experiences of road traffic crashes and near crashes.

There is clear evidence that waiting for loading and unloading and incentive-based remuneration are fundamental issues for the long distance road transport industry which increase safety risks for drivers. The problem of scheduling loading/unloading activities that results in prolonged waiting and queuing has been well-recognised in recent years and has resulted in the development and implementation of amendments to occupational health and safety regulation which call for mutual responsibility between all parties in the long distance road transport industry.

This Regulation also requires certain consignors and consignees of freight (including their agents and persons acting on their behalf) not to enter a contract with a carrier for the transport of freight long distance by means of a heavy truck unless they are satisfied that the delivery timetables are reasonable and that each driver who will transport the freight long distance under the contract is covered by a driver fatigue management plan.

Section 81C of Occupational Health and Safety Amendment (Long Distance Truck Driver Fatigue) Regulation 2005 states that:

> A consignor or consignee must not enter a contract with a head carrier for the transport of freight long distance unless the consignor or consignee has satisfied itself on reasonable grounds:
> (a) that any delivery timetable is reasonable as regards the fatigue of any driver transporting freight long distance under the contract, taking into account industry knowledge of a reasonable time for the making of such a trip (including loading, unloading and queuing times).

Chain of responsibility regulations under Road Transport regulations (2005) administered by the Roads and Traffic Authority also require consigners and freight forwarders to exceed the permitted number of driving hours, fail to have minimum rest period and exceed the speed limits and Consignee/receiver must not knowingly encourage or reward a breach of the mass, dimension, load restraint or driving hours laws.

While these regulations set the scene for controlling excessive waiting by long distance truck drivers, there is little evidence to date whether they are having the desired effect. This study will examine the relationships between driver experiences of long waiting times during loading and incentive-style payments and safety-related outcomes.

There is evidence from previous studies of Australian long distance truck drivers that incentive payments are very common in the industry. National surveys of truck drivers found that at least two-thirds of drivers were paid on an incentive basis either by the trip or the (AMR Interactive, 2007; Williamson, Feyer, Coumarelos, & Jenkins, 1992; Williamson, Feyer, Friswell, & Sadural, 2001). These surveys also found that incentive payments and working hours were directly related, with drivers paid by the trip or kilometre doing significantly more work per week than those paid under non-incentive arrangements. The same surveys also asked drivers about waiting time to load or unload and showed that a significant proportion of the driver's work time is spent in loading-related waiting activities.

There is some evidence that the incentive payment practices can motivate driver behaviours that are not necessarily compatible with health and safety. For example, the results of a study of the predictors of stimulant use by long distance truck drivers identified external pressures to do more work through linking payments with productivity and problems with managing fatigue as the two main factors that increase the likelihood of stimulant use by long distance truck drivers. The implications for prevention are clearly that efforts to decrease the need for stimulants in this industry must focus on reducing fatigue for long distance truck drivers but they also show that this will only be achieved if the external pressures of productivity-based payments are removed from the industry. While drivers continue to be encouraged to do more trips on the basis that they can earn more money, fatigue will continue to be a natural consequence. Further research is needed on the links between incentive payments and other safety and health outcomes.
The small amount of research on waiting times also signals the need for further research. A pilot survey conducted at major distribution centres by the Transport Workers Union showed a direct link between waiting to unload at major distribution centres and the method of payment, with drivers paid on an incentive basis spending more waiting time on average than drivers paid by the hour. Furthermore, less than five percent of drivers received any payment for waiting time despite the fact that the majority spent more than two hours unpaid waiting time per week and up to 40 to 50 hours per week. Again, these results suggest that waiting time arrangements for drivers are unsatisfactory, but further research is needed to confirm it. This project will attempt to provide more depth of analysis on the relationships between incentive payments, waiting time and health and safety outcomes.

1.2 Aims

The objective of this study is to develop a better understanding of the relationships between external non-driving factors such as loading/unloading waiting time and incentive-based remuneration and safety outcomes for NSW long distance truck drivers.

The results of this study will provide:

- information on the extent to which waiting time and incentive-based remuneration systems are factors for long distance truck drivers in NSW
- information on the effects of these factors on health and safety outcomes

- targets for further action to improve occupational health and safety for long distance truck drivers and to improve safety for NSW road users.

On the basis of previous research, the following outcomes are expected: Prolonged waiting time increases the duration of each trip, which may increase the risk of fatigue. For drivers paid a time-based rate, waiting time should not impair their income-earning potential. However for drivers paid under an incentive system (i.e., paid by amount of work done by kilometre, trip or load), waiting time increases the hours that must be worked to complete a trip without providing a concomitant increase in income. In effect, extended waiting time reduces the hourly pay rate for these drivers. To maintain income, such drivers might be expected to undertake additional work thus increasing their working hours further. It is hypothesised that prolonged waiting time will be associated with longer working hours and increased risk of fatigue particularly among drivers paid under an incentive system.

2 METHOD

2.1 Design

A cross-sectional survey design was used to gather information from long distance heavy truck drivers in NSW. Drivers were surveyed about their exposure to external factors that might influence their ability to manage fatigue and safety, including their employment status, fatigue management arrangements, payment system, waiting and queuing time, and working hours. Outcome measures of fatigue experiences, crashes and occupational injuries were also collected. A subset of the participants were also asked additional qualitative questions designed to provide a more detailed understanding of their survey responses.

Consistent with the NSW Road Transport (General) Regulation 2005, 'long distance' work was defined as extending more than 100km from the home base or depot. 'Heavy vehicles' were more than 12 tonnes Gross Vehicle Mass (GVM).

2.2 Sampling and recruitment

2.2.1 Data collection sites

Long distance heavy truck drivers were recruited at retail rest stops on the major freight routes in NSW.

Locations were selected on the Hume, Pacific, Newell, New England, Midwestern and Kamilaroi Highways to tap the main north–south and east-west freight corridors. Specific locations that were also popular with drivers were identified through the TWU, other industry contacts and informal advice from drivers.

In total, eight locations were sampled during ten field trips. Two locations (Wyong and Marulan) were visited twice because these were particularly well-frequented by drivers. Tarcutta was included because it is a major stop for drivers who work changeover operations between Sydney and Melbourne and who might not otherwise be sampled.

Where possible, two retail rest stops at each location were sampled to encourage a broader cross-section of drivers into the sample. Retail rest stops were used because they generally offer a broad range of services, such as petrol, food, bathroom, toilet, laundry, lounge, internet and truck parking facilities. As a result, they are likely to attract a range of different types of drivers. Permission to conduct the survey at rest stop premises was obtained from the proprietors in advance.

Five data collection trips were completed between 19th November and 11th December 2009 and five were done between 3rd February and 19th February 2010. Recruitment was suspended over the Christmas-New Year period because drivers typically have very high workloads at this time of year which would likely impact on survey participation rates. The recruitment period at each location spanned three days (or four days when the visit required extended travel time).

Table 1 summarises the routes, locations and number of rest stops sampled together with the data collection periods.

Table 1: Summary of data collection locations

Data collection dates	Route (Highways tapped)	Locations	Rest stops
19/11/2009-21/11/2009 17/2/2010-19/2/2010	F3/Pacific New England	Wyong	2
25/11/2009-27/11/2009 3/2/2010-5/2/2010	Hume	Marulan	2
24/11/2009-27/11/2009	Hume	Tarcutta	2
7/12/2009-9/12/2009	Hume	Glenfield	1
8/12/2009-11/12/2009	Newell	Gilgandra	2
3/2/2010-5/2/2010	New England Pacific	Beresfield	1
9/2/2010-12/2/2010	Newell Mid Western	West Wyalong	2
10/2/2010-12/2/2010	New England Kamilaroi	Willow Tree/Murrurundi	2

2.2.2 Sampling

Pairs of data collectors worked at each location. They allocated their work time across the day and between the rest stops using intelligence gathered from the individual rest stop operators about when drivers were most likely to visit. Depending on the rest stop and its clientele, recruitment occurred between 6:00am and 2:00am, but breakfast time and evenings were the most frequent and productive recruitment times.

While at each rest stop, data collectors endeavoured to invite every visiting driver to participate. Of course, this could not always be accomplished, for example, when both data collectors were occupied in interviews. Drivers were offered the choice of completing the survey as an on-the-spot interview or as a self-administered survey. Drivers who opted to self-administer the survey could do so at a personally convenient time and mail their survey back to the researchers in a reply paid envelope. In this way, any negative effects on participation rates of immediate time pressures or need to sleep could be minimised. In addition, the participation of drivers with little enthusiasm or capacity for paperwork could be maximised by interview administration.

Drivers who completed the survey as an interview were invited at the end to answer some further follow-up questions if they had the time.

Based on previous survey studies of long distance drivers conducted by the authors, a sample of approximately 1000 drivers was expected from the recruitment regime, at a response rate of 25%. Table 2 summarises the actual distribution of

Table 2: Summary of data collection

		Distribution			Returns				Rates		
Location	**Highway**	**Total number of drivers approached**	**Number of direct refusals**	**Number of surveys distributed for self-completion**	**Number of self completions returned**	**Number of interviews conducted**	**Total number of returns**	**(%)**	**Total response rate (total returns/approached)**	**Interviews as proportion of all returns**	**Number of qualitative interview extensions conducted**
2009											
Wyong	F3/Pacific/New England	278	83	187	51	8	59	(12.4)	0.21	0.14	2
Marulan	Hume	237	53	171	70	13	83	(17.4)	0.35	0.16	3
Tarcutta	Hume	170	31	130	27	9	36	(7.5)	0.21	0.25	3
Glenfield	Hume	62	22	32	11	8	19	(4.0)	0.31	0.42	3
Gilgandra	Newell	212	23	188	21	1	22	(4.6)	0.10	0.05	0
Unknown	Unknown				2		2	(0.4)			
2010											
Wyong	F3/Pacific/New England	128	24	81	41	23	64	(13.4)	0.50	0.36	6
Marulan	Hume	190	49	104	30	37	67	(14.0)	0.35	0.55	10
Beresfield	New England	152	23	116	38	13	51	(10.7)	0.34	0.25	6
West Wyalong	Newell/Mid Western	102	15	54	13	33	46	(9.6)	0.45	0.72	0
Willow Tree/ Murrurundi	New England/Kamilaroi	66	4	51	17	11	28	(5.9)	0.42	0.39	8
	TOTAL	**1597**	**327**	**1114**	**321**	**156**	**477[a]**	**(100)**	**0.30**	**0.33**	**41[a]**
	Expected	*4000*		*3750*	*750*	*250*	*1000*		*0.25*	*0.25*	

[a] 1 self-administered survey and 1 interview with additional qualitative questions were later excluded from analysis.

surveys and the data returns by location. Overall, surveys were returned by 477 drivers at a rate of 30%. The rate was somewhat better than predicted but the absolute number of returns was only around half that expected. Visits to three different recruitment sites by one of the authors (RF) confirmed that the limiting factor on returns was the number of drivers at the sites, and not some aspect of the sampling behaviour of the data collectors. To try to improve the number of returns, data collectors were instructed to focus more on face-to-face interview completion in 2010.

Forty one of the drivers who completed the survey as an interview agreed to answer the additional qualitative questions about their survey responses.

Prior to analysis, two surveys were excluded from the sample. One was completed flippantly. The other, with extended interview questions, reported a trip to deliver a vehicle and that vehicle was driven rather than a truck. The final sample contained 475 drivers, 40 of whom completed additional qualitative questions. Two-thirds completed a self-administered survey, with the remainder participating by interview. Almost all surveys were completed on-site, with only 15.6 percent returned by mail.

2.3 Materials and measures

During recruitment, participants were provided with a Participant Information Statement (Appendix 1) that explained the purpose and nature of the study.

The survey instrument and additional qualitative interview questions were developed in consultation with project liaison staff at the TWU and drew upon previous surveys of long distance heavy vehicle drivers in Australia (AMR Interactive, 2007; Williamson, 2007; Williamson, et al., 2001).

The survey and interview questions were piloted on six volunteer long distance heavy vehicle drivers attending a TWU conference. Pilot participants were asked to comment on how they had responded to the survey questions so that any problems with wording or response options could be identified. A number of wording issues were identified and refinements to the final survey were made accordingly. All participants completed the survey questions in 10 minutes or less. The additional interview questions took between 5 and 15 minutes to complete, with two thirds of participants taking 10 minutes or less.

The final survey and additional interview questions are presented in Appendices 2 and 3, respectively. The survey contained questions on:
(a) Demographics, perceived work-life balance, and professional memberships;
(b) Characteristics of usual working arrangements, including vehicle type, employment status, payment system, and weekly work hours;
(c) Details of the last round trip undertaken, including distance, freight, fatigue management, pay, pre-trip rest, trip hours, deadlines, and participation in and payment for queuing, loading and local driving, and fatigue experiences;
(d) Safety outcomes including fatigue experiences on the last round trip, fatigue experience generally, and crash and injury experiences in the past year.

The additional interview questions that were posed to each participant depended on their answers to questions in the survey. Drivers reporting regular fatigue were asked about the main contributing factors and the contribution, if any, of waiting, queuing, scheduling and payment arrangements. All participants were asked about the impact of legislative changes enacted in October 2008. Participants working under Basic or Advanced Fatigue Management arrangements were asked for their views on those arrangements. Participants who had experienced a crash or occupational injury in the previous year were asked about the nature and possible causes of latest incident. All participants were asked about the potential for chronic injuries in their work. Lastly, participants were asked for their views on whether and how their work has affected their family and personal relationships.

2.4 Procedure

Approval to conduct the survey was obtained from the University of New South Wales Human Research Ethics Committee.

Pairs of data collectors traveled to the data collection sites and met with the rest stop proprietors to determine the best times to recruit participants. They also completed on-site OHS inductions where required.

Data collectors approached as many drivers as possible at the rest stops to invite them to participate in the survey. Drivers were only approached when they had completed any commercial transactions. Data collectors did not approach drivers while they were eating a meal unless invited. The nature, purpose and time commitment of the survey was explained. Drivers who consented to take part by self-administration were given a copy of the survey, the Participant Information Statement and a reply paid envelope. Drivers who volunteered to take part by interview were given a copy of the Participant Information Statement. The interviewer then read through the survey questions and recorded the driver's answers. At the end of these interviews, the data collectors asked drivers whether they would be willing to answer some additional follow-up questions and the extra time commitment was explained. If drivers were amenable to this, the interviewer asked the relevant additional qualitative questions and recorded driver's responses.

Each data collector kept an ongoing tally of the number of drivers approached, the number of direct refusals, the number of surveys distributed for self-completion and the number of interviews and extended interviews conducted.

2.5 Analysis

Data were analysed using PASWStatistics 18.0 (i.e, SPSS).

Most responses were from self-administered versions of the survey (67.8%) rather than interviews. A comparison of the two administration modes showed no statistically significant differences between the two modes on any study variables, so the data were combined for analysis.

The analysis involved three sections. The first was a univariate analysis of the driver participant responses to the survey. The objective of this analysis was to describe the characteristics or survey participants, their work-rest experiences in general and on their last trip and their experiences of fatigue and safety-related outcomes. The second section was a bivariate analysis of driver responses broken down by the two main factors of interest: whether they were paid by incentive or trip-based pay or paid on a time basis and whether they experienced the need to wait and queue for loading and unloading on their last trip. The bivariate analysis involved Chi-square testing for all frequency data and ANOVA for all continuous data. The third section was a multivariate analysis using logistic regression to identify the external predictors of health and safety variables. For this section five outcome variables were selected and a range of predictors were tested based on the study aims and hypotheses. The outcome variables included fatigue-related variables: experience of fatigue on the last trip, experience of dangerous events due to fatigue on the last trip and experience of fatigue in general. The occurrence of injury at work in the last year and a measure of work-life balance were also used as outcome measures.

3 RESULTS

3.1 Characteristics of study participants

The demographic and family-life characteristics of drivers are shown in Table 3. Over half of participating drivers were between 40 and 60 years of age, with a mean age of 45.3 years and almost all were male. Most drivers lived in a situation with a partner and/or children. Two-thirds were married or in a de facto relationship. More than half of the drivers had children up to 18 years of age living with them at least part of the time. Of these drivers, around two-thirds (69%) had one or two children. When asked how often their current work interferes with family responsibilities, almost half of drivers responded often or always.

Table 3: Demographic characteristics of long distance truck driver participants

Variable	
Age (years; mean (SD); n=471)	45.3 (10.5)
Gender (%, n=468)	
• Male	98.3
Marital status (%, n=473))	
• Single	17.7
• Married/defacto	67.4
• Separated/Divorced/Widowed	14.5
% with Children ≤18 yrs living with driver (n=438)	57.9
Number of Children ≤ 18yrs (n=438)	1.69 (1.29)
Work interferes with family responsibilities (%, n=434))	
• Often/Always	47.8
• Sometimes/Rarely/Never	52.2

Table 4 shows the driving experiences of driver participants. Most participants were very experienced drivers. Most had been driving heavy vehicles for a living for 20 years or more and 17.5 percent had been driving for more than 30 years. For most drivers in the sample, home base was NSW, followed by Victoria and Queensland which is not very surprising as all surveys were conducted in NSW. The greater majority of drivers (82.7%) usually drove an articulated truck or B-double and most drivers were employees of companies. Only a relatively small percentage were members of an industry organisation, with around one in five being a member of the Transport Workers Union. Around two-thirds of drivers were paid by productivity payment for each trip, i.e., a trip rate. Drivers were asked whether they usually did a range of non-driving activities and if so, were they paid to do so. Almost all drivers reported having to do non-driving work (93.5%), having to wait to load and unload (88.8%) and having to do local work (81.3%) Of those drivers who did these kinds of work, considerably fewer were paid to do so.. Around forty percent were paid for non-driving work such as loading or for local drop offs and pickups, and one-quarter were paid for waiting and queuing time. The usual weekly working hours reported by

drivers was around 68 hours on average, but over one-quarter (29.4%) reported usually working more than 72 hours each week which is more than the legal limit under Standard working hours limits in all of the eastern states.

Table 4: Driving experiences of driver participants

Variable	
Experience of long haul driving (years; mean (SD); n= 468)	20.97 (11.3)
Home State (%, n=473)	
• NSW/ACT	44.6
• Victoria	31.3
• Queensland	20.5
• South Australia	2.3
• WA/NT/Tas	1.1
Type of truck driven (%, n=475)	
• Rigid	4.8
• Articulated	32.8
• B-double	49.9
• Road Train	1.7
• Other/multiple answers	10.7
Member of industrial organisation (%, n=459)	24.6
• Transport Workers Union	21.5
Type of employment (%,n=468)	
• Employee	81.9
• Owner driver/operator	18.1
Usual pay type (%, n=471)	
• Hourly based (hourly, daily, weekly rate)	22.7
• Trip based	65.2
• Other/Multiple	12.1
Pay for other activity (%)	
• Non-driving work (n=458)	42.7
• Waiting time (n=436)	25.9
• Local drop-offs/pickups (n=433)	39.6
Usual hours per week (mean (SD); n=449)	68.6 (17.59)

Drivers reported details of their last round trip (see Table 5). On average, they covered nearly 2,300 km on their last trip involving average driving times of nearly 22 hours. Around one in four drivers did more than 3,000km and took more than 25 hours on their last trip. Analysis of the total take-home pay for drivers on the last trip showed a very skewed distribution of payments. While on average drivers received nearly $1,000 for the last round trip, about half received less than $700 and 25 percent received nearly twice that amount ($1,320).

For a significant percentage of drivers the last trip involved a number of stops for unloading and/or loading. While on average the last trip involved two freight stops, 20 percent of drivers did four or more stops on their last trip. Around half of drivers were personally involved in loading activities during their last trip and about half of those drivers were paid for doing so. For around 40 percent of drivers loading activities involved waited for others to load/unload for them, with just less than one-third of drivers being paid for waiting. Approaching half of drivers (40.8%) waited to load/unload in a queue during their last trip, with around 30 percent waiting in a moving queue and fewer (22%) waiting in a non-moving queue. About one-quarter of the drivers who waited in queues were paid for waiting time (24.9%). A minority of drivers also did local pick-ups and deliveries (19.3%) with nearly half (42.5%) being paid to do so. A notable percentage of drivers (43.1%) had set arrival time windows for loading/unloading on their last trip, but almost all met their arrival windows. Although NSW OHS regulations require long distance heavy vehicle drivers to have a Safe Driving Plan, only around half of drivers reported seeing their plan for the last trip.

Table 5: Driver participant's reports of experiences on their last round trip

Variable	
Size of truck (GVM; mean (SD); n=458)	54.2 (20.1)
Distance covered in last round trip (kms; mean (SD); n=382)	2,294.4 (1854.5)
Driving Hours in last round trip (mean (SD); n=403)	21.52 (18.7)
Non-driving hours in last round trip (mean (SD); n=383)	6.27 (8.6)
Total take-home pay for last round trip ($; mean (SD); n=361)	972.90 (840.14)
Total freight stops (mean (SD); n=431)	2.0 (3.15)
Sleep in 10 hrs before trip (hrs; mean (SD); n=411)	6.24 (2.5)
Rest in 10 hrs before trip (hrs; mean (SD); n=399)	2.58 (2.32)
Other activities in 10 hrs before trip (hrs; mean (SD); n=398)	1.2 (2.1)
% Wait to load in moving queue and % paid (n=444)	30.9 (24.1%)
% Wait to load in non-moving queue and % paid (n= 444)	22.2 (20.4)
% Personally un/loaded truck and % paid (n=438)	51.4 (50.4)
% Waited for others to un/load truck and % paid (n=438)	40.6 (30.3)
% Made local pick-ups deliveries and % paid (n=441)	19.7 (42.5)
% Set time windows for arrival (n=445)	43.1
If yes, met this window? (%)	92.9
% Saw Driving plan (n=441)	48.8

A number of questions related to fatigue risk management (Table 6). About half of drivers were working under the Standard hours option of the Fatigue Risk Management regulations, with almost all of the remainder working under Basic Fatigue Management (BFM) and only seven drivers were working under Advanced Fatigue Management (AFM). As for the Safe Driving Plan, fewer than half of drivers had seen a Fatigue Management Plan for their last trip. Drivers were asked a number of questions about their experiences of fatigue. Around one-quarter (26.6%) reported experiencing fatigue on about half their trips or more. One in five (20.8%)

reported starting their last trip feeling at least a bit tired and more than half (55.2%) reported experiencing fatigue on their last trip.

Table 6: Fatigue risk management experiences of drivers

Variable	
FRMS option (%n=466)	
• Standard hours	55.79
• BFM	41.84
• AFM	1.5
% Saw Fatigue management plan (n=410)	45.1
How often usually fatigue while driving for work? (%, n=470)	
• Every trip	5.7
• Most trips	12.6
• About half trips	8.3
• Occasionally	43.4
• Very rarely	25.5
• Never	4.5
How refreshed at start of last trip? (%, n=470)	
• Very fresh	38.1
• Quite fresh	41.2
• A bit tired	16.8
• Quite tired	3.1
• Very tired	0.9
Experienced fatigue at any stage on last trip (%, n=469)	55.2

Only a small percentage of drivers reported adverse events on the last trip or over the last 12 months (Table 7). One in ten drivers reported a dangerous event related to fatigue occurring on their last trip. In most cases this involved nodding off at the wheel or crossing lane lines, with a few drivers reporting falling asleep at the wheel, running off the road or colliding with something on the last trip. Only a small percentage of drivers reported using stimulants on the last trip.

A small number of drivers (23 drivers) reported crashing over the last 12 months and almost all cases involved one crash and only two cases involved injury to the driver and four cases involved injury to someone else. Other work-related injuries were around three times more likely for drivers in this survey. Fifty-six drivers reported a work injury over the last 12 months requiring time off for more than half of these drivers and for one-third of cases, the injury required a period of light duties.

Table 7: Driver reports of experiences of dangerous events related to fatigue on their last trip and experiences of crashes and other work-related injury over the past 12 months

Variable	
Dangerous events due to fatigue on trip (%, n=469)	10.2
• Nodding off	60.4
• Falling asleep at wheel	8.3
• Running off the road	6.3
• Near miss	4.2
• Cross lane lines	41.7
• Over/understeering	10.4
• Late braking	8.3
• Colliding with something	2.1
• Other	8.3
Used drugs on last trip (%, n=464)	3.2
Crashed in last 12 months (%, n= 470)	4.9
• Number of crashes? (mean (SD))	1.13 (0.46)
• Injured?	11.1
• Time off?	11.1
• Light duties	5.6
Other work-related Injury (%, n=464)	12.1
• Number of times injured? (mean (SD))	1.21 (0.76)
• Time off?	60.0
• Light duties?	35.6

3.2 The effects of incentive-based payment

3.2.1 Comparison of drivers working under trip-based and hourly-based payment

Drivers were asked how they are usually paid and were provided a list of options (See Question 11, Appendix 2). The responses were broken up into those working under trip-based (64.6%; rate for each trip based on kilometres travelled or tonnage carried or flat rate for every truck load carried) and hourly based (22.5%, hourly rate, flat day rate, day rate with overtime, weekly rate, weekly rate with overtime) payment systems with an additional 12.8 percent of drivers making other or multiple responses.

As shown in Table 8, there was no difference between trip and hourly paid drivers in their experience of long distance truck driving or whether they were employee or owner drivers/operators. Drivers paid by trip rate, however were statistically significantly less likely to be paid for other activity including non-driving work, waiting time or local drop-offs/pickups. Trip-rate drivers also did longer trips, with the average usual weekly hours for trip rate drivers being very close to the limit of driving

per week and nearly eight hours longer per week on average than drivers being paid on an hourly basis.

Table 8: Comparison of driving experience and remuneration for drivers with trip-based and hourly based payment

Variable	Trip-based pay	Hourly-based pay	Statistical test result
Experience of long haul driving (years; mean (SD))	21.16 (11.31)	19.98 (12.07)	n.s.
Type of employment (% (n))			n.s
• Employee	81.1 (249)	84.9 (90)	.
• Owner driver/operator	18.9 (58)	15.1 (16)	
Usually paid for other activity (% (n))			
• Non-driving work	32.2 (96)	72.7 (72)	$X^2(1)=47.9$, $p<0.001$
• Waiting time	13.5 (38)	71.1 (64)	$X^2(1)=113.41$, $p<0.001$
• Local drop-offs/pickups	37.1 (96)	79.8 (67)	$X^2(1)= 46.37$, $p<0.001$
Usual hours per week (mean (SD))	71.46 (17.77)	63.89 (14.98)	$F(1,391)=14.91$, $p<0.001$

Comparison of the experiences of drivers on their last trip for those paid by trip or hourly (see Table 9) shows that drivers under trip payment drove significantly heavier loads, covered significantly longer distances and drove for significantly longer hours compared to drivers on hourly payment. Despite doing around 1,000km more on their last trip, trip payment drivers did not earn significantly more take-home pay than hourly payment drivers. Trip payment drivers also did not differ on the number of non-driving hours nor the number of freight stops on the last trip.

During the last trip, drivers with trip payment were significantly more likely to have waited in a queue to load/unload and to have set time windows for arrival at freight destinations than hourly paid drivers. In contrast, trip based drivers were significantly less likely to be paid to wait in a queue or for other activities including personally loading/unloading or waiting for others to do so, or to make local pick-ups or deliveries.

In the period before the last trip, drivers on trip payment slept for a significantly shorter period (around 42 minutes less on average) than hourly payment drivers, but they did not differ on the amount of rest they took before the trip or the time spent doing other activities.

Table 9: Experience around the last trip for drivers paid by trip or hourly.

Variable	Trip-based pay	Hourly-based pay	Statistical test result
Size of truck (GVM; mean (SD))	56.98 (19.99)	45.47 (19.23)	F(1,399)=26.18, p<0.001
Distance covered in last round trip (km; mean (SD))	2562.97 (2005)	1594.6 (1253.8)	F(1,389)=20.55, p<0.001
Driving Hours in last round trip (mean (SD))	23.2 (20.03)	18.41 (16.81)	F(1,346)=4.05, p<0.045
Non-driving hours in last round trip (mean (SD))	6.68 (8.68)	6.05 (10.1)	n.s.
Total take-home pay for last round trip ($; mean (SD))	1005.96 (847.81)	894.47 (821.89)	n.s.
Total freight stops (mean (SD))	2.18 (3.17)	2.26 (3.69)	n.s.
Sleep in 10 hrs before trip (hrs; mean (SD))	6:07 (2:44)	6:49 (1:50)	F(1,359)=5.08, p<0.025
Rest in 10 hrs before trip (hrs; mean (SD))	2:37 (259)	2:18 (1:36)	n.s.
Other activities in 10 hrs before trip (hrs; mean (SD))	1:17 (2:03)	0:51 (1:37)	n.s.
% Waited in queue at all last trip (n)	44.5 (130)	30.2 (29)	$X^2(1)= 6.12$, p<0.013
% Paid to Wait in queue last trip (n)	32.7 (16)	85.7 (18)	$X^2(1)= 16.57$, p<0.001
% Paid to Personally un/load truck (n)	34.2 (52)	81.7 (49)	$X^2(1)= 38.84$, p<0.0001
% Paid to Wait for others to un/load truck (n)	21.3 (27)	70.4 (19)	$X^2(1)= 25.63$, p<0.001
% Paid to Make local pick-ups deliveries (n)	29.5 (18)	72.2 (13)	$X^2(1)= 10.64$, p<0.001
% Set time windows for arrival (n)	48.8 (142)	26.0 (25)	$X^2(1)= 15.24$, p<0.001
If yes, met this window? (% (n))	92.9 (140)	96.0 (24)	n.s.
% Saw Safe Driving Plan (n)	46.9 (144)	42.1 (45)	n.s.

Analysis of the differences between trip and hourly payment groups in their experience of fatigue (see Table 10) shows that drivers receiving trip-based payment were significantly more likely to usually experience fatigue on at least half of their trips compared to hourly payment drivers. In addition, despite no differences between the groups in the amount of fatigue experienced at the start of their last trip, trip payment drivers were significantly more likely to report experiencing fatigue during their last trip. In spite of these differences in experience of fatigue, the drivers on hourly-based payment were more likely than those on trip payment to report

dangerous occurrences due to fatigue on their last trip although the numbers are small.

Table 10: Experiences of fatigue for trip and hourly-based payment groups

Variable	Trip-based pay	Hourly-based pay	Statistical test result
How often usually fatigue while driving for work? (% (n))			$X^2(1)= 8.47$, $p<0.004$
• Half or more trips	30.8 (94)	16.2 (17)	
• Less than half trips	69.2 (211)	83.8 (88)	
How refreshed at start of last trip?			n.s.
• Very fresh	38.7 (115)	42.7 (44)	
• Quite fresh	38.4 (114)	44.7 (46)	
• A bit tired	18.2 (54)	10.7 (11)	
• Quite tired	3.7 (11)	1.0 (1)	
• Very tired	1.0 (3)	1.0 (1)	
Experienced fatigue at any stage on last trip (% (n))	58.6 (178)	43.8 (46)	$X^2(1)=6.85$, $p>0.009$
Dangerous events due to fatigue on last trip (% (n))	16.3 (29)	30.4 (14)	$X^2(1)= 4.71$, $p<0.03$
Interference with family life (% (n))			$X^2(1)=)3.79$, $p<0.052$
• Often/Always	50.2 (154)	39.3 (42)	
• Sometimes/Rarely/Never	49.8 (153)	60.7 (65)	

3.3 The effects of waiting and queuing on drivers

3.3.1 Comparison of drivers who waited in queues and those who did not on the last trip

Drivers were divided into those who had waited in a still or moving queue on their last trip and those who had not. Of all study participants, 38.9 percent had waited in a queue, 54.3 percent had not and this question was missing for 6.7 percent. Analysis of the driving and remuneration experiences for these two groups of drivers (see Table 11) showed that drivers who waited had around two years less experience of driving heavy vehicles for a living than those who had not, but both groups were very experienced, with around 20 years of experience on average. Drivers who waited, however were not more likely to be employees or owner drivers/operators and their

usual working hours per week were also not significantly different from drivers who did not wait on the last trip. On the other hand, drivers who waited were significantly more likely to be paid by the trip rather than by the hour although again the majority of both groups were paid by trip-based pay. Furthermore, drivers who had waited were significantly less likely to be usually paid for activities other than driving including non-driving work, waiting time and local drop-offs and pick-ups.

Table 11: Comparison of driving experience and remuneration for drivers who had waited or not on their last trip

Variable	Waited in queue on last trip	Did not wait in queue on last trip	Statistical test result
Experience of long haul driving (years; mean (SD) n)	19.49 (11.44) 183	21.98 (10.97) 255	F(1,436)= 5.27, p<0.022
Type of employment (% (n))			n.s.
• Employee	42.0 (153)	58.0 (211)	
• Owner driver/operator	41.0 (32)	59.0 (46)	
Usual pay type (% (n))			$X^2(1)$= 6.12, p<0.009
• Hourly based (hourly, daily, weekly rate)	18.2 (29)	29.3 (67)	
• Trip based	81.8 (130)	70.7 (162)	
Usually paid for other activity (% (n))			
• Non-driving work	39.3 (70)	50.0 (119)	$X^2(1)$= 4.68, p<0.019
• Waiting time	21.9 (37)	34.6 (79)	X2(1)= 7.64, p<0.006
• Local drop-offs/pickups	41.6 (64)	53.8 (112)	$X^2(1)$= 5.35, p<0.02
Usual hours per week (mean (SD))	70.34 (18.37)	68.0 (17.13)	n.s.

Comparison of the last trip experiences for drivers who had waited in queues on their last trip and those who had not (see Table 12) shows that the two groups did not differ in the distance covered nor the driving hours and their total take-home pay was not different. There was also no difference between drivers who waited and those who did not in the number of freight stops they did on their last trip, but drivers who had to wait did significantly more non-driving hours of work than those who did not wait. Around one-quarter of drivers who waited on the last trip reported being paid to do so. While similar percentages of drivers who waited or not were paid to wait for others to load or unload their truck, drivers who waited were less likely to be paid to personally load or unload the truck and to make local deliveries or pick-ups. Drivers who waited were also significantly more likely to have set windows for arrival, although almost all drivers met their arrival times.

Table 12: Comparison of experiences on the last trip for drivers who had waited or not on their last trip

Variable	Waited in queue on last trip	Did not wait in queue on last trip	Statistical test result
Size of truck (GVM; mean (SD) n)	57.27 (21.37) 175	52.69 (18.80 254	F(1,427)=5.49, p<0.2
Distance covered in last round trip (km; mean (SD) n)	2328 (1501) 175	2317 (2121) 245	n.s.
Driving Hours in last round trip (mean (SD) n)	22.98 (17.20) 166	20.43 (19.60) 231	n.s.
Non-driving hours in last round trip (mean (SD) n)	7.39 (8.19) 162	5.42 (8.98) 216	F(1,376)=4.78, p<0.029
Total take-home pay for last round trip ($; mean (SD) n)	948.47 (643.60)	1016.66 (982.32)	n.s.
Total freight stops (mean (SD) n)	2.30 (2.56) 176	1.99 (3.53) 249	n.s.
Sleep in 10 hrs before trip (hrs; mean (SD) n)	6:03 (2:32) 168	6:18 (2.38) 231	n.s.
Rest in 10 hrs before trip (hrs; mean (SD) n)	2:30 (2:15) 164	2:41 (2:22) 226	n.s.
Other activities in 10 hrs before trip (hrs; mean (SD) n)	1:28 (2:16) 163	1:00 (1:49) 226	F(1,387)=4.75, p<0.03
% (n) Paid to Wait in queue last trip (of those who waited) (n=185)	24.3 (45)		
% (n) Paid to Personally un/load truck (n=242)	44.1 (52)	57.3 (71)	$X^2(1)= 4.21$, p<0.04
% (n) Paid to Wait for others to un/load truck (n=174)	25.0 (21)	36.7 (33)	n.s.
% (n) Paid to Make local pick-ups deliveries (n=89)	32.7 (17)	54.1 (20)	$X^2(1)= 4.06$, p<0.04
% (n) Set time windows for arrival (n=437)	56.5 (104)	33.6 (85)	$X^2(1)= 22.8$, p<0.001
If yes, met this window? (% (n))	89.4	92.9	n.s.
% (n) Saw Safe Driving Plan (n=443)	40.5 (75)	48.1 (124)	n.s.

As shown in Table 13, drivers who had waited on their last trip were significantly more likely than drivers who did not wait to queue to have experienced fatigue on that trip. Drivers who waited also were also significantly more likely to report experiencing fatigue on at least half of their trips. There was no difference between drivers who waited and those who did not in their estimated level of fresh or tiredness at the start of the last trip. The two groups also did not differ in their experience of dangerous events due to fatigue on their last trip.

Table 13: Comparison of fatigue experiences for drivers who had waited or not on their last trip

Variable	Waited in queue on last trip	Did not wait in queue on last trip	Statistical test result
How often usually fatigued while driving for work? (% (n)) (n=440)			$X^2(1)= 5.62$, $p<0.018$
• Half or more trips	33.7 (62)	23.4 (60)	
• Less than half trips	66.3 (122)	76.6 (196)	
How refreshed at start of last trip? (% (n)) (n=430)			n.s.
• Very fresh	33.3 (60)	43.2 (108)	
• Quite fresh	40.6 (73)	41.6 (104)	
• A bit tired	21.1 (38)	12.4 (31)	
• Quite tired	3.9 (7)	2.0 (5)	
• Very tired	1.1 (2)	0.8 (2)	
Experienced fatigue at any stage on last trip (% (n)) (n=439)	65.2 (120)	47.8 (122)	$X^2(1)= 13.04$, $p<0.001$
Dangerous events due to fatigue on the last trip (% (n)) (n=242)	19.2 (23)	17.2 (21)	n.s.
Interference with family life (% (n))			$X^2(1)= 4.2$, $p<0.04$
• Often/Always	54.1 (100)	44.2 (114)	
• Sometimes/Rarely/Never	45.9 (85)	55.8 (144)	

3.2.2 Comparison of drivers who were usually paid to wait in queues and those who were not usually paid to wait in queues

Drivers were asked to whether they usually got paid for waiting and queuing time or whether they did not do this work. Very few drivers reported that they did not have to wait in queues (2.5%), around half reported they did not usually get paid for waiting (50.7%) and the remainder were usually paid for waiting (42.7%).

Analysis of the driving experiences and remuneration for drivers who were usually paid to wait and those who were not (see Table 14) showed that drivers who were usually paid for queuing were also usually paid for other non-driving work and local work. They also did significantly fewer hours work per week and were less likely to be paid on a per trip basis. The two groups did not differ, however on their experience of long distance driving nor on their type of employment.

Table 14: Comparison of driving experience and remuneration for drivers who were usually paid to wait or not

Variable	Usually paid to wait	Usually not paid to wait	Statistical test result
Experience of long haul driving (years; mean (SD))	20.79 (12.37)	20.82 (10.68)	n.s.
Type of employment (% (n))			n.s.
• Employee	80.5 (99)	82.4 (244)	
• Owner driver/operator	19.5 (24)	17.6 (52)	
Usual pay type (% (n))			$X^2(1)= 113.41$, p<0.001
• Hourly based (hourly, daily, weekly rate)	62.7 (64)	9.7 (26)	
• Trip based	37.3 (38)	90.3 (243)	
Usually paid for other activity (% (n))			
• Non-driving work	91.6 (109)	23.5 (69)	$X^2(1)= 106.32$, p<0.001
• Local drop-offs/pickups	90.3 (102)	29.0 (76)	$X^2(1)= 118.81$, p<0.001
Usual hours per week (mean (SD))	63.7 (17.79)	72.29 (18.46)	F(1,398)=21.34, p<0.001.

There were also some differences between drivers who were usually paid to wait and those who were not on their experiences on the last trip (see Table 15). Those who were usually paid to wait drove smaller trucks on average, did fewer kilometers and shorter driving hours on the last trip than those who were usually not paid to wait. In contrast, there were no differences between these two groups on the number of non-driving hours or the number of freight stops in the last trip. There were also no differences between the two groups on the amount of sleep or rest before the last trip, but drivers usually paid to wait spent significantly less time on other activities before the last trip.

Table 15: Comparison of experiences on the last trip for drivers who were usually paid to wait or not

Variable	Usually paid to wait	Usually not paid to wait	Statistical test result
Size of truck (GVM; mean (SD))	47.71 (17.54)	58.10 (20,27)	F(1,405)=23.87, p<0.001
Distance covered in last round trip (km; mean (SD))	1600.1 (1152.83)	2605.53 (2053.2)	F(1,395)=24.42, p<0.001
Driving Hours in last round trip (mean (SD))	18.19 (15.98)	23.55 (20.23)	F(1,364)=6.15, p<0.014
Non-driving hours in last round trip (mean (SD))	5.92 (10.09)	6.54 (8.10)	n.s.
Total take-home pay for last round trip ($; mean (SD))	$962.73 ($1100.62)	$996.98 ($741.645)	n.s.
Total freight stops (mean (SD))	1.97 (2.44)	2.17 (3.53)	n.s.
Sleep in 10 hrs before trip (hrs; mean (SD))	6.52 (2.49)	6.00 (2.71)	n.s.
Rest in 10 hrs before trip (hrs; mean (SD))	2.67 (2.27)	2.57 (2.43)	n.s.
Other activities in 10 hrs before trip (hrs; mean (SD))	0.85 (1.75)	1.45 (2.18)	F(1,357)=6.45, p<0.012
% (n) Saw Safe Driving Plan (n=443)	52.1 (61)	46.59 (130)	n.s.

Table 16 shows the fatigue experiences for drivers who were usually paid to wait and queue or not. Fewer drivers who were usually paid to wait reported fatigue on more than half of their trips, more reported feeling fresher at the start of their last trip and fewer experienced fatigue on their last trip. Drivers who were usually paid to wait were also less likely to report frequent interference of family responsibilities due to work.

Table 16: Comparison of fatigue experiences for drivers who were usually paid to wait or not

Variable	Usually paid to wait	Usually not paid to wait	Statistical test result
How often usually fatigue while driving for work? (% (n)) (n=440)			$X^2(1)= 10.14$, p<0.001
• Half or more trips	16.5 (20)	31.9 (94)	
• Less than half trips	83.5 (101)	68.1 (201)	
How refreshed at start of trip? (% (n)) (n=430)			$X^2(1)= 10.17$, p<0.038
• Very fresh	42.1 (51)	36.0 (103)	
• Quite fresh	45.5 (55)	38.1 (109)	
• A bit tired	11.6 (14)	20.6 (59)	
• Quite tired	0.8 (1)	4.2 (12)	
• Very tired	0 (0)	1.0 (3)	
Experienced fatigue at any stage on last trip (% (n)) (n=439)	41.3 (50)	61.7 (182)	$X^2(1)= 14.43$, p<0.0001
Dangerous events due to fatigue on the last trip (% (n)) (n=242)	22.0 (11)	19.8 (36)	n.s.
Interference with family life (% (n))			$X^2(1)= 13.16$, p<0.0001
• Often/Always	35.8 (44)	55.2 (164)	
• Sometimes/Rarely/Never	64.2 (79)	44.8 (133)	

3.4 Multivariate analysis

A logistic regression analysis was used to examine the predictors of **experiences on the last trip**: whether the driver experienced fatigue and whether they experienced dangerous events due to fatigue. The predictors employed in this analysis were chosen to evaluate the study hypotheses including:

- Waiting in a queue: the drivers experience of waiting in a queue to load or unload and whether or not they were paid to wait,
- Characteristics of driver payment: whether paid by trip or hourly,
- Work-rest for the last trip: distance travelled on the last trip and the amount of sleep obtained in the 10 hours before the beginning of the last trip,

- driver characteristics: age and experience of driving heavy vehicles for a living

Logistic regressions were also used to examine the predictors of outcomes drivers **usually experience** including the frequency of experiencing fatigue, the experience of road crashes or work-related injury over the last 12 months and the extent to which work interferes with family responsibilities. The predictors used in this analysis were also based on the hypotheses put forward for this study and involve almost the same categories of variables as the multivariate analysis of the predictors of outcomes for the last trip, with the addition of the nature of fatigue risk management for each driver. The predictors include:

- Waiting in a queue: whether or not drivers are usually paid for time spent waiting and queuing,
- Characteristics of driver payment: whether paid by trip or hourly,
- Work-rest for the last trip: usual working hours per week,
- Fatigue risk management: whether drivers were working under Standard or alternative compliance (BFM, AFM) options
- driver characteristics: age, experience of driving heavy vehicles for a living and whether employee or owner driver/operator

3.4.1 Predictors of fatigue on the last trip

The analysis of predictors of experiencing fatigue on the last trip was based on 51.8 percent of cases due to missing data on one or more variables. Missing data ranged from two percent for age to 28.4 percent for Paid to wait in a queue. Examination of the missing data did not show any systematic patterns. Analysis of outliers showed no cases with standardised residuals greater than two standard deviations.

The results of this analysis (see Table 17) show that Waiting in queue, Amount of sleep in the 10 hours before the trip, and driver experience were all significantly and independently associated with experience of fatigue on the last trip, all other factors being equal. Inspection of odds ratios (OR) shows that fatigue was more than 2.5 times more likely for drivers who waited in queues on the last trip compared to drivers who did not have to wait to queue. Drivers who had less sleep in the 10 hours before the last trip were significantly more likely to be fatigued during the last trip. Fatigue was about 11 percent more likely for each hour of reduced sleep drivers had in the 10 hours before commencing driving. Less experienced drivers were also more likely to be fatigued on the last trip. Fatigue decreased by around four percent for each year of experience.

3.4.2 Predictors of dangerous events on the last trip

The logistic regression analysis of the predictors of dangerous events due to fatigue on the last trip was based on 47.5 percent of cases who had experienced fatigue on the last trip. All variables had at least one missing case, with the range from 6.6 percent of missing cases for Waited in a queue on the last trip to 32.0 percent for Paid to wait in a queue on the last trip. There were no systematic patterns in the

missing data. Only six cases had standardised residuals greater than two standard deviations so no changes were made to the dataset.

Overall, the model generated was not statistically significant ($\chi^2_{(7)}$= 11.2,p=0.13) and the analysis revealed no statistically significant predictors of reporting dangerous events due to fatigue on the last trip.

Table 17: Logistic regression model of factors associated with driver experience of fatigue on the last trip

Predictors [a]	B	S.E.	Odds Ratio (OR)	95% C.I.for OR		p value
				Lower	Upper	
Waiting to Queue:						
Waited in a Queue on last trip or not*	.937	.459	2.552	1.039	6.268	0.04
Paid to wait in a queue on last trip or not*	.455	.589	1.576	.497	4.996	0.44
Payment characteristics:						
Incentive payment: Trip or hourly based*	.446	.309	1.561	.852	2.863	0.15
Work-rest for last trip:						
Distance travelled on last trip	.000	.000	1.000	1.000	1.000	0.54
Amount of sleep in 10hrs before last trip	-.115	.053	.891	.803	.989	0.03
Driver characteristics:						
Age	.023	.021	1.024	.983	1.066	0.25
Heavy truck driving experience	-.037	.019	.964	.930	1.000	0.05
Constant	-.601	1.050	.548			

* reference or comparison category

[a] Overall model $\chi^2_{(7)}$= 19.9,p=0.006; Hosmer and Lemeshow test $\chi^2(8)$= 9.31,p=0.32; Nagelkerke r^2=10.4%

3.4.3 Predictors of the usual experience of fatigue

The analysis of predictors of the usual experiences of fatigue was based on 70.0 percent of cases due to missing data on one or more variables. All variables involved some missing data ranging from 1.3 percent of cases for Employment status to 13.7 percent of cases for Type of payment. Examination of the missing data did not show any systematic patterns. Analysis of outliers showed only seven cases with standardised residuals greater than two standard deviations so no change was made to the dataset.

The analysis (see Table 18) shows that the likelihood of experiencing fatigue on at least half of trips was more than doubled for drivers who were not usually paid to spend time waiting and queuing. None of the other predictors was statistically significant.

Table 18: Results of the logistic regression analysis of predictors of usual experience of fatigue

Predictors [a]	B	S.E.	Odds Ratio (OR)	95% C.I.for OR		p value
				Lower	Upper	
Waiting to Queue:						
Paid for waiting and queuing time or not*	.777	.397	.460	1.00	0.211	0.05
Payment characteristics:						
Incentive payment: Trip or hourly based*	.449	.409	1.567	.702	3.495	0.27
Work-rest for last trip:						
Usual weekly working hours	.009	.007	1.009	.995	1.023	0.22
Fatigue risk management:						
Fatigue risk management option: Standard hours* or Alternative (BFM/AFM)	-.375	.262	.687	.411	1.149	0.15
Driver characteristics:						
Age	-.003	.019	.997	.960	1.036	0.90
Heavy truck driving experience	-.017	.019	.983	.948	1.020	0.37
Employment group: Employee* or Owner driver/operator	-.067	.350	.935	.471	1.857	.848
Constant	-1.969	.840	.140			.019

* reference or comparison category

[a] Overall model $\chi^2_{(7)}$= 20.0,p=0.006; Hosmer and Lemeshow test $\chi^2_{(8)}$= 7.45,p=0.49; Nagelkerke r^2=8.4%

3.4.4 Predictors of injury

The analysis of predictors of the drivers' experiences of injury including crashes and work-related injury over the past 12 months was based on 70.9 percent of cases due to missing data on one or more variables. All variables involved some missing data ranging from one case for Employment status to 12.8 percent of cases for Type of payment. Examination of the missing data did not show any systematic patterns. Analysis of outliers showed 27 cases with standardised residuals greater than two standard deviations. These outliers were removed from the dataset.

Logistic regression analysis of the predictors of drivers' experiences of injury including crashes and work-related injury over the past 12 months generated a model that was not statistically significant (Overall model $\chi^2_{(7)}$= 2.8,p=0.91) and showed no significant predictors from the chosen predictor set.

3.4.5 Predictors of interference with family responsibilities

The analysis of predictors of the extent that drivers believe that their work interferes with family responsibilities was based on 70.9 percent of cases due to missing data on one or more variables. All variables involved some missing data ranging from one case for Employment status to 12.8 percent of cases for Type of payment. Examination of the missing data did not show any systematic patterns. There were no significant outliers.

The results of the logistic regression analysis (Table 19) showed that usual work hours per week and whether drivers usually get paid for waiting and queuing time were significant predictors of interference between work and family responsibilities. Odds ratios show that for each additional hour worked per week, there is a small (1.7%), but statistically significant increase in likelihood that drivers experienced more frequent interference with family responsibilities. More notable, is that drivers who are not usually paid for waiting and queuing are 2.5 times more likely to report that work interferes with family responsibilities often or always.

Table 19: Logistic regression analysis for predictors of the extent that current work interferes with family responsibilities

Predictors [a]	B	S.E.	Odds Ratio (OR)	95% C.I.for OR		p value
				Lower	Upper	
Waiting to Queue:						
Paid for waiting and queuing time or not*	.926	.323	.396	0.210	0.747	.004
Payment characteristics:						
Incentive payment: Trip or hourly based*	.012	.338	1.012	.522	1.963	.971
Work-rest for last trip:						
Usual weekly working hours	.017	.007	1.017	1.003	1.031	0.015
Fatigue risk management:						
Fatigue risk management option: Standard hours* or Alternative (BFM/AFM)	-.124	.234	.883	.559	1.397	.596
Driver characteristics:						
Age	-.033	.018	.968	.934	1.003	.075
Heavy truck driving experience	.030	.017	1.031	.997	1.066	.077
Employment group: Employee* or Owner driver/operator	.126	.309	1.135	.619	2.079	.683
Constant	-1.025	.769	.359			.182

* reference or comparison category

[a] Overall model Overall model $\chi^2_{(7)}$= 29.9,p=0.0001; Hosmer and Lemeshow test $\chi^2_{(8)}$= 6.37,p=0.61; Nagelkerke r^2=11.3%

3.5 Follow-up interview results

The responses of the 40 drivers who completed the qualitative follow-up interview questions are summarised in this section. The drivers' open-ended responses supplement the quantitative survey analyses and provide a richer picture of drivers' views and the issues they face. The quotations used in this section were taken from the interviewers' written records of the interviews.

3.5.1 Fatigue

The 15 drivers who completed the additional follow-up interview questions and who also reported fatigue on at least half of their trips were asked to identify the main contributors to their fatigue. The drivers reported a diverse range of factors with only one or two drivers reporting each factor. Their responses included: driving itself; lack of sleep and sleep disruption from noise; boredom; long work or driving hours; truck conditions such as a lack of air conditioning or high horse power that resulted in longer time in the vehicle; the concentration required especially when road conditions were poor; time of day; time pressure and stress; non-driving work like freight drops, queuing and loading that extended work time or reduced break time; lack of flexibility to take breaks when needed because freight schedules were determined using regulated working hours limits not drivers' needs; and the trade off between getting home quicker or taking more rest breaks en-route.

When these drivers were asked specifically if waiting time, queuing time or delivery windows interfered with their ability to manage fatigue, 60% thought that they did, compared with 27% who thought they did not. The remainder of respondents did not wait, queue or have delivery windows. Drivers reported a number of different ways that waiting, queuing or delivery windows affected their fatigue, including:

- Waiting and queuing are themselves tiring
  (e.g., "you get tired sitting there doing nothing regardless of how fresh you are", "it's very tiring sitting in a queue");
- Waiting and queuing increase working hours
  (e.g., " you start work at a certain time so you know have to work 12-15 hours, queuing up takes extra time", "queuing means you are working the whole time");
- Waiting and queuing interfere with rest time
  (e.g., "delays interfere with rest time", "dictates when you can sleep");
- Delivery deadlines may be unrealistic, especially if drivers are given extra work or made to wait
  (e.g., "they make you meet deadlines then make you sit and wait to load and unload", "running around for 2 hours before starting the job when given set arrival times").

Drivers who experienced fatigue regularly, proposed a range of changes to their working arrangements to improve their fatigue management. Most changes were noted by one or two drivers but the issue of sleep time flexibility was raised by four drivers:

- the flexibility to sleep or rest as needed, rather than as dictated by schedules or regulations
  ("let me sleep when I need it", "let me get out of bed when I want, not when someone says so", "more frequent shorter rest stops", "mandatory breaks are bad for fatigue management because you have to take them at an inappropriate time for your own fatigue");
- increased remuneration
  ("more money for the job you do so you could work fatigue management better", "increase rates");
- no waiting to load and unload or no loading/unloading at all
  ("not having to wait to load and unload – depot-to-depot work", "loading and unloading straight away rather than waiting around", "no loading and unloading");
- scheduling more time to drive;
- working regular hours rather than constantly changing hours;
- two-up (shared) driving;
- better organisation on the part of employers and customers;
- making customers aware of their obligations under the regulations;
- air conditioning in truck;
- reduce overly–zealous roadside inspections and resultant driver stress (*"It's stressful when pulled into inspection – could cost downtime or a fine for silly things like manufacturers design of truck"*);
- make each log book page a designated 24-hour period;
- improve the quality of food at truck stops.

One driver questioned whether it is possible to eliminate fatigue entirely in fixed route driving because of the inherent monotony (*"Don't know if it's possible to improve fatigue management. Driving the same route, you get used to it so you get bored. It can't be eradicated"*).

Drivers who regularly experienced fatigue were asked whether improved pay rates for driving work and non-driving work or time would help them manage fatigue. Just over half of the drivers (53%) thought that improved pay rates for driving would NOT help them to manage their fatigue better. One of these drivers elaborated that improving company management practices would be more helpful. One driver was undecided about the effect of driving pay rate increases on fatigue. He thought that if driver pay rates were increased, companies might respond by increasing drivers' workload which would cancel out any benefit of the pay increase for fatigue management. Six drivers thought that their ability to manage fatigue would be improved by increased driving pay rates. Four of these drivers explained that increased driving rates would reduce the number of hours they have to work to earn their living, making it easier to manage fatigue (*"Reasonable rates would allow you to pay bills and make a decent living without having to work 100 hours a week"*, *"Wouldn't need to work too many hours"*, *"Wouldn't have to do as much work", "More money for the work you do so you could work fatigue management better"*). One driver thought that increased driving rates would reduce the time pressure on drivers and result in safer driving overall.

More drivers were in favour of increased pay for non-driving work, with 53% responding that improved non-driving pay would help them manage fatigue. Again, the most common explanation (n=4) was that increased non-driving rates would

reduce the number of hours that had to be worked to earn a living. Two drivers felt that there would be less pressure to rush if non-driving work were paid and one predicted less frustration. One driver noted that although payment for non-driving work would certainly make him happier, he and another driver both acknowledged that extra money would not necessarily reduce fatigue. Among the drivers who thought that increased non-driving rates would not help fatigue management, one observed that the *"job still has to be done"*, regardless of pay, and another argued that drivers shouldn't do non-driving tasks at all.

3.5.2 Reported effects of changes to regulations on queuing and waiting

All interviewed drivers were asked whether they had noticed any changes in the way their customers managed queuing, waiting or delivery windows following the introduction of new regulations in October 2008. Seven drivers (17.5%) could not comment because they did not load or queue. Twenty eight drivers (70%) said they had not noticed any changes and only three drivers said they had noticed changes. Of these three, one driver felt that waiting times had gotten longer especially at large customers and gave the example of one large customer who had cut back the number of staff available for loading and unloading which increased waiting times. Another driver felt that the responsibility for fatigue management under the revised regulations was placed back on him by large customers because he had to sign forms to certify that he was fresh on departure and arrival. Only the third driver felt there had been positive changes, in particular, improvements in the time management of trucks such that loading schedules were negotiated a day in advance to reduce big queues.

3.5.3 Experiences of BFM/AFM

Eighteen of the twenty drivers who participated in the follow-up interview and who were working under the Basic Fatigue Management (BFM) regulatory option responded to questions about their experiences. All but two of these drivers had worked under the BFM for at least 12 months. Half had previously worked under standard working hours provisions for periods ranging from four months to 44 years. The other half of the drivers currently working under BFM provisions had previously worked under Transitional Fatigue Management provisions or had been part of a pilot BFM program. Their experience of these prior programs ranged from 2 to 10 years. Overall, nine drivers reported that the BFM was different to their previous system but four thought there was little difference, including one who had previously worked under standard hours. Drivers identified longer breaks (n=2), longer working hours (n=2) and the structure of the system (n=2) as the main differences between BFM and their previous system.

Fifty six percent (56%) of drivers felt that BFM contained provisions which helped them manage fatigue better than their previous work system, whereas 44% did not. The provisions designed to allow more sleep and breaks and night sleep were singled out by a number of drivers as helpful (*"more sleep, not nocturnal", "forces people to take a break", "7 hour continuous break", "allows more driving and sleeping time"*). Two drivers noted that the longer driving times were helpful in that they made

the overall duration of trips shorter (e.g., *"longer driving periods allow us to get to Sydney quicker"*). Individual drivers mentioned changes to unloading practices, being able to *"do the right thing in the log book"*, the general protection offered to drivers, and the mandatory fatigue management course for drivers.

Thirty nine percent (39%) of drivers identified aspects of BFM that made fatigue management more difficult. The longer working hours per day were highlighted by two drivers. The Work Diaries were identified as difficult by two drivers and enforcement and fines for Work Diary infringements were described as *"over-the-top"* by one. Two drivers also drew attention to negative effects of the mandatory 7-hour continuous break, in particular the inflexibility in the timing of the break – *"encourages people to drive faster/harder so that they can get that 7 hour break in. It reduces drivers' ability to take breaks as needed and meet deadlines", "forces you to take 7 hour break when you don't need it"*, and *"even when you're really close to the depot, you still have to take the break rather than finish and go home"*. Other drivers felt that BFM is just a propaganda exercise, that it is not well suited to long haul drivers and that it should be tailored to individual companies rather than applying a blanket set of rules.

3.5.4 Circumstances of recent crashes

Two drivers who participated in the follow-up interview questions had experienced a crash in their truck in the past year. Both crashes occurred in urban areas and involved a car. In both cases the crash was attributed largely to the behaviour of the car driver and neither of truck drivers felt there was anything they could have done to prevent it. In one crash, the car pulled out from a side street. In the other, the car clipped the truck and spun while trying to undertake (in the left hand lane). No serious injuries were sustained in either crash. Both crashes occurred later in the drivers' shifts (near the end and three quarters through). One occurred at night and the other at 4:30 in peak traffic. Both drivers felt that distraction, fatigue, or a lack of concentration on their part might perhaps have contributed in some small way (*"Perhaps"* and *"Maybe lack of concentration because I didn't see the car early enough and perhaps I should have"*).

3.5.5 Circumstances of recent occupational injuries

Five drivers who participated in the follow-up interview questions had experienced a work-related injury in the past year. In only one case was another person involved and he/she was not injured. Two incidents involved the drivers hand or fingers being crushed by freight and three involved a driver slipping and falling out of a vehicle (Table 20). The two drivers who sustained hand injuries, were treated in hospital and both claimed workers' compensation. They were advised to take one week and fourteen weeks off work, respectively. Two drivers sustained leg injuries. Neither took time off, sought immediate medical treatment or claimed workers' compensation, although one was assigned to light duties for a week. The fifth driver sustained a shoulder and neck injury, sought preliminary treatment from a GP and was off work for 2 weeks without claiming compensation. Four of the injury events happened in the middle of the drivers' shifts (the timing of the fifth was not reported). They were

spread across the morning and afternoon (7:00, 11:00, 12:00, 15:00, 16:45) with no obvious pattern. Two of the drivers who fell thought that fatigue or a lack of concentration, respectively, might have contributed and the third admitted he was *"being silly, joking around"* which suggests he may not have been concentrating sufficiently on the task at hand.

Table 20: Injury incident descriptions

"A forklift driver dropped a 7 tonne machine on my middle finger and crushed the end. The forklift was too small for the lift job so he couldn't centre the item. I was packing rubber in to raise the load on the forks but the forklift driver started to lift."
"I slipped and fell out of the back of a freezer truck."
"I twisted my knee jumping out of the cab."
"I fell out of the truck."
"I was cleaning the truck. Broke my hand when timber fell on it and crushed it."

The majority of drivers (58%) who took part in the follow-up interview reported that their job was not particularly physically demanding. Twelve drivers (30%), however, identified particular work tasks that were demanding. These included:

- Load-related tasks - loading and unloading (n=2), delivering fuel (n=1), lifting (n=2), pallet jacking (n=1), chaining the load (n=1);
- Vehicle-related tasks – vehicle maintenance (n=2), changing flat tyres (n=1), repeatedly using a heavy clutch (n=1), climbing up and down the truck (n=1);

Not surprisingly, drivers most commonly reported that these tasks affected their back (n=7), shoulders (n=4), and arms (n=4), but also their hands (n=1), legs (n=2) and knees or joints (n=2).

A somewhat different picture emerged when drivers were asked whether there were parts of their job that might contribute to chronic injury down the track. Again, heavy manual tasks were linked to potential back, shoulder and arm problems, but other issues were also of concern to drivers:

- Load-related tasks – deliver fuel, lifting/pulling, climbing up and down loads, heavy lifting of gates in and out of trailer and pallet jacking may affect the back, shoulder, arms, knees
- Vehicle-related tasks – changing tyres, gear changes, and climbing in and out of truck may affect the back, shoulder, neck and knees
- Poor truck seats (n=3) were linked to future back and hip injury
- Product handling and other exposures (n=4) were linked to potential future lung and skin problems.

3.5.6 Work-life balance

The majority of the drivers (70%) who participated in the follow-up interviews reported that their work interfered with family responsibilities at least sometimes (sometimes, often or always). The most common effects of work on family life were related to the driver working away from home so much of the time:

- Missing family events (n=10) such as dinners, birthdays, children's school and sporting functions and social events ;

- Not being there to help deal with family issues (n=7) or to take on home management tasks (n=6) with a consequent extra burden on the driver's partner (n=2);
- Simply not seeing the family (n=5) or being able to spend quality time with them (n=1);
- Family distress at drivers' absence (n=1).

Drivers' responses communicated their own personal disappointment at not being able to participate in family life more fully, but also an appreciation of the impact of their absence on their partners and children and some feeling that they were letting the family down.

Two drivers mentioned that time spent at home was often compromised by work (*"Sleep when home, away during the week"*, *"Lack of time on weekends because of unpaid work"*).

Not surprisingly, the key things that drivers wanted to change about their work to improve their work-life balance targeted their time at home:

- More time at home (n=1)
- Increased pay rates or payment for unpaid work (so that hours of work could be reduced) (n=10)
  (e.g., *"be paid more to do less trips. This means I earn the same but can be home more often*", *"Higher pay rate especially for waiting/queuing"*, *"Work less hours for same money - we're not paid what we're worth."*, *"Get paid for what you do"*, *"Better pay rate", "More money, less hours, better job security (because currently doing casual work)", "Not work on Saturday mornings for no pay", "Don't take the jobs that pay by the kilometer or by the trip"*);
- Shorter, more flexible, or more family-friendly working hours (n=9)
  (e.g., *"Better rostering. 40 hours instead of 72"*, *"Shorter more regular day shift hours"*, *"Amount of hours per day. I'd like to be home every night"*, *"Would like to do 2 round trips a week instead of 2.5 round trips"*, *"More flexible so I could be around more at home"*, *"Would prefer to work local so around home more"*, *"Getting home earlier"*; *"logbook hours"*);
- More leave time (n=2)
  (*"24 hour break"*, *"more leave time"*).

Four drivers suggested that the only way to improve work-life balance was to leave the job or the industry and three drivers felt there was nothing they could do (e.g., *"There's nothing that can be changed. You just have to deal with problems at work as they come up")*.

Eight of the drivers who reported a good work-life balance offered advice about achieving it. For four of them, the solution lay in leaving the industry or finding a better employer (*"Do a different job"*, *"If you get bullied by your employer, change your job"*, *"Find a good employer who pays well and looks after drivers. There are a lot of good companies but still many bad ones"*, *"Change jobs if balance is not right. Find a more suitable job."*). Others advised drivers to work within their own limits to achieve a better balance (*"Just know when to stop and take a break"*, *"Learn to know your own body and rest when you need it"*, *"Give and take. Don't drive until sunrise"*).

When all the drivers were asked whether their work had affected their personal relationships, 23 of the 40 (58%) thought it had. Seven (30%) of these 23 people cited family breakdown or divorce as a significant effect of their work (e.g., *"my previous marriage breakdown was due to not being home"*). Three drivers felt that they did not have time to develop or maintain personal relationships at all (*"Don't get time for them", "I'm divorced. There's not much time to meet new people", "Steady girlfriends aren't possible").* One driver commented that work affected the closeness of his personal relationships (*"Not as close as you would like"*) and five drivers explained that their personal relationships were affected because they didn't have enough time to spend with their partners or others (e.g., *"No time with wife"*, *"They understand but I only see them sometimes", "Wife has struggled with not seeing me"*). Not being there to support their partners in daily activities or when problems arose was mentioned by four drivers, one of whom described the stress that this placed on his relationship – *"Being away puts strain on my wife which in turn puts strain on relationship. I can't be there to help when things go wrong".*

Lastly, the follow-up interview participants with children up to 18 years old were asked whether their work had affected their parenting or their relationship with their children. Five of the eighteen drivers with children thought their work had either no effect or a positive effect on their parenting (e.g., *"Very little. I'm talking to her every day"*, *"My relationship is good with the kids and I see them often because work takes me to the places where they live"*). However, 12 drivers thought there were negative effects of their work on their parenting. These were almost universally a result of their being away from home so often. The main effects included:

- Missing the children growing up (n=3)
  (*"You don't get to see them grow up"*, *"Not seeing them growing up because I was away too much"*, *"missing the kids growing up, not being around enough"*);
- Feeling isolated from the children's lives (n=4)
  (*"I'm a guest at home, not Dad. I never get consulted"*, *"I'm not as close as I can be with them"*, *"I don't know what's happening with them"*, *"Sometimes I feel like an alien sitting at home"*);
- Not being able to help the children through parenting activities (n=5)
  (*"I'm not there for the kids"*, *"The kids miss out because Dad is not home"*, *"I'm not there to help with discipline especially for the "terrible twos""*, *"I'm not around to help the kids with schoolwork, and general parenting (discipline etc)"*, *"Not being there when they need fatherly advice"*);
- Not being able to share the parenting role (n=2)
  (*"Overburden on partner"*, *"wife has to be mother and father"*).

4 DISCUSSION

One of the most striking findings from this study is that long distance truck drivers are doing average working hours that are close to the legal limit for working and well over one-quarter are doing more hours than legally allowed. The sample of drivers in this study reported working between 19 and 23 percent more hours per week compared to drivers surveyed in 1998 (Williamson, et al., 2001: 57.8hrs) and 2006 (AMR Interactive, 2007: 55.9hrs). Similarly, a markedly higher percentage of drivers in the current study reported working longer than 72 hours than in the 2006 survey where only 16 percent of drivers reported driving beyond the working hours limits. These comparisons suggest that long distance truck drivers currently working in the eastern states of Australia are doing working hours as high or higher than seen over the last 12 years. The results also suggest that changes to fatigue risk management practices in this industry are not having an effect of reducing working hours for drivers. This is a concerning finding.

The study also showed that trip-based payments are related to the hours drivers work and their experience of fatigue. Drivers remunerated by incentive payment do around 8 hours more work per week than those paid by the hour. This is confirming previous studies but is also a sign that working conditions and practices in the industry are not improving despite considerable activity to manage fatigue risk while driving. Reported stimulant use was low in this survey but the pressures on drivers that have been shown in previous studies to encourage stimulant use (Williamson, 2007) have clearly not reduced over the last decade. Trip-base pay was related to longer trips in terms of driving hours and distance travelled and less sleep in the 10 hours before the trip. Drivers remunerated by trip were also more likely to experience other pressures including being more likely to need to wait in queues to load/unload, and to have set windows for arrival. Again as shown in previous studies, being paid by the trip was associated with greater fatigue both on the last trip and as a usual experience compared to hourly-pay. In fact, trip-based payment was associated with a doubling of the number of drivers who reported experiencing fatigue on at least half their trips. Clearly, the influence of trip-based payment is not diminishing in the long distance road transport industry.

The objective of the current study was to look at the influence of waiting in queues to load or unload as well as the effects of incentive-based pay. The survey results clearly highlight the important influence of waiting in queues on long distance truck driver well-being. Waiting in queues did not change the fundamental nature of the job for most drivers. It did not change the distance covered or the driving hours on the last trip. Nor did it change the number of freight stops on the last trip. Rather, the effects of waiting in queues were on non-driving aspects of the last trip. The need to wait in a queue was related to more non-driving hours on the last trip, adding around two more hours, on average. Drivers who had to wait in a queue on the last trip, were less likely to be paid for any non-driving activity including waiting time in queues, non-driving work such as loading and unloading and local work. Drivers who waited were also more likely to have arrival time pressures during the trip.

The effect of having to wait and queue is highlighted in the multivariate analysis. Factors relating to waiting and queuing were significant predictors of fatigue on the

last trip, drivers' usual experience of fatigue and of work interfering with family life. Having to wait in a queue on the last trip made fatigue more than twice as likely compared to drivers who did not have to wait. The survey showed that queuing increased the amount of non-driving work and added two hours to the duration of the last trip. Importantly, the multivariate analysis showed that the need to queue was the strongest predictor of fatigue on the last trip. The amount of sleep before the last trip also predicted fatigue which is not surprising. Less experience also predicted fatigue, but in both cases the effect is much smaller than that of queuing.

When drivers usual experience of fatigue and waiting were examined, drivers who were not paid had twice the odds of experiencing fatigue on at least half of trips. Similarly, drivers who were not paid to wait were also more than twice as likely to report that work often or always interfered with family life. Drivers who were usually paid to wait did significantly shorter usual hours and shorter last trips than those who were not paid. This is consistent with a finding of less frequent fatigue and better balance between work demands and family responsibilities.

For the analysis of usual driver experiences, being paid to wait in queues was also the most important predictor of fatigue and work-life balance outcomes. In fact being paid to queue was the only predictor from a range of possible important predictors of drivers' usual experience of fatigue. For work-life balance, not being paid to wait and higher usual weekly hours both increased the likelihood that work interfered with family responsibilities, but lack of remuneration for queuing had a stronger effect.

It is of note that the predictors of fatigue on the last trip included having to wait in a queue, but did not include being paid to wait. In contrast, being paid to wait was a significant predictor of driver reports of their usual fatigue experiences. An important distinction needs to be made here. Drivers were asked whether they usually spent time on waiting and queuing and whether they were paid to do so. Only a very small percentage of drivers (2.9%) reported that they did not usually do work that required waiting or queuing so for this analysis the variable relating to waiting and queuing experiences in general was whether or not drivers were paid to wait or not. For the analysis of driver experiences on the last trip, however, it was possible to look at the influence of actually waiting, separately from that of being paid to wait. When the two variables were separated, it is clear that just having to wait and queue increases driver fatigue, but being paid to wait does not.

From the analysis of usual work experiences, it appears that paying drivers while they wait in queues is associated with shorter hours of work and with significantly less fatigue and less interference with family life. This suggests that paying drivers moderates the adverse effects of having to wait in queues so presenting a significant benefit to drivers. Another possible reason for this link is that drivers who were usually paid to wait also drove smaller vehicles, and were markedly less likely to be paid by the trip which has already been shown in bivariate analysis to be linked with higher fatigue. This possibility is challenged however, by the finding that incentive payment did not emerge as a significant predictor in any of the multivariate analyses. The fact that payment type did not explain unique variance over that explained by waiting variables suggests that waiting is a marker for incentive pay and long hours but that waiting also reflects additional pressures on drivers and so is statistically significant in its own right. To test the effect of incentive payment without the

influence of the waiting variables, the analysis of the predictors of usual fatigue experiences was run again. Without the waiting variables, trip payment and usual weekly working hours were significant predictors. It seems that waiting time exerts a strong independent influence on driver fatigue experiences.

The results of this research confirm the previous Transport Workers Union study that drivers on incentive pay were more likely to need to wait on their last trip but are less likely to be paid for waiting and, in fact, less likely to be paid for any non-driving activities. When they waited, drivers spent significantly longer non-driving hours in their trip. Not being paid to wait was associated with markedly increased driver workload in terms of greater distances covered in the last trip and longer hours per week. The average driving hours for drivers who were not paid to wait increased to over 72 hours indicating that amongst these drivers it is the norm to do the legal limit of driving hours or more per week. It seems that drivers on incentive payments who are not paid to wait need to push themselves for longer in order to make up their usual or expected level of remuneration. The weekly earnings of drivers who were paid or not paid to wait did not differ despite differences in usual weekly hours and trip hours. Drivers paid to wait were able to maintain the same level of earnings without having to do an additional five hours of driving on a trip.

In the same vein, it is notable that drivers on incentive payment did not earn significantly more than drivers paid on an hourly rate. It seems that drivers can earn the same amount being paid hourly without the pressures of incentive payment. By so doing drivers would do fewer kilometres each trip, fewer working hours, wait less in queues and be more likely to be paid for non-driving work. This would result in less fatigue for drivers, better work-life balance and a more efficient long distance road transport industry.

The results of this study also demonstrate clearly that trip-based payment in the long distance road transport industry is truly productivity-based. Drivers are only being paid when freight is moving. While drivers are on the road moving from Point A to Point B, they are paid. When they stop to allow loading or unloading, consignors, consignees, freight companies and employers do not acknowledge this as work and do not remunerate drivers for waiting for these activities to occur. If payment for non-driving work was mandated, it would be certain that the industry would become more efficient and require significantly less waiting and queuing for drivers. This would also have significant benefits for drivers and the industry.

5 REFERENCES

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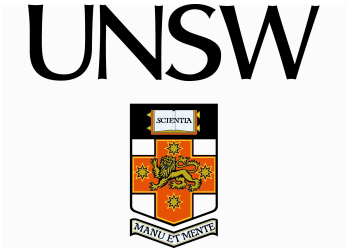
6 APPENDICES

Appendix 1: Participant Information Statement

Appendix 2: Driver Survey

Appendix 3: Additional Qualitative Questions

6.1 Appendix 1: Participant Information Statement



Approval No: 08/2009/39

THE UNIVERSITY OF NEW SOUTH WALES

PARTICIPANT INFORMATION STATEMENT

External influences on health and safety outcomes in NSW long distance trucking

You are invited to participate in a study about the relationship between work practices in the long distance road transport industry and driver safety. We hope to learn more about the non-driving part of your job and how that might affect safe driving.

You were selected as a possible participant in this study because you are a long distance heavy vehicle driver. The study is being funded by WorkCover NSW and is being done on behalf of the NSW Transport Workers Union (TWU).

If you decide to participate, we will provide you with a short anonymous survey to complete. You can do the survey now as an interview or you can take it away to complete in your own time and post it back to us in the reply paid envelop provided. The survey should take about 5 to 10 minutes to complete.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission, except as required by law. If you decide to participate in the study, we plan to publish a report and articles summarising the results. The report will be publicly available on the IRMRC website (http://www.irmrc.unsw.edu.au/) and the findings will be discussed with the TWU and NSW WorkCover. In any publication, information will be provided in such a way that you cannot be identified.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 02 9385 4234, fax 02 9385 6648, email ethics.sec@unsw.edu.au). Any complaint you make will be investigated promptly and you will be informed out the outcome.

Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

If you have any questions, please feel free to ask us. If you have any additional questions later, Ms Rena Friswell (02 9385 5353) or Professor Ann Williamson (02 9385 4599) will be happy to answer them.

You will be given a copy of this form to keep.

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6.2 Appendix 2: Driver Survey

UNSW long distance heavy vehicle driver survey

Please record today's date *(dd/mm/yyyy)*: _____/_____/2009

1. What is your age? _____ years

2. Are you: *(please tick one option)* ☐ Male ☐ Female

3. Are you currently: *(please tick one option)*
   ☐ Single
   ☐ Married or de facto
   ☐ Separated
   ☐ Divorced
   ☐ Widowed

4. Do you have children aged: 0-14 years? ☐ Yes ☐ No
   15-18 years? ☐ Yes ☐ No

   If yes, how many of these children live with you at least part of the time? _____

5. How often does your current work interfere with your family responsibilities? *(please tick one option)*

   ☐ Always ☐ Often ☐ Sometimes ☐ Rarely ☐ Never

6. How long have you been driving heavy vehicles for a living? _____ years

7. Where is your home base or depot?

   Town/city: _____ and State: _____ or Postcode: _____

8. What sort of vehicle do you **usually** drive? *(please tick one option)*
   ☐ Rigid truck
   ☐ Articulated truck
   ☐ B-double
   ☐ Road train
   ☐ Other *(please describe)* _____

9. Are you currently a member of:
   ☐ the Transport Workers' Union?
   ☐ another industry organisation? *(please list)* _____
   ☐ no industry organisations

10. Are you: *(please tick one option)*
    ☐ an employee driver
    ☐ an owner driver
    ☐ an owner operator

    If you are an owner driver or owner operator, which of the following best describes your work: *(please tick one option)*
    ☐ Prime contractor
    ☐ Subcontractor in company colours
    ☐ Freelance subcontractor
    ☐ Transport your own goods
    ☐ Other *(please describe)* _____

Loc: ____ ____ ☐ Interview

11. How are you **usually** paid? *(please tick one option)*

- ☐ Hourly rate
- ☐ Flat day rate
- ☐ Day rate with overtime
- ☐ Weekly rate
- ☐ Weekly rate with overtime
- ☐ Flat rate for every truck load carried
- ☐ Rate for each trip based on kilometres travelled or tonnage carried
- ☐ Other *(please describe)*

_____

12. Do you usually get paid for time spent on:

	Yes	No	Don't know	I don't do this work
• Non-driving work (like loading)?	☐	☐	☐	☐
• Waiting and queuing time?	☐	☐	☐	☐
• Local/metro drops and pick-ups?	☐	☐	☐	☐

13. In total, how many hours would you **usually** work in a week? _____ hours

---

We would like to learn about your last complete, long distance, round trip.
That is, we are interested in the round trip **BEFORE** the one you are on now.

'long distance' is a trip of 100 km or more from your home base or depot
'round trip' is a trip that starts and ends at your home base or depot.

14. In total, what was the distance of your last complete round trip? _____ kilometres

15. What was your route for that round trip? *(e.g., Brisbane-Sydney via Newell Hwy and Sydney-Brisbane via Pacific Hwy)*

_____

16. What size truck were you driving? _____ tonnes GVM

17. What type of freight were you carrying? _____

18. Did you drive as a: *(please tick one option)*

☐ Solo driver ☐ Two up driver ☐ Staged/crossover driver

19. Did you drive under: *(please tick one option)*

- ☐ Standard Hours
- ☐ Basic Fatigue Management
- ☐ Advanced Fatigue Management
- ☐ Other *(please describe)* _____

20. Did you receive or see your:

• Safe Driving Plan?	☐ Yes	☐ No	☐ Don't know
• Fatigue Management Plan?	☐ Yes	☐ No	☐ Don't know

21. What were you paid in total for the round trip (end to end)? $_____

If you are an owner driver or operator, how much of this amount do you make after all business costs are paid? $_____

22. In the 10 hours before starting work for the trip, roughly how much time did you spend:

- Sleeping ____ : ____ hours : minutes
- Resting/relaxing but not sleeping ____ : ____ hours : minutes
- Not sleeping or relaxing ____ : ____ hours : minutes

TOTAL **__10 : 00__ hours**

23. For this round trip, when did you:

Start work before the trip? Time: ____ : ____ ☐ am ☐ pm Day: _____ Date: _____

Start driving the trip? Time: ____ : ____ ☐ am ☐ pm Day: _____ Date: _____

Finish driving the trip? Time: ____ : ____ ☐ am ☐ pm Day: _____ Date: _____

Finish work after the trip? Time: ____ : ____ ☐ am ☐ pm Day: _____ Date: _____

24. From when you started work before the trip to when you finished work after the trip, how many hours in total did you spend:

Driving? _____ hours and Doing non-driving work _____ hours

25. Not including the start and end of the trip, how many freight stops and changeovers did you make during the trip? _____ stops

26. On the last round trip, including at the start and end, did you ever have to:

	NO	YES	(If you answered YES) How much time did you spend doing this on the trip?	Were you paid for this time?
Wait to load/unload in a moving queue	☐	☐ ➔	_____:_____ hrs:mins	☐ Yes ☐ No
Wait to load/unload but not in a moving queue (e.g., take-a-number or call-for-loading system)	☐	☐ ➔	_____:_____ hrs:mins	☐ Yes ☐ No
Personally load/unload or tarp the truck	☐	☐ ➔	_____:_____ hrs:mins	☐ Yes ☐ No
Wait for another person to load/unload the truck	☐	☐ ➔	_____:_____ hrs:mins	☐ Yes ☐ No
Make local pick-ups or deliveries	☐	☐ ➔	_____:_____ hrs:mins	☐ Yes ☐ No

27. How many times did you wait more than 15 minutes in a moving queue? _____ times
(If none, write 0)

28. Did you have any set times or time windows when you had to arrive for loading or unloading on the trip? ☐ Yes ☐ No

If Yes, Did you meet these arrival times or windows? ☐ Yes ☐ No

How long were the arrival windows? _____:_____ hours:minutes

The following questions are about fatigue you may experience when driving for work.
By fatigue, we don't only mean feeling drowsy or sleepy. We also mean being tired, lethargic or bored, unable to concentrate, unable to sustain attention and being mentally slowed.

Fatigue experiences during your last complete round trip

29. How did you feel when you started driving your last round trip? *(please tick one option)*
    - ☐ Very fresh
    - ☐ Quite fresh
    - ☐ A bit tired
    - ☐ Quite tired
    - ☐ Very tired
    - ☐ Don't remember

30. Did you feel fatigue at any stage on your last round trip? ☐ Yes ☐ No

31. Did any potentially dangerous things happen due to your fatigue on this trip? ☐ Yes ☐ No

    If Yes, please tick any things that happened.
    - ☐ Nodding off for a moment – called a microsleep
    - ☐ Having a near miss
    - ☐ Crossing lane lines
    - ☐ Late braking
    - ☐ Other (Please describe)
    - ☐ Falling asleep at the wheel
    - ☐ Running off the road
    - ☐ Over/understeering
    - ☐ Colliding with something

    _____

32. Did you use any drugs to manage fatigue at any time on your last round trip? ☐ Yes ☐ No

    If Yes, what did you use? _____

Fatigue experiences generally

33. How often do you become fatigued while driving for work? *(please tick one option)*
    - ☐ On every trip
    - ☐ On most trips
    - ☐ On about half your trips
    - ☐ Occasionally
    - ☐ Very rarely
    - ☐ Never

Crash and injury experiences

34. Have you had a crash driving a heavy truck for work in the last 12 months? ☐ Yes ☐ No
    If Yes,
    - How many crashes did you have in the last 12 months? _____ crashes
    - Were you injured in any of these crashes? ☐ Yes ☐ No
      If Yes, did you need: Time off? ☐ Yes ☐ No
      Light duties? ☐ Yes ☐ No
    - Was anyone else injured in any of these crashes? ☐ Yes ☐ No

35. Have you been injured at work through other causes in the last 12 months? ☐ Yes ☐ No
    If Yes,
    - How many times were you injured in the last 12 months? _____ times
    - Did you need: Time off? ☐ Yes ☐ No
      Light duties? ☐ Yes ☐ No

Thank you for taking part in this study

6.3 Appendix 3: Additional Qualitative Questions

UNSW long distance heavy vehicle driver survey
In depth questions

Interviewer instructions

- If drivers do not seem to be in a hurry, ask them if they would mind giving a bit more information about some of their answers.
- Make sure the interviewee knows he/she can decline to answer any of these questions.
- When finished, securely attach this record of responses to the survey form of the interviewee.

That's the end of the survey, but I'd like to follow-up on some of the answers that you gave in a bit more detail. It would take about 5 minutes extra. Would you mind?

Today's date *(dd/mm/yyyy)*: _____/_____/20____

FATIGUE, WAITING, QUEUING, PAYMENT

If Fatigue occurs on at least ½/most/all of trips at Q33
What do you think are the main contributors to YOUR fatigue?

Do waiting time, queuing time or delivery windows interfere with your ability to manage fatigue?
(If yes) In what way?

What are the main things you would change about your working arrangements to improve your fatigue management?

Would improved pay rates for driving help you manage fatigue better?
(If Yes) In what way?

Would improved pay rates for non-driving work or time help you manage fatigue better?
(If Yes) In what way?

All drivers
New regulations covering queuing and waiting came into effect last October. Have you noticed any changes in the way your customers manage queuing, waiting, or delivery windows?
(If yes) What sorts of changes have you noticed?

Are all customers changing or just some?

If BFM/AFM at Q19
How long have you been working under your current BFM/AFM?

What were you working under before that? (e.g., standard hours, Transitional or Full fatigue management) How long did you work under that system? Is your BFM/AFM different to your previous system?

Are there any good things in your BFM/AFM that have helped you manage fatigue better than under your previous system?

Are there any things in your BFM/AFM that make fatigue management difficult?

ACCIDENTS AND INJURY

If crashed at work in the last year at Q34
Tell me about your LAST crash at work in the past year. What happened?

When was it in the shift (eg near start, end etc)?

What time did it happen?

Were you injured in this crash? What parts of your body were affected? Were you off work or on light duties? For how long? Did you seek medical treatment? From a GP or hospital? Did you claim compensation (workers comp or private injury/income replacement)?

Was anyone else involved? Were they injured?

Looking back, is there anything you could have done to prevent the crash?

Do you think distraction, fatigue, or lack of concentration on your part contributed at all?

If injured at work in the last year at Q35
Tell me about your LAST injury at work in the past year that was not due to a crash. What happened?

When was it in the shift (eg near start, end etc)?

What time did it happen?

What parts of your body were affected? How long were you off work? Were you off work or on light duties? For how long? Did you seek medical treatment? From a GP or hospital? Did you claim compensation (workers comp or private injury/income replacement)?

Was anyone else involved? Were they injured?

Looking back, is there anything you could have done to prevent it?

Do you think distraction, fatigue, or lack of concentration on your part contributed at all?

All Drivers
Are there any parts of your job that are physically demanding?
(If Yes) What parts?

Which parts of your body are most affected?

Are there any things you do as part of your job that might contribute to chronic injury down the track?
(If Yes) What are these?

What parts of your body are affected?

WORK-LIFE BALANCE

If work interferes Always/Often/Sometimes at Q5
When your work interferes with your family responsibilities, what sorts of things happen or don't happen? (That is, how does your job interfere?)

If you could change one or two key things about your current job to improve your work-life balance what would you change?

If work interferes Rarely/Never at Q5
What do you think the secret to a good work-life balance is? What advice would you give other drivers?

All Drivers
Do you think your work has affected your personal relationships at all?
(If yes) In what way?

If Children at Q4
Do you think your work has affected your parenting or your relationship with your children at all?
(If yes) In what way?