CHALLENGING THE FOCUS OF JOURNEY MANAGEMENT: EXPLORING THE INFLUENCES OF MINERS' DRIVING DECISIONS AT THE END OF SHIFTS

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Commuting; drive in/drive out; journey management; mining industry; shift work; safety policy; safety climate; social norms approach; Theory of Planned Behaviour; workplace road safety.

Abstract

It is relatively common for many mine workers in Australia to drive an average of 240 kilometres to and from work following long shifts and shift blocks (Di Milia, 2006). This long distance commute sometimes occurs following alternating day and night shift rosters of 12 to 14 hours. Shift work and irregular hours contribute to the likelihood of an adverse event during the commute (Rogers, Holmes, & Spencer, 2001). In addition to the risks associated with driving following irregular hours and long shifts, anecdotal evidence also suggests that these workers are not engaging in a break following their shift prior to driving home. This behaviour further exacerbates the risk of an adverse outcome during the commute. In a 2010-11 report regarding work-related fatalities in Australia, the highest commuter fatality rate was recorded by the mining industry, representing 2.44 commuter deaths per 100,000 workers (Safe Work Australia, 2012). However, despite the readily identifiable risks and the poor safety performance of the industry in respect to commuting fatalities, there is limited research in respect of commuting behaviours of mine workers, and little is known about the factors that influence these workers to leave a site immediately following their shift.

The aim of the current program of research was to explore the reasons why mine workers drive home from site immediately following shifts in order to devise potential interventions which might reduce the adverse outcomes of such commuting behaviour. The program of research comprised four studies that initially explore and explain issues and impacts of driving-related commuting within the mining industry, and then explain behavioural intentions associated with the decision to drive home immediately. The core objective of this research is exploratory in nature, given the limited research that has previously examined driving-related commuting decisions. This exploration focuses primarily on individual, social, and organisational influences on driving intentions and how a focused examination of these influences

can be used to identify opportunities for interventions to guide industry efforts to limit or prevent the risk of adverse outcomes associated with the drive home after shift.

The primary catalyst for this program of research was the 2011 Coronial Inquiry investigating the road crash-related deaths of two mine workers. The mine workers were engaged in their commute at the time of the crashes. The Coroner made recommendations primarily associated with fatigue management and education. Given the industry is very safety conscious and a large number of risk management tools are associated with fatigue and journey management, this research challenges the current focus of journey management by exploring the influences of miners' driving decisions at the end of shifts.

The research program was informed by a review of the history of the mining industry in Australia, focusing mainly on individual factors that influence the prevalence of workers engaging in the mining lifestyle in Australia. Social impacts associated with engaging in a transient lifestyle, as well as the reasons associated with the migration of the workforce toward coastal or larger communities, were considered in order to contextualise the reasons for commuting such significant distances. An examination of literature associated with rural and remote driving and fatigued driving revealed situational risks associated with the driving-related commute. The overlap between the on- and off-site nature of the behaviour highlighted the need to understand the organisational and industrial influences associated with the behaviour; as such, examination of employment structures, as well as rostering and shift times on the commute, were considered. These individual, social and organisational factors directed the focus of the research program. The exploratory and iterative nature of the research program supported the use of three key theories to explain *why mine workers drive home immediately following shift blocks*. Firstly, the Theory of Planned Behaviour (TPB), including attitudes, subjective norms and perceived behavioural control, assisted in the explanation of individual and social influences on intention to drive home immediately following shifts. Secondly, considering the strong social influence identified throughout the research program, the social norms approach guided the exploration of individual perceptions of industry behaviour and significant others' approval, and how those social influences influenced driving immediately following shifts. Finally, organisational safety theory, including safety performance and safety climate, guided the exploration of safety behaviours by accounting for individual perceptions of site and journey safety performance and compliance.

Study 1 was a descriptive study that examined a secondary data set of workers' compensation journey claims. The study examined 282 cases associated with commuting crashes in the mining industry in Queensland between June 2009 and July 2013. The primary aim of Study 1 was to examine the circumstances of motor vehicle crashes associated with the drive-in/drive-out (DIDO) workforce in Queensland. This study also examined the costs incurred by industry as a result of workers' compensation and journey claims to provide a financial impact incurred by industry as a result of commuting crashes. The study found a large variation in the financial impact associated with general workplace claims and journey claims, with a difference of approximately \$20,000 in compensation. The crash circumstances identified in Study 1 were primarily related to fatigued and rural and remote driving. The frequency of workers encountering these circumstances was examined further in Studies 3 and 4.

Study 2 was made up of two parts to define the legislative parameters within a Queensland context to understand the environment in which this commuting behaviour occurs. The first part of Study 2, Study 2a, was a critical examination of the relevant legislation, industry standards and organisational policy documents analysed using a top-down approach (i.e., legislation through to internal organisational policy). The second part of Study 2, Study 2b, sought confirmation of the findings of the critical review by examining the perceptions of eight site safety experts from the target mine site. The data from the focus group were analysed using thematic analysis. Examination of the legislation, industry standards and organisational policy in Study 2a revealed a key focus on on-site related fatigue risks. As such, the primary focus of organisational policy centres on the journey *to* work to ensure that the worker is fit to perform their duties once they commence on day one of their rostered shift block. Therefore, the focus of organisational policy on the journey home is restricted to limiting hours of work and commute time to not exceed a total of 14 hours in a 24 hour period. The site safety experts agreed that the primary focus of organisational safety policy was based on managing site-related fatigue risks and therefore organisational policy focused on the journey to work. The site safety experts also highlighted the general approach to journey management and limitations in the ability to enforce this off-site behaviour. The findings also revealed that the safety experts perceived that workers drive home immediately following shifts primarily due to social influences. The findings of Study 2 were used to guide Studies 3 and 4 in the research program, particularly confirming the importance to focus on the journey home.

Study 3 consisted of 37 semi-structured, in-depth interviews with workers at all levels of the mine site, from management to labourers. This study was the first study in the research program to gain an understanding of the key influences on workers' intentions from individual, social, organisational and situational perspectives. Extending on Study 1 and Study 2, Study 3 explored the situational influences identified in Study 1 and the organisational influences identified in Study 2. Extending beyond those themes, this study also explored attitudes toward the commute, social influences, and risk perceptions. The data was analysed through two steps. The first step was a thematic analysis, through which eight themes were identified. The thematic analysis confirmed the suitability of exploring driving-related commuting behaviour using the TPB. The second step was a theoretical alignment with the TPB. The findings of the in-depth interviews demonstrated that workers minimise risks by planning the commute and implementing controls to justify their commuting behaviour. A large component of commuting behaviour, as a finding of the in-depth interviews, is that as a result of social influences, including perceptions of what others in the industry do following shifts, driving immediately following shifts is acceptable, and the perception that significant others support and approve the worker driving home immediately following a shift, with some even pressuring the worker to leave immediately. The critical beliefs associated with workers' attitudes, subjective norms and perceived behavioral control, also follow the themes associated with risk identification and social influences. These themes were used to further understand underlying beliefs and key influences of intentions in Study 4.

Study 4 comprised three parts reporting the results of a cross-section survey conducted with 461 participants from all organisational levels of the target mine site. The survey was made up of measures adapted from existing scales to fit within the context of driving home from mine sites following shift blocks. There were two surveys developed using identical measures; however, one survey focused on behavioral intentions following day shifts (*N*=239) and the other on night shifts (*N*=222). The measures focused on four key areas, the traditional TPB measures, social norms approach measures, safety climate measures and driver behaviour measures. Study 4a examined group differences between driving immediately following day and night shifts, occupation and employment type, as well as worker intention to drive home immediately, when considering situational driving risks such as risks associated with rural and remote driving and fatigued driving. The risks are readily identifiable by considering that the average distance travelled following both day and night shift was 437 kilometres, or approximately four and a half hours. The key finding was the higher intention of those workers finishing day shifts to drive home immediately following the shift.

Study 4b explained the key influences identified in the previous studies using the TPB, augmented with key findings identified throughout the research program. Regression analysis predicted intentions to drive home immediately following day and night shifts using TPB measures, the perception of others in the industry driving home immediately, the perceived approval of supervisors, and the perception of safe journey practices. The multiple regression analysis supported the use of the TPB to explain intentions to drive home immediately following shifts. The predictors explained 77% of the variance in intention to drive immediately following night shifts, and 74% of the variance in intention to drive immediately following day shifts. The TPB predictors of attitude, subjective norms and perceived behavioural control (PBC) were strong predictors of intention for both the day and night sample. Intentions were further predicted by the perception that others in the industry engaged in the behaviour for both the day and night shift sample. For night shifts, those who were less likely to apply safe journey practices also predicted intention to drive immediately. These findings were used to consider some preliminary opportunities for interventions.

The final analysis within Study 4, Study 4c, was undertaken to identify additional opportunities for interventions through consideration of the underlying beliefs of attitudes, subjective norms and PBC. These beliefs were drawn from an analysis of the in-depth interviews to identify advantages and disadvantages, facilitators and barriers, as well as to identify those who approve and disapprove of the behaviour. A step-wise regression analysis was performed in line with the recommendations of von Haeften et al. (2001). The analysis identified that key opportunities for interventions vary depending on whether the worker is finishing a day or night shift. The disadvantage of leaving immediately following a shift associated with putting others at risk was consistent across the day and night sample. This highlights a potential efficacy for developing an education campaign associated with the risks associated with leaving immediately, and who may be at risk by engaging in this behaviour. An additional efficacy can be gained by educating family and challenging their approval of the workers' intention to leave immediately following shifts. Beyond these two underlying beliefs, opportunities for interventions are then specific to the shift type, highlighting that a one-size fits all approach may not be the most appropriate method for behaviour change.

Overall, this thesis presents findings from four studies to investigate why mine workers drive home immediately following shift blocks. The findings from these studies highlight a number of theoretical and practical implications for driving-related commuting which can be applied to several contexts. The research program ultimately presented opportunities for interventions which can be used to complement the current approach of fatigue management education and policy. The program of research identifies a new direction for post-shift safety policy in respect of driving home from site following shift blocks in the mining industry, by challenging the current focus of journey management. The key practical implications of the research are associated with acknowledging the difference between behaviour following day and night shift blocks; education in respect of the responsibility for the commute; understanding how risk assessing techniques are being applied to this context; challenging the focus of fatigue management and highlighting the need for an integrated approach which considers factors in addition to fatigue management.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviation/symbol	Definition
α	Cronbach's alpha measures internal reliability across items in a scale
ARIA	Accessibility/Remoteness Index of Australia
BAC	Blood Alcohol Content
CI	Confidence interval
df	Degrees of freedom
DIDO	Drive in/Drive out
Cohen's d	Effect size between two means
F	F distribution
FMP	Fatigue Management Plan
FIFO	Fly in/Fly out
QGN16	Guidance Note for Fatigue Management 2013
KSS	Karolinska Sleepiness Scale
R^2	Line of best fit
M	Mean
ω^2	Omega squared
r	Person product-moment correlation
p	Probability level
RAA	Reasoned Action Approach
B	Regression coefficient
RTW	Return to work
ΔR^2	R-squared change
SMS	Safety Management System
SSE	Site Safety Executive
SD	Standard deviation
$\boldsymbol{\beta}$	Standardised regression coefficient
n	Sub-sample for specific analysis
Q-Comp	The Queensland-based workers' compensation regulator
Qld	The state of Queensland, Australia
TIB	Theory of Interpersonal Behaviour
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
N	Total sample for the study
t	t-Statistic
Tukey's HSD	Tukey honest significant difference (post-hoc analysis)
VIF	Variance inflation factor
WH&S	Workplace health and safety

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature: QUT Verified Signature

Date: December 2017

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Chapter 1: Introduction

1.1 INTRODUCTION

Long distance commuting to and from mine sites following long shifts and shift blocks is widespread in the mining industry in Australia. Distances of 240 kilometres or more are not unusual and these journeys occur following day and night shifts of 12 to 14 hours (Di Milia & Bowden, 2007). There is a large amount of research that demonstrates that shift work and irregular hours, coupled with travelling significant distances, contribute to the likelihood of an adverse outcome while driving (Rogers et al., 2001). Despite the acknowledgement of these risks, workers continue to engage in these long commutes, with some leaving immediately at the conclusion of the shift block. This behaviour further exacerbates the risk of an adverse outcome during the commute.

The mining industry in Australia is relatively safety conscious. As a result of a 2011 Coronial Inquiry into the driving-related commuting deaths of two Queensland mine workers, the industry has been focused on developing fatigue management education and policies associated with driving-related commuting. While these risk management tools are important, this research seeks to explore if there are other factors that should be considered in addition to fatigue management education and policies. Furthermore, mine and industry representatives acknowledge an issue associated with mine workers leaving site immediately following shifts and as a result of this issue are seeking appropriate intervention strategies. By focusing on a mine site in Queensland, Australia, this research seeks to examine the key influences affecting workers' decisions to drive home from the worksite immediately after a shift block, and to identify opportunities for interventions for consideration by the industry. By analysing the reasons why these workers leave a site immediately after shifts, this research challenges the focus of journey management and redirects the focus to encourage industry to implement interventions associated with behavioural evidence for what is revealed to be a multifaceted problem.

This chapter outlines the background and the geographical area in which the research was conducted (Section 1.2). The rationale of the research is presented in Section 1.3, and Section 1.4 summarises the research aims and objectives which will be considered further in Chapter 3. Section 1.5 introduces the theoretical framework considered throughout this research program. The significance and scope of this research is described in Sections 1.6. Finally, Section 1.7 includes an overview of the remaining chapters of the thesis, and Section 1.8 summarises the chapter

1.2 BACKGROUND

Australian employees are increasingly choosing to commute long distances to and from work for various reasons, including above average salaries, longer periods away from work, and arguably, a higher quality work-life balance. This phenomenon is particularly apparent within the resource industries, such as construction and mining. The mining industry in Australia is a major contributor to the national economy (Office of the Chief Economist, 2014). Over the past 10 years, this industry has dramatically increased in size. Nationally, production doubled between 1990 and 2012, resulting in approximately 42,000 jobs in Queensland alone (Australian Bureau of Statistics, 2012). While in recent times employment in mining industry has decreased by approximately 6.9% from 2013-2015 due to falling coal and iron ore prices, there are still more than 173,000 workers employed in the industry (Australian Bureau of Statistics, 2016a), with almost 40,000 of those jobs being based Queensland (Australian Bureau of Statistics, 2016b). In response to the mining boom, mine sites opted to hire workers from all parts of Australia, typically on a fly-in/fly/out (FIFO) or drive-in/drive-out (DIDO) basis (Infrastructure Planning and Natural Resources Committee, 2015). This employment arrangement has continued, despite the slight decrease in industry employment (Infrastructure Planning and Natural Resources Committee, 2015).

Trends indicate that a large proportion of workers reside in coastal communities, which have greater access to facilities, services, and generally less expensive housing compared to mining towns (Carrington & Hogg, 2011). The nature of shifts and the roster results in workers staying on site for a shift block and then commuting home on their rostered days off (RDO) (Infrastructure Planning and Natural Resources Committee, 2015). These employees average 12 hour workdays and on average commute approximately 240 kilometres home (Di Milia & Bowden, 2007). There are variations in the length of the shift block, e.g., 7 days on and 7 days off (Infrastructure Planning and Natural Resources Committee, 2015), but typically the structure of the shift block allows for workers to live two separate lives, a work life and a home life. For the duration of the shift, workers are housed in work camps. This industrial arrangement allows appropriately skilled workers from anywhere in Australia to be employed. The employer benefits from this arrangement by increasing their prospective resource pool (Cheshire, 2010), and the flexible working arrangements benefit the employees (Taylor & Simmonds, 2009).

In reality the itinerant nature of the workforce is a double-edged sword. Research indicates that there is short-term surge in the local community economy (Ivanova, Rolfe, Lockie, & Timmer, 2007); however, mine workers face risks that are no longer only associated with the performance of onsite duties, but now also associated with long-distance commuting in rural areas (Di Milia & Bowden, 2007). There are also risks to local communities, families, and individuals because of the itinerant lifestyle adopted by these workers (Carrington, Hogg, & McIntosh, 2011). Given the surge in prevalence of this lifestyle across a wide range of industries, research focusing on long-distance commuting and commuting following shiftwork is increasing (e.g., Di Milia, 2006; Di Milia et al., 2011; Sutherland, Chur-Hansen, & Winefield, 2016). However, a large proportion of the research on mine worker commuting concentrates on FIFO workers and the associated impact on communities resulting from their transience (e.g., Ivanova et al., 2007; Taylor & Simmonds, 2009). Most research articles, industry papers, and government reports limit the scope of research to the impacts resulting from the transience of the FIFO workforce on workers and their families (e.g., Beach, Brereton, & Cliff, 2003; Haslam McKenzie, 2010; Rolfe, 2011; Taylor & Simmonds, 2009). Also, there is more research that focuses on the flying workforce rather than the driving workforce. This limitation means that the DIDO workforce and the dangers associated with the *actual* driving journey, factors influencing the driving journey, and associated driving decisions, remain unexplored.

Research is yet to explore the overlap between individual and social influences and how these influences affect driving decisions in respect of commuting. The remote location of mine sites in Australia means that commuting following a shift block results in a number of driving-related risks resulting from work (e.g., fatigue resulting from length of shift) and the road (e.g., animals on the road) (Di Milia, 2006; Sheehan et al., 2008). These risks are amplified if, coupled with a long driving distance in remote areas, the worker leaves immediately at the end of their shift (Di Milia & Bowden, 2007). To the best of the writer's knowledge, research to date has not examined the reasons *why* workers engage in this risky behaviour, nor has an examination focused specifically on DIDO workers, the road safety risks and the *influences* on worker decisions to drive home immediately following long shift blocks. There is some research that examines DIDO or shift workers commuting in remote locations (e.g., Di Milia et al., 2011; Sutherland et al., 2016). Examination of this previous research highlights the risks associated with leaving a site immediately following shifts (Di Milia, 2006; Di Milia & Bowden, 2007; Di Milia et al., 2011). There is also considerable support for further research into commuting within this industry due to the statistics associated with road fatalities. In a 2010-11 report regarding work-related fatalities in Australia, the highest commuter fatality rate resulting from driving-related commuting crashes was recorded in the mining industry. This represents 2.44 commuter deaths per 100,000 workers (Safe Work Australia, 2012).

There is a need to investigate the influences impacting workers' decisions to drive extended distances home from the mine site, immediately after shift blocks. The limited previous research indicates the need for an exploration of workers' decisions. With a Queensland Australia focus, the current program of research explores the relationships between influences on individual decisions regarding commuting home from work immediately after a shift block, in an attempt to identify opportunities for interventions that might ameliorate the likelihood of adverse driving outcomes among DIDO workers. More specifically, this research addresses the broad research question of *why do some workers leave the worksite immediately after their shift block to drive home?*

1.3 THE RESEARCH CONTEXT

This research was undertaken in the Australian coal mining industry, with a focus on the state of Queensland. The research was conducted at one site based in the Bowen Basin. This mine site employs approximately 600 staff on a DIDO basis. In order to protect the interests of the organisation, the precise location is not revealed. The variation in state legislative requirements in the Australian mining industry makes it important to clarify the research context. For example, in New South Wales, Western Australia and Queensland, mining health and safety falls within the ambit of state specific legislation (Gunningham, 2006). Comparatively, in all other states, the mining industry is regulated by the *Work Health and Safety Act (2011)*. Whilst the current research generally discusses other jurisdictions to compare and contrast common issues facing the mining industry in Australia, the main focus is the Queensland mining industry and the issues faced by Queensland-based organisations. The focus on Queensland is primarily due to project resource limitations.

1.4 RATIONALE FOR THE RESEARCH

In February 2011, industrial scrutiny about driving-related commuting intensified following the Queensland Coronial Inquest into the road deaths of three people, resulting from two separate road crashes. The inquest was primarily commissioned to investigate commuting of mine workers to and from mine sites in Queensland, Australia and to what extent work-related fatigue contributed to these road crashes. The inquest demonstrated that both drivers in the two separate crashes had recently finished 12-hour shifts at nearby mine sites and were travelling to their residence some distance away at the time of the crashes. The findings of the inquest discussed driver inattention and fatigue, as well as the condition of the road. The Coroner outlined the complex and multifaceted nature of driver fatigue as an issue within this workforce. The recommendations of the inquest specifically highlighted public policy issues associated with (1) organisations running 24 hour a day operations; (2) driver fatigue; (3) the resulting implications of a *travelling* workforce; and (4) the lengthy commutes adopted by some mine workers (Coroner of Queensland, 2011). The implications of the findings handed down by Coroner, Annette Hennessy, are far reaching. She noted, "the general import of the evidence from Queensland Transport and Queensland Police Service was that the proportion of fatigue-related crashes in Central Region (an area including the Bowen Basin with significant coal mining activities) is significant in comparison to the rest of the State" (Coroner of Queensland, 2011: 32).

The motivation behind the current program of research stemmed from the recommendations of the inquest. However, anecdotal evidence from industry sources suggests that there is concern with the means through which their workers are making their way to and from work. Coroner Hennessy reported, "the evidence of the Police at Dysart ... paints a concerning picture of many fatigued drivers at the termination of shift driving long distances and long hours in a state of fatigue potentially putting themselves and other road users at risk' (Coroner of Queensland, 2011: 32). The inquiry had significant implications for the scope of an employer's responsibility, specifically in respect to the recommendations to increase fatigue countermeasures and fatigue awareness training. There were also recommendations associated with the implementation of a recognised standard of fatigue management to provide clearer parameters and guidance to workers (Coroner of Queensland, 2011). Further investigation of this issue and discussion with industry leaders revealed that, while some companies are proactive in responding to this issue, responses are relatively ad hoc.

1.5 RESEARCH AIMS AND OBJECTIVES

It is important to understand the factors contributing to the problem of mine workers leaving immediately after their shift block in order to answer the broader research question of *why these workers engage in this behaviour*? Therefore, the aim of this program of research was to examine the key influences affecting workers' decisions to drive home from the worksite immediately after a shift block. Understanding why this behaviour occurs is then used to identify opportunities for interventions for consideration by industry. In order to achieve this aim, the program of research had four objectives:

1. examine the costs of motor vehicle crashes associated with the mining industry workforce in Queensland, Australia;
2. explore the parameters of legislative requirements in respect to commuting within a Queensland and Australian mining context;
3. explore and examine the relationships of individual, social, organisational, and situational influences on worker driving-related commuting behaviour and how these key influences impact workers' decisions to drive home immediately following a shift block; and
4. identify opportunities for interventions regarding driving home from site immediately following a shift block.

Chapter 2 provides an overview of the literature surrounding this issue. Drawing on this review, a series of research questions are presented in order to address these research objectives. Chapter 3 outlines the research design adopted to address the objectives presented here. Each objective is addressed through overall research questions and study-specific research questions. The structure of these questions is described further in Chapter 3.

1.6 SIGNIFICANCE AND SCOPE OF RESEARCH PROGRAM

The context of mine workers' commuting decisions is an important area of study. As previously identified, industry, government, and academics have identified the need for further understanding of the issue of mine workers' commuting behaviour prior to and following shift blocks. Undertaking research on the driving-related commuting issues is justified given the rate of commuter-related fatalities reported by Safe Work Australia and the two road crashes that were the subject of the Coronial Inquiry in 2011.

The current program of research is one of the few empirical studies to thoroughly analyse driving relating to the journey home from work following shifts and, to the writer's knowledge, is the first to analyse influences on worker driving-related commuting behaviour from major industrial work sites (e.g., mining, construction, resources) in regional/rural areas. Previous research, from a variety of contexts, examines frequency and prevalence of incidents or distance travelled, with the goal being to empirically examine the significance of fatigue-related crashes or events (e.g., Di Milia & Bowden, 2007; Scott et al., 2007). However, to the writer's knowledge, no research has focused on DIDO workers, the road safety risks, and the *influences* on workers' decisions to drive significant distances following long shift blocks.

The current research provides valuable insight into the extent and severity of the problem, but most importantly it identifies the key influences that shape decisions to drive home from work immediately following a shift block. A key objective of the current research is to propose opportunities for interventions to provide industry with a solid research base for responding to the issue of commuting home following shift blocks. Identifying these opportunities for interventions provides industry with the ability to respond to the issue of driving-related commuting immediately following shifts, using a targeted approach.

Arguably, there are other industries which lend themselves to research of this nature. The key focus on the mining industry centres around the significant growth of this industry over the past decade, the reduction in construction of mining communities to house mine employees, the significant distances travelled by these workers, and finally, the laborious nature of the work contributing to fatigue-related issues (which is subject to much research in the road safety domain). While it is noted that other shift-work-dominant industries (e.g., medicine, hospitality, and construction) also provide a suitable context for this research, the mining industry provides a research context where the risks to these workers are intensified by the significant number of kilometres travelled, the typical duration of the shift, and the remote location of worksites. This research provides the opportunity to guide future research to investigate commuting behaviours associated with other industries potentially affected by this driving-related commuting issue (e.g., medical professions, construction workers or emergency services personnel).

1.7 THESIS OUTLINE

The current program of research was conducted through the use of four complementary studies. The results of these studies are presented with background information, discussion, and the resulting practical and theoretical implications. This thesis comprises the following:

- Chapter 2 discusses the literature relevant to this area of study and highlights how the coal industry in Queensland, Australia has changed over the past 20 years. This chapter provides further context to the problem of commuting in the mining industry and discusses theoretical frameworks and how they are relevant to this program of research. This chapter provides an overview of the research questions addressed throughout the thesis.
- Chapter 3 explains the research design and discusses the mixed method approach. This chapter also provides a rationale for each study adopted within the research program.

- Chapter 4 provides an overview of workers' compensation journey claim data for crashes associated with the mining industry in Queensland, from 1 July 2009 until 30 June 2013. These data reveal crash circumstances and highlight one financial impact associated with these crashes through examination of compensation costs incurred by industry.
- Chapter 5 examines the current legislative parameters and industry-based guidelines employed by mining operations to promote journey management. This chapter provides a thorough critical review of relevant legislative and policy documents.
- Chapter 6 further explores the legislative parameters and organisational requirements through a site safety expert focus group. This study further reviews the information presented in the critical review and provides a brief overview of the problem from the perspective of safety professionals. The findings of the focus group were used to guide the development of further studies in the research program.
- Chapter 7 describes the relationships of key influences (individual, social, organisational, situational) and how these key influences impact workers' decisions to drive home immediately following shift blocks. These key influences are highlighted through a series of qualitative in-depth interviews (N = 37) and thematic analysis of the accounts of interviewed workers. This chapter confirms the suitability of the Theory of Planned Behaviour (TPB) as an appropriate framework to statistically examine and explain the immediacy of driving-related commuting.
- Chapter 8 provides an overview and rationale for the survey items and constructs tested in Study 4 (Chapter 9, Chapter 10, and Chapter 11). This chapter also presents an overview of the participants and overall method used for Study 4.

- Chapter 9 statistically explores the relationships of organisational and situational factors on commuting behaviour using the factors identified in Study 1, Study 2, and Study 3 of the research program.
- Chapter 10 statistically explores the individual, social, situational and organisational influences on commuting behaviour in line with the TPB. This chapter presents and tests a series of hypotheses developed throughout the mixed method, iterative approach adopted within the research program.
- Chapter 11 explores behavioural, normative, and control beliefs through a critical beliefs analysis. This analysis provides direction for future research and identifies opportunities for interventions to address the limitations associated with organisational policies considered throughout the thesis, particularly in Chapter 5.
- Chapter 12 provides an overview of the studies undertaken and summarises the key findings. This chapter canvasses the limitations of the research and makes recommendations and identifies opportunities for interventions.

1.8 CHAPTER SUMMARY

This chapter has provided a brief overview of this program of research. The background of the mining industry in Queensland and Australia was provided and the research context identified. The current research effort is one of the few empirical studies to thoroughly analyse driving relating to the journey home from work following shift, and is the first to analyse influences on worker driving-related commuting behaviour. Chapter 1 provided an overview of the method through which these influences are examined and how the results are presented within this thesis.

The next chapter will present a review of relevant literature relating to the reasons why mine workers engage in DIDO, as well as provide an understanding of the issues associated with workers travelling significant distances following shift blocks. Chapter 2 will further discuss the mining industry in Queensland and Australia and the identifiable influences based on an examination of previous literature. Current research gaps and limitations are presented, along with the development of the research questions which guided the direction of the research program. Finally, Chapter 2 examines theoretical perspectives.

Chapter 2: Literature Review

2.1 INTRODUCTION

Chapter 2 provides an overview of the literature on the reasons why mine workers engage in DIDO work. The primary purpose of the chapter is to outline the characteristics of long distance commuting in the Australian mining industry, individual pressures faced by workers, as well as organisational and industrial influences on worker commuting behaviours. This chapter begins with an historical background about the progression of the Australian mining industry over the past 20 years (Section 2.2) and how the changes in the mining industry have resulted in a *travelling workforce* (Section 2.3). The influences on workers' commuting decisions, in respect of their continuation in this form of employment, as well as their actual commuting behaviour, are then discussed. Firstly, individual pressures associated with family, wages, social integration, and housing are discussed in Section 2.4. Journey characteristics, including a brief overview about exposure, vehicle crash statistics and environmental pressures are considered (Section 2.5). These journey characteristics highlight two key risk factors of long distance commuting in an Australian environment; fatigue-related risks and risks associated with rural and remote driving. Organisational and industrial influences are discussed, specifically in relation to commuting decisions, rostering and the influence of the organisational structure (Section 2.6). The research gaps and limitations are then presented in order to justify the research objectives, and questions are presented in Section 2.7 and Section 2.8, respectively. Various theoretical perspectives relating to road and organisational safety are reviewed in Section 2.9. This section provides the initial justification for the application of the TPB to this research. Finally, Section 2.10 provides a chapter summary.

2.2 HISTORICAL BACKGROUND

Over the years, Australia has been subjected to peaks and troughs associated with the mining industry and the global demand for commodities like coal. The chronological growth of the mining industry identifies the 1960s as the decade that Australia became a key player in the global market (Carrington et al., 2011). Australia is now a key exporter and producer of commodities such as iron ore, coal, bauxite and copper (Connolly & Orsmond, 2011). In 2015-16, minerals and fuels made up 41% of Australian exports, with iron ore and coal contributing to nearly two-thirds of the total mineral and fuels export (Thirlwell, 2017). Over the past decade, the mining industry in Australia has experienced significant growth due to growing economies and demand from Asia, and significant advancements in technologies which streamline production processes and improve transportation and logistics (Carrington et al., 2011). Between 2000 and 2014, the value of Australian mining exports increased by $136,745 million to $194,578 million (Office of the Chief Economist, 2014). There has been speculation that a downturn is likely; however, Treasury estimates in early 2011 suggest that the growth will continue until at least 2025 (Carrington et al., 2011: 336). This proposition is supported by recent estimates which predict Australian mining export earnings will reach $215,000 million by 2018, representing a 32 per cent growth on 2016 earnings (Office of the Chief Economist, 2017).

This considerable growth resulted in ever increasing production demands. During the 2016/17 Australian financial year, the coal industry produced 448 mega tonnes of black saleable coal (Office of the Chief Economist, 2017). Whilst technologies have streamlined end-to-end processes making the production of such large volumes viable, companies have responded to demand by increasing the duration of shifts and increasing production to 24 hours a day. The increase in production has resulted in a demand for skilled and unskilled mine workers. Between 2000 and 2014, Australian employment in the mining industry grew by 42% and now the industry employs approximately 241,000 people (Office of the Chief Economist, 2017). The increasing labour demand has predominately been realised in resource-rich states of Australia such as Queensland, Western Australia, and the Northern Territory (Connolly & Orsmond, 2011; Office of the Chief Economist, 2014). It is usual for mine sites in Australia to be located in remote areas. As such, workers are sourced from major coastal centres, sometimes hundreds of kilometres away (Di Milia & Bowden, 2007).

In the past, Australian mining towns were developed in order to cater for the influx of workers in these remote locations. However, there has been a trend away from this practice, with the last of the mining towns developed in the late 1980s (Storey, 2001). Since then, there has been a trend to engage a non-residential workforce to meet the demand created by the specific development stages and ongoing production of mine sites (Australian Bureau of Statistics, 2000). In order to attract workers to these remote locations, workers receive above average salaries compared to skilled and non-skilled workers in other industries (Connolly & Orsmond, 2011). As a result, key mining regions around Australia have seen an overall increase in employment levels and demand for this work. As at February 2017, employment in the mining industry increased by approximately 7% compared to the previous year, reaching 241,000 workers (Office of the Chief Economist, 2017). Approximately 40,000 of these workers are engaged in coal mining (Australian Bureau of Statistics, 2016a). Queensland is a large coal producer, with 54 coal mine sites currently operating in the state (Department of Natural Resources and Mines, 2016).

There is an increased trend toward workers maintaining a permanent residence in larger centres and commuting to and from a mine site. Research associates this trend with (1) increased mobility of the workforce; (2) block shift work patterns (i.e., 7 days on and 7 days off); and (3) lifestyle and social factors (Rolfe, Miles, Lockie, & Ivanova, 2007). The adoption of either DIDO or FIFO workforces is dependent on the proximity of the site to airports and larger coastal towns. In order to cater for the transience of the workforce, workers are typically provided with accommodation in work camps. The demountable cabins or "dongas" typically contain basic living facilities, common eating and laundry areas; recreation areas are usually located close by. Workers use these facilities while on-site and return to their permanent residences during their rostered time off. Industry bodies and unions summarise the key factors contributing to the phenomenon of the travelling workforce as predominantly associated with the rural or remote location of the mine site (Construction Forestry Mining Energy Union Queensland, 2011).

The location of the site also indicates the common commuting method. For example, north Western Australian sites, which are located in very remote areas, operate on a FIFO basis. Most central Queensland sites, such as sites in the Bowen Basin, operate on a DIDO basis or a combination or DIDO and FIFO. DIDO research suggests an average trip for a DIDO worker is approximately 200 kilometres one-way (Di Milia & Bowden, 2007). These trips usually follow long, consecutive shifts. DIDO workers are sometimes subjected to shift lengths of up to 14 hours; typically on a 24 hours a day, 7 days a week roster (Di Milia & Bowden, 2007). Di Milia & Bowden (2007) conducted a survey which investigated the typical commuting behaviour of DIDO mine workers in the Bowen Basin area. They reported that 63% of mine employees surveyed averaged 12 hour shifts. In their research, these authors reported that on average workers were commuting up to 2 hours one way. Therefore, with an average shift length of between 10 and 12 hours and an average trip time of 2 hours, these DIDO workers are potentially exposing themselves to a 14 to 16 hour day.

Despite the inherent dangers, the itinerant nature of the workforce is beneficial for both the employee and employer. Mining companies benefit from accessing labour from a larger pool, while mine employees benefit primarily from the ability to remain in a city or large town with greater access to facilities and services. Furthermore, the rosters associated with DIDO work result in long periods of rostered time away from work. However, the itinerant nature of the mining workforce is a double-edged sword. While workers receive above average salaries for working in these remote locations, they spend little daily time with their family and friends.

2.2.1 Shifts and shift blocks in the mining industry

Most mine sites in Australia operate 24 hours a day, 7 days a week; therefore, the mining industry employs workers to perform both day and night shifts. There are occupations that do not perform shift work and also occupations which are expected to perform longer hours than others. Previous research examining shift work highlights the risks associated with extended shifts (i.e., 12 hours or more) (Baulk, Fletcher, Kandelaars, Dawson, & Roach, 2009), and the risks to the worker associated with isolation (Taylor & Simmonds, 2009). However, mine workers accept the risks associated with these shifts and rosters as an opportunity for a better lifestyle (Misan & Rudnik, 2015). There are a number of different rosters in operation around the country. The time on site is referred to as a shift block[1]. Following these shifts blocks, workers usually travel to their home residence.

In Queensland, Australia, a recent review of long distance commuting practices in regional Queensland detailed 10 different shift blocks (Infrastructure Planning and Natural Resources Committee, 2015). These rosters include:

- 3 days on, 1 day off;
- 3 nights on, 5 days off;
- 4 days on, 5 days off;
- 5 days on, 4 days off;
- 28 days on, 7 days off;
- 14 days on, 7 days off;
- 8 days on, 6 days off;
- 7 days on, 7 days off;
- 4 weeks on, 1 week off; and
- 2 weeks on, 2 weeks off.

'Swing rosters' allow for even distribution of night and day shifts across employees, with alternate night and day shifts for each shift block. Alternatively, shifts are operated using a mid-roster change. This type of rostering means that the

[1] This thesis uses shift block, end of shift or following shifts interchangeably. These terms should be taken to mean at the conclusion of a block of consecutive shifts on site.

worker starts the shift block with either a day or night shift, and then switches to the other shift type part way through the shift block.

2.3 IDENTIFIED INFLUENCES OF THE TRAVELLING WORKFORCE

The above discussion of the history of mining in Australia and how the industry supports a large number of workers engaging in DIDO work highlights three key factors, as indicated in *Figure 2-1*. In order to understand the decisions made by these workers in respect of their commute home and when they start the commute following their shift, the next sections will further discuss the key influences on the travelling workforce generally. The influences presented in the figure below describe all elements of a worker's journey and engagement in a DIDO role. As a consequence of limited previous research and no existing model to investigate the immediacy of the commuting decision within the mining industry, the key influences identified in *Figure 2-1* provide a framework for the investigation of influences affecting workers' decisions to drive home immediately after a shift block throughout this research program. The factors presented in the figure below are refined iteratively throughout the research program. Individual factors faced by workers will be examined first, then the characteristics of the journey from remote mine sites to larger coastal towns (Section 2.5). The influences of the organisation on commuting within the mining industry will be considered in Section 2.6.

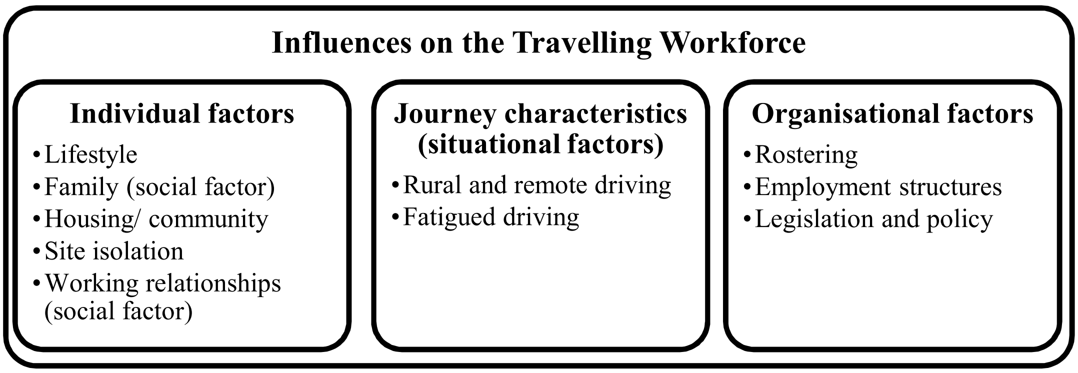

Figure 2-1: **Identified influences on the travelling workforce**

2.4 INDIVIDUAL FACTORS

Research examining the mining industry in Australia is increasing, particularly given the growth of the industry. Research has focused on the pressures faced by individuals who engage in DIDO or FIFO type work. However, the various factors have been investigated distinctly, concentrating predominantly on influences external to the individual as a result of engaging in remote work, rather than engaging in the commute itself. For example, current research efforts focus on (1) social integration (Carrington & Pereira, 2014); (2) demographic change in mining regions (Hajkowicz, Heyenga, & Moffat, 2011); (3) family impacts (Taylor & Simmonds, 2009); (4) housing and facilities in the community (Ivanova & Rolfe, 2011); (5) the impact on other industries in the community (Cheshire, 2010; Houghton, 1993); and (6) the local economy (Carrington & Hogg, 2011; Carrington et al., 2011; Houghton, 1993; Ivanova et al., 2007; Petkova, Lockie, Rolfe, & Ivanova, 2009). It is not proposed that the impact of these external influences be discounted, as each factor contributes to understanding of a broad and complex issue. However, these influences need to be considered from the perspective of the commuting decisions of these workers and the pressures faced by these workers to commute significant distances immediately following shifts.

In order to develop an understanding of the immediacy of the commuting decision, the impact of these workers continuing to work and commute in this industry should be first examined. A review of the literature on mine workers in the Australian mining industry reveals four areas of interest to this research program: (1) the impact long-distance commuting has on the family unit; (2) how workers' decisions to commute are influenced by the local facilities and housing on offer; (3) how isolated the site is from the workers' community, friends and family; and (4) the influence of colleagues on workers' commuting decisions. These factors are discussed in the following sections.

2.4.1 Lifestyle of the mining workforce

Recent research has identified that a factor in the popularity of engaging in this type of work is associated with the shift block rostering offered to workers. Working rosters allocated in this manner results in the worker committing to long periods at work to enable a significant break at the end of shift. Lifestyle rostering is a key motivator for engaging in and maintaining work in the mining industry in Australia (Misan & Rudnik, 2015).

2.4.2 Family impact

Family impact is a major consideration of research examining the mining industry, particularly when considering the impacts of mining on workers and the community (Carrington & Pereira, 2014). From the perspective of DIDO workers, the nature of their work means that they are away from home for extended periods of time and upon return there is an expectation they will transition seamlessly back into family life (Taylor & Simmonds, 2009). Research focusing on this commuting workforce suggests that workers opt for extended shifts to increase their rostered days-off to make their commute viable, as well as to make the most of their time off when they return home (Di Milia & Bowden, 2007).

While research has typically investigated the FIFO worker and the impact of working non-standard hours on workers and their families, it can be argued that the pressures and impacts faced by DIDO workers are comparable. Research examining FIFO workers and their families has found a considerable amount of the stress faced by these workers is due to poor communication between partners, inequality in respect of household responsibilities, limited time spent as a family unit, and the sometimes difficult transition between work and home life (Taylor & Simmonds, 2009). These impacts are contingent on factors such as family life cycle, involvement with children, experience with FIFO/DIDO work, length of shift, and work status of partner (Taylor & Simmonds, 2009).

2.4.3 Housing, facilities and the community

There is a significant amount of research on the influence of the community environment on the location of the family home (Haslam McKenzie, 2010). Research suggests that in areas such as Queensland's Bowen Basin there have been pressures associated with general living due to the rapid growth of the mining industry (Petkova et al., 2009). Known as 'Dutch Disease', the rapid growth of an industry leads to adverse economic and social consequences by increasing factors in other sectors (e.g., cost of labour and increasing housing prices) (Rolfe et al., 2007). Uneven growth patterns are observed given the inability for those on lower incomes to find affordable housing which forces that labour pool to seek employment elsewhere, further decreasing the availability of affordable labour. Overall, the benefits resulting from the growth are outweighed by the constraints placed on other industries operating in that location (Rolfe et al., 2007).

The mining communities in the Bowen Basin have experienced problems such as housing shortages and high rental prices, limited facilities and services for families, limited social opportunities, constraints on infrastructure, and limited work opportunities for spouses (Ivanova et al., 2007). The rapid growth of the mining industry over the past decade has had impacts on local business and local employment opportunities. Employment opportunities outside the mining industry are scarce and the availability of services in local mining communities is limited. Therefore, those who do not work in the mining industry (such as spouses) do not benefit from the boom (Carrington et al., 2011). In addition to employment opportunities, residents feel that there are negative impacts on local business and economy, local services, amenities, and infrastructure (Carrington & Pereira, 2011). As such, even if these workers would prefer to relocate closer to the site at which they work, it is not usually viable to do so. Previous research demonstrates that worker perceptions of local services and infrastructure in mining communities is generally poor, resulting in workers opting for coastal residences (Carrington & Pereira, 2014). Therefore, there is a tendency for these workers to live in larger communities to ensure access to required facilities, jobs for other family members and desirable housing.

While the issues associated with the cost of living in these mining communities are subsiding, worker preference remains to locate their families in larger communities with greater access to facilities and better infrastructure (Haslam McKenzie, 2010). The preference of a family unit to be located close to facilities may change over time due to family lifecycles. For example, a family with young children may need to be located in a large town for education. Older workers may not have the same requirements, and therefore may be content to live closer to the site in a smaller community (Rolfe, 2011).

Research examining the extent to which workers are opting to commute long distances for work demonstrates that approximately 40% of mining workers in Queensland reside in larger coastal communities (Rolfe, 2011; Rolfe et al., 2007). While there are some limitations to these data, they serve to demonstrate that it is the preference of a large proportion of the workforce to live in larger communities. This preference further highlights the link between engaging in commuting for work while maintaining the ideal lifestyle for their family. Therefore, the increasing trend toward the adoption of this type of workforce has created sustainability issues for local mining communities, which forces this workforce further into an itinerant lifestyle.

2.4.4 Site isolation/mental health

Mine workers on Australian sites tend to be isolated, given the sites are typically in remote areas. Working and staying in the same place for a shift block has led to research discussing the adverse effects on communities, families, and individuals (Carrington & Pereira, 2014; Taylor & Simmonds, 2009). Most commonly discussed is the mental health impact on these workers, given the location of the site and the extensive distance between worker and family (McLean, 2012; Taylor & Simmonds, 2009). While generally these studies investigate FIFO workers, the key findings are typically associated with isolation from families and the consequential impacts (McLean, 2012), which results in an eagerness to get home as soon as possible to make the most of the time off (Houghton, 1993). The time at home acts as an outlet and allows these workers to forget about work (McLean, 2012).

2.4.5 Working relationships in the mining industry

Working relationships in the mining industry are unique considering the significant amount of time that these workers spend at work with their colleagues. Research outlines that mine sites typically have a strong family-type culture (Misan & Rudnik, 2015). Each worker understands the pressures associated with working in the mining industry. Due to common work goals and circumstances, colleagues become quite close and these relationships mean that everyone looks out for each other (Misan & Rudnik, 2015). Anecdotally, these relationships result in carpooling and other risk mitigation behaviours in respect to commuting.

2.5 JOURNEY CHARACTERISTICS OF THE TRAVELLING WORKFORCE

The term *'the travelling workforce'* summarises the nature of the labour engaged in this industry. Previous research investigating the issue of driving following long shifts and shift work concentrates on: (1) the frequency of motor vehicle crashes and near misses (Barger et al., 2005; Di Milia, 2006; Lee et al., 2016); (2) fatigue-related risks (Di Milia & Bowden, 2007; Scott et al., 2007); (3) the demographics of the work force and their influence on frequency and mode of commuting, as well as distance travelled (Petkova et al., 2009; Rolfe et al., 2007); (4) the association between key demographic variables and fatigue; (5) the influence of working arrangements; (6) commute time; (7) personality characteristics; and (8) circadian chronotype on crash risk (Di Milia et al., 2011). There is little doubt that workers travelling these considerable distances following shifts, coupled with extended shift lengths, results in a fatigue-related risk. Two key risks will be discussed in detail in the following section: (1) fatigue-related risks; and (2) rural and remote driving. These factors are also referred to as situational factors throughout the thesis.

2.5.1 Fatigued driving

Fatigue has been identified as a major issue in consideration of commuting home from work following shift blocks (Di Milia, 2006). While this consideration has been identified by organisations, the concentration on the relationship of fatigue to the incidents subject to the Coronial Inquiry mentioned above, remains one of the primary reasons fatigue has come to the fore recently. In road safety literature, there is extensive evidence of the contribution of fatigue to traffic crashes across various settings, such as the heavy vehicle industry (Williamson et al., 2011), as well as across non-professional drivers (Philip et al., 2005). More specifically, fatigue and sleepiness contribute to approximately 15% of fatal road crashes in Australia (Armstrong, Obst, Banks, & Smith, 2010). However, it is believed that the incidence of fatigue-related motor vehicle crashes is under-reported due to reliance on self-reported data (Brown, 1994; Di Milia et al., 2011). As a result of these reporting methods, fatigue-related crash statistics usually report a large range. For example, a study on heavy vehicle crashes attributable to fatigue suggested that fatigue could be a contributor to a crash in 10% to 60% of cases (Dawson, Searle, & Paterson, 2014). The variation in the data is likely to be attributable to the reporting of first responders and the reliance on self-reported data, given limitations in the detection and assessment of fatigue in instances where crashes or near-misses have occurred (Dawson et al., 2014).

While technologies to assess and detect fatigue have improved, the objectivity of these tests has been questioned. More recent research has provided an overview of the various types of assessment techniques and concluded that techniques currently available are still in the developmental stage (Dawson et al., 2014). As such, drivers are required to self-assess their fatigue level and make judgements about driving ability without a clear definition or objective measure to assist in assessing their ability to drive safely. However, research indicates that over 80% of people continue to drive once they have noticed they are ‘sleepy’ (Armstrong, Obst, Livingstone, & Haworth, 2009).

Fatigue or sleepiness[2] are contested terms within the literature and are not considered interchangeable. Fatigue typically refers to time-on-task. Comparatively, sleepiness relates to how hard it is to stay awake while completing a task, such as driving or working (Connor, Whitlock, Norton, & Jackson, 2001; Di Milia, 2006). The effect of fatigue has been frequently discussed in the context of shift work, working extended hours and in labour-oriented roles (Dawson & Fletcher, 2001). There are two types of fatigue: firstly, fatigue related to quality and quantity of sleep and circadian rhythms. This fatigue is influenced by quality and quantity of sleep and wakefulness, as well as the time of day (Dawson et al., 2014; Williamson et al., 2011). The second type of fatigue is that associated with the type of task being engaged in, or time-on-task. Both types are relevant for this discussion given the type of shifts undertaken by these workers, which typically results in a variation in sleeping patterns from week to week. Furthermore, given the monotonous nature of the driving and the significant distances travelled, time-on-task related fatigue is also an important consideration.

Drivers are sleepier at the end of shift, particularly following night shifts (Di Milia, Rogers, & Åkerstedt, 2012; Horne & Reyner, 1999). Hence mine workers are particularly vulnerable given the length of shift performed and the time of the day spent driving; those engaging in shift work, particularly night shifts, demonstrate decreased driving performance and as a result have an increased risk of being involved in a crash (Åkerstedt, Peters, Anund, & Kecklund, 2005; Di Milia et al., 2012). Research frequently reveals that fatigue resulting from a deficiency in sleep results in slower reaction times, and impaired mental and driving performance (Philip et al., 2005). A well-rested driver can manage a long distance drive with no noticeable decrease in performance. By comparison, a driver with sleep deprivation

[2] This thesis uses the term fatigue for consistency with mining industry fatigue management policies.

(i.e., two hours' sleep) demonstrates a noticeable decrease in their performance, with the performance becoming worse during the course of the day, in line with the natural troughs in performance associated with the circadian rhythm (Philip et al., 2005). The literature indicates that there is a relationship between high levels of sleepiness and adverse outcomes on road, including crashes and near misses (Dawson & Reid, 1997).

These adverse outcomes are particularly notable for long distance driving and those engaging in shift work (Di Milia, 2006; Lee et al., 2016). Shift work and the number of consecutive shifts is also a significant predictor of near misses, even when only driving 20 minutes (Di Milia et al., 2011; Dorrian et al., 2008). Research examining shift workers driving on rural roads in Queensland following shifts and shift blocks found that over one-fifth of those surveyed (N=48) described falling asleep at the wheel within the past twelve months when travelling to or from the worksite (Di Milia & Bowden, 2007). Further, this research indicated that some workers are travelling up to 655 kilometres. While the sample size in Di Milia and Bowden's research is small, the results highlight the significant distances being travelled and the high levels of exposure to a fatigue-related crash. It also indicates the potential catastrophic outcomes, with respondents associating a 'near-miss' to outcomes such as running off the road, crossing the centre line, and braking for no reason (Di Milia & Bowden, 2007; Di Milia et al., 2012). Following night shifts, simulator studies indicate that on average, major incidents occur 83 minutes after commencing the driving task (Åkerstedt et al., 2005; Di Milia et al., 2012). This risk compounds toward the end of the night shift block, given a 'build up' of fatigue, particularly following a 12 hour shift (Di Milia, 2006; Tucker, Barton, & Folkard, 1996), which is a standard shift length in the mining industry in Australia.

These adverse outcomes are evident in simulation studies whereby drivers reporting a Karolinska Sleepiness Scale (KSS) of seven or more drove for an average of 43 minutes before being involved in a major incident[3] (Reyner & Horne, 1998). A KSS score of seven means that the respondent reports being sleepy, but experiences no effort to remain awake (Åkerstedt et al., 2005). Research has described that following 17 hours of wakefulness, task performance is comparable to performance experienced at a 0.05% blood alcohol concentration (BAC) (Dawson & Reid, 1997). As such, given the length of shifts and the potential drive home, it is suggested that it is highly likely that these workers would achieve a KSS score as described above, if not higher. Given the research discussed above, it is important to determine the risks associated with commuting for all mine workers, considering the typically remote location of the site, the length of shifts and the frequency of engaging in night shifts.

2.5.1.1 Time of day driving

Mining rosters typically function around 12 hour days. Shifts generally commence at either 6am for day shift or 6pm for night shift (Di Milia, 2006). Shift lengths are determined by operational requirements; however, legislation in Queensland enables rostered shifts to be 12 hours in length, up to a maximum of 14 hours for urgent operational demands (see *Coal Mining Safety and Health Act (1999)(QLD)*). Based on a 12 hour shift, should these workers leave immediately following a shift, driving will commence around 7am or 7pm.

Research indicates that high risk driving periods are typically associated with peak hour traffic, with peaks of distribution occurring around 9am and 5pm (S. S. Smith, Armstrong, & Steinhardt, 2008). However, driving at night also has risk factors associated with impaired vision, alcohol, driver inexperience, and fatigue (S. S. Smith et al., 2008). Driving during the early morning hours increases the risk of a crash by five times (Åkerstedt & Kecklund, 2001).

[3]In these simulator studies, major incidents were described as two and four wheels outside the lane markings (Åkerstedt et al., 2005).

2.5.2 Rural and remote driving

Driving in rural and remote locations has been identified as risky (Siskind, Steinhardt, Sheehan, O'Connor, & Hanks, 2011). The remote location of the majority of mine sites in Queensland and across Australia makes the consideration of rural and remote driving a central issue of this research. Driving on rural and remote roads poses unique risks, associated predominantly with wildlife or livestock on the road, and the long, monotonous nature of the drive. Wildlife such as kangaroos on the road are usually more prevalent at dawn and dusk (Rowden, Steinhardt, & Sheehan, 2008), which coincides with the conclusion of shift as detailed above. Further, in remote Australia, there are limited rest stops with facilities.

Research has found that crashes occurring in rural and remote areas are likely to result in serious or catastrophic injuries, if not death (Siskind et al., 2011). The increased likelihood of a catastrophic outcome in rural and remote areas can be attributed to driver behaviour, as well as the environment (Sticher, 2005). The key contributors to the risks associated with driving in rural and remote areas are: (1) road design and conditions; (2) fatigue; (3) behavioural factors (i.e., failure to wear a seatbelt, driving under the influence of alcohol and speeding); and (4) distraction/inattention (Sheehan et al., 2008; Siskind et al., 2011). Furthermore, higher speed zones are usual in rural areas (Blackman, Steinhardt, & Veitch, 2009). Research has reported a significant increase in the percentage of speeding-related incidents occurring in very remote areas (Steinhardt, Sheehan, & Siskind, 2009). Two of the four factors outlined above are associated with poor sleeping patterns/habits (i.e., fatigue, and distraction/inattention), demonstrating that "human behaviours play a far greater role in the severity of traffic crashes than do environmental, vehicle or road factors" (Siskind et al., 2011, p. 1088).

A recent study examining driver inattention using data from the Australian National Crash In-depth Study found that approximately 58% of crashes are related to some type of distracted driving (Beanland, Fitzharris, Young, & Lenné, 2013). In rural and remote areas, crashes resulting in serious injuries are attributed to distraction/inattention, with estimates being as high as 75% (Siskind et al., 2011). Research examining the factors which contributed to traffic crashes in rural and remote regions of Queensland reported that crash involvement was generally consistent across ages, with a higher representation of males than females (Siskind et al., 2011).

The risks associated with rural and remote driving are thus split between environmental factors and driver behaviour. Two factors of rural and remote driving that are relevant to mine workers' commuting are associated with the road environment: animals on the road and monotonous driving.

2.5.2.1 Animals – wildlife and livestock

Collisions between animals and vehicles sometimes result in catastrophic injuries, and usually in damage to property (Rowden et al., 2008). Risk factors are particularly prominent in rural and remote locations, where Australian mine sites are located. In more remote areas there tends to be more wildlife and livestock, drawn to the roadside for feeding, particularly during drought periods, certain seasons and at dawn and dusk (Rowden et al., 2008). A rural and remote road safety study focusing on North Queensland reported 5.5% of all serious crashes involved collisions with an animal or swerving to avoid an animal on the road, with almost 60% of these incidents occurring during night hours (Rowden et al., 2008). Furthermore, the rural and remote road safety study described a higher involvement of motorcycle riders (52%) compared to cars (Rowden et al., 2008).

2.5.2.2 Monotonous journey

Monotonous road environments, such as rural and remote locations in regional Australia, result in higher levels of fatigue symptoms (Michael, 2009), states of reduced vigilance (Schmidt et al., 2007), and poor reaction to unexpected traffic events (Schmidt et al., 2007). From the perspective of rural and remote driving, it is suggested that fatigue and inattention are typically associated with the significant distances travelled and the monotony of driving. Research finds fatigue is a common factor, as well as over-familiarity with the road which leads to complacency (Sticher, 2005). Beanland et al. (2013) applied criteria developed by Regan et al. (2011) to assess the contribution of distraction and inattention to a representative sample of Australian serious injury crashes since 2000. Beanland et al. (2013) reported that, of the 464 coded cases[4], nearly two-thirds were attributable to inattention and 16% to driver distraction (Beanland et al., 2013), with other research suggesting that these adverse outcomes are likely to occur very early in the driving task (Larue, Rakotonirainy, & Pettitt, 2010; Michael, 2009), with driving vigilance decreasing over time during long, monotonous driving (Schmidt et al., 2007). Simulator-based research which examined reaction and vigilance during monotonous driving tasks indicated that reaction times decrease as the length of the driving task increases, even during daylight hours (Schmidt et al., 2007; Schmidt et al., 2009). However, when nearing the end of the journey, self-assessment ability is limited, given drivers report an improved level of vigilance (Schmidt et al., 2009), which is consistent with the findings of Armstrong et al. (2009) in respect of fatigue.

2.6 ORGANISATIONAL AND INDUSTRIAL FACTORS

The nature of the industry and the type of work engaged in by the worker are important considerations. Thus far, this chapter has highlighted fatigue-related issues and factors relating to driving in remote areas. This section describes organisational and industrial influences as important considerations in the issue of workers commuting home immediately following a shift. This section discusses rostering and organisational structures. An organisation's environment (including its employees) is influenced by legislation and resulting organisational policies and procedures. For example, research suggests that there has been an increase in the number of workers driving extended distances and residing in coastal communities following the changes to the legislation associated with shift length in 1996, demonstrating the

[4] Cases were obtained from the Australian National Crash In-depth Study (ANCIS).

influence legislation has on commuting behaviours in the industry (Petkova et al., 2009).

2.6.1 Organisational employment structures

There have been arguments in the literature that extended shifts and engaging a higher number of contractors have resulted in the trend for a change in living arrangements which stimulates the incidence of workers engaging in DIDO work (Di Milia & Bowden, 2007). As at June 2015, there were approximately 40,000 employees in the mining industry in Queensland (Australian Bureau of Statistics, 2016b). Based on previous census data[5], it is estimated that approximately a quarter of those employees are contractors (Australian Bureau of Statistics, 2011). Variation in employment structures is evident within the mining industry. Literature examining the pros and cons of commuting long distances in a mining context discusses the variation between the benefits afforded to contracting and permanent employees (Misan & Rudnik, 2015). For example, contractor and permanent employees differ in terms of the roster structure offered. There is contention that in some sections of the mining industry, contractors work longer shifts, are provided with different accommodation, and have different lengths of time off when compared to those workers employed directly by the mine (Misan & Rudnik, 2015). These differences are also evident in injury reporting and safety practices (Misan & Rudnik, 2015). Anecdotal evidence suggests that, because of the variation in employment structure and opportunities offered to permanent and contracting employees, contractors are more likely to leave the worksite immediately following a shift block compared to permanent employees.

Literature discussing relevant aspects of an organisation's safety management system describes employee engagement as a relevant situational factor (Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2007), suggesting the importance of a consideration of organisational employment structures in the present research. The

[5] More recent figures are not yet available.

perceived precariousness of employment associated with contracted employment has the potential to result in adverse outcomes, such as perceived employment security, fatigue-related incidents, mental health problems, issues with employee retention, WH&S implications, and reduced workplace commitment (Construction Forestry Mining Energy Union Queensland, 2011; Ivanova & Rolfe, 2011; Lockie, Franettovich, Petkova-Timmer, Rolfe, & Ivanova, 2009; Quinlan, Mayhew, & Bohle, 2001).

2.6.2 Rostering and shift time

The time of day at which the journey home commences and occurs is an important consideration for these workers. There is extensive research which demonstrates that increasing the length and irregularity of shifts increases worker fatigue levels (Di Milia, 2006; Scott et al., 2007) (see Section 2.5.1). In 1996, legislative changes resulted in the standard shift length being increased from 8 hours to between 10 and 12 hours in Queensland. The significant increase in shift length enabled workers to work a reduced number of shifts in a 28 day cycle. Swing rostering further contributes to the irregular shifts undertaken by these workers. This means that a proportion of workers in this industry will be exposed to irregular shifts and the majority will be exposed to long shift lengths, two of the key indicators affecting fatigue levels. Shift work and working irregular or extended hours are known risks for commuting (Barger et al., 2005; Rogers et al., 2001; Scott et al., 2007).

Working different shift types results in the worker travelling home at different times of the day. For example, one week the worker may be driving home during the day, and following their next shift they may be driving home at night. Research investigating shift worker commutes in Queensland reveals that the average time for arriving home following a night shift block was approximately 10:00am with a 12 hour range, and approximately 5:00pm with an 8 hour range following a day shift block (Di Milia, 2006). The large range in this research could be explained in two ways: because the workers are taking longer rest breaks either prior to commencing their journey or, alternatively, they are taking longer rest breaks during the journey home following a night shift.

2.7 RESEARCH GAPS AND LIMITATIONS

The various factors in shift work studies (as summarised above) are typically investigated distinctly, concentrating predominantly on influences external to the individual (i.e., social and economic influences) (Carrington & Hogg, 2011; Ivanova et al., 2007). It is not proposed that the impact of these external influences be discounted, as each factor contributes to providing a framework to further understand a broad and complex issue. However, these influences need to be considered from the perspective of the impact on the driving-related commuting decisions of these workers, the pressures faced by these workers, and how these pressures affect driving immediately following shifts.

To the knowledge of the author, there is currently no research which examines individual pressures, journey characteristics, and organisational influences on worker commuting behaviours. The above discussion highlighted some key areas of consideration in previous relevant research. There is a significant amount of research which focuses on FIFO operations; however, a key limitation of mining research is the limited focus on the DIDO workforce. While some conclusions drawn across various travel types are relevant, there are nuances which are specific to DIDO workers in the mining industry in Australia, such as the characteristics of their journey, and organisational influences. There are key gaps identified throughout this discussion which informed the direction of this research program.

Firstly, there is a significant amount of research and industry literature which highlights the issues with FIFO commuting on the community, family, and individual (Haslam McKenzie, 2010; Misan & Rudnik, 2015; Rolfe, 2013). This research, while examining long-distance commuting, focuses on the FIFO workforce with limited consideration of the DIDO workforce, despite the risks associated with this type of commuting. It is relatively easy to identify that there are risks associated with this form of commuting; however, there has been no examination of the costs associated with commuting-related crashes in the mining industry in Australia. While attempts are being implemented to address commuting risks through a series of recommendations resulting from the Coronial Inquiry previously mentioned, these are related to on-site fatigue management education and policies associated with journey management in the mining industry. This focus on fatigue management may be sufficient, but given this is an off-site behaviour, research should consider the influence of other factors on commuting decisions, particularly in respect of those workers leaving immediately following shifts.

To the best of the author's knowledge, research has not explored the individual, social, and external influences on workers' commuting decisions. Rostering and lifestyle are considered benefits of working in the mining industry. These organisational influences have not been considered in respect of the commuting practices of the travelling workforce. In addition to organisational and rostering considerations, the off-site benefit associated with the shift-block roster is also relevant to commuting decisions. There is also anecdotal evidence from industry which suggests that family and friends influence timing of the commute. With an understanding of these factors, research-based interventions can be recommended rather than implementing ad hoc responses.

2.8 RESEARCH QUESTIONS

The literature discussed here highlights the need for further research with a focus on the key areas of individual (including social), organisational, and situational (journey characteristics) factors associated with driving home from the mine site immediately following a shift block. Research Questions for this program of research are presented below. These Research Questions contribute to understanding the key research problem: *why do some workers drive home immediately following their shift* *block?* Table 2-1 describes how these research questions address the Research Objectives presented in Chapter 1 (see Section 1.5).

Table 2-1.

Research objectives addressed by the research questions

Research objective	**Addressed by**				
	RQ1	**RQ2**	**RQ3**	**RQ4**	**RQ5**
1. Examine the compensation costs of motor vehicle crashes associated with the drive-in/drive-out workforce in Queensland	❖	❖			
2. Explore the parameters of legislative requirements in respect to commuting within a Queensland and Australian mining context			❖		
3. Explore and examine the relationships of individual, social, organisational and situational influences on worker commuting behaviour and how these key influences impact workers' decisions about driving home immediately following a shift block	❖		❖	❖	❖
4. Identify opportunities for interventions regarding driving home from site immediately following a shift block			❖	❖	❖

Research Question 1 [RQ1]: What are the circumstances in which crashes are occurring during mine workers' journeys to and from the mine site? While there is research which concentrates on the social and economic impacts of transient mining workforces around Australia, there is little research which focuses specifically on the DIDO workforce. As argued above, there are significant risks faced by DIDO workers during their commute; however, previous research has only focused on the frequency of motor vehicle crashes of shift workers and near misses and fatigue-related risks (Di Milia, 2006). The present research will provide an understanding of the circumstances of these crashes, including the type of crash, direction of travel, vehicle type being driven, as well as the time of crash and location of crash using self-reported crash data. The studies uncover the key risks associated with the commute and therefore contribute to understanding the characteristics of the journey (see *Figure 2-1*) The focus on crashes occurring during journeys to and from the mine site is to ensure the research program is appropriately positioned and the focus on the journey home is appropriate. This study is descriptive in nature and informs Research Objectives 1 and 3.

Research Question 2 [RQ2]: What is the cost of motor vehicle crashes associated with the drive-in/drive-out workforce in Queensland from the perspective of workers' compensation costs incurred by industry? As with Research Question 1, this question provides an understanding of the nature of the problem within a Queensland environment. This research question justifies the research program and provides an understanding of the adverse outcomes associated with commuting-related crashes. Previous research has not investigated the costs resulting from commuting associated crashes to describe their financial impact. There is a clear need to explore the problem further and understand the associated financial impacts incurred by industry as a result of crashes in the Queensland jurisdiction. These costs will be associated with workers' compensation journey claims. This research question contributes to addressing Research Objective 1.

Research Question 3 [RQ3]: What are the current legislative controls, as well as industry-based guidelines employed by organisations/operations to promote safe commuting behaviour? Given the limited research efforts in this area, there has been no study examining the organisational and industrial policies which impact on commuting. Given the mining industry is safety conscious, it is important to understand the controls in place to further contextualise this issue and to refine the organisational factors discussed in Section 2.6, contributing to an understanding of Research Objectives 3 and 4. Furthermore, the above discussion has argued that employment structures, rostering and operations have an impact on commuting behaviours; therefore, it is imperative that organisational management of these factors is considered. Finally, an understanding of current policies will also assist with the discussion associated with RQ5.

Research Question 4 [RQ4]: What are the key influences on the travelling workforce from individual, social, organisational, and situational perspectives and how do these key influences impact workers' decisions about leaving the work site to *drive home immediately following a shift block?* As identified in the discussion above, there are a number of factors which influence the commuting decision of this workforce. While there are some previous examinations of the travelling workforce, the key factors drawn from literature are not specific to the issue of driving home following shift blocks, nor does the literature examine the influences on worker commuting decisions (Research Objective 3). The literature and discussion above demonstrates that there are individual influences from various aspects of work and home life (see *Figure 2-1*). Therefore, there is a need to explore the factors influencing the immediacy of commuting behaviour to support Research Objective 4, to identify opportunities for interventions. As discussed earlier, without an understanding of the factors contributing to the problem of mine workers' commuting behaviour, identifying opportunities for interventions perpetuates the *ad hoc* approach currently adopted to manage decision making in respect of driving after shifts.

Research Question 5 [RQ5]: What are the relationships of the key influences on the travelling workforce from individual, social, organisational, and situational perspectives and how do these key influences impact workers' decisions about driving home immediately after a shift block? The importance of the exploration of the relationships between the key influences is to extend Research Question 4. As argued in this chapter, currently the approach adopted by mining companies in response to this issue is *ad hoc* rather than being a part of an integrated strategy. This research question provides scope to explore the interrelationships between key influences identified iteratively throughout the research program. A deeper understanding of the relationship between key influences would enable the most salient factors to be targeted and opportunities for interventions to be identified, in line with Research Objective 4.

2.9 THEORETICAL PERSPECTIVES

The current research spans two relevant fields of literature, namely, road and organisational safety. A thematic review of previous research on commuting behaviour reveals three distinct categories of influence: (1) personal and social pressures; (2) the influence of the organisation; and (3) other external factors (e.g., the characteristics of the journey itself).

The first part of this section provides an overview of the theories commonly adopted within road safety literature, and the second part will discuss relevant theories within organisational safety. Research with similar objectives in a road or organisational safety context generally focuses on behavioural change or cognitive decision models (e.g., the Theory of Planned Behaviour). These decision models aim to understand the factors which facilitate or inhibit behavioural performance or non-performance. It is with these factors that opportunities for interventions can be identified (Fishbein, 2008). Using well-established theoretical frameworks will assist in categorising relevant factors and conditions to understand and predict behavioural outcomes, putting structure to a previously unexplored topic.

Cognitive decision models describe the influences on one's intentions and subsequent behaviours and are typically used to analyse decision making processes within road safety research. There are many cognitive decision models which describe individual behavioural responses. Given the aim of this research is to understand the decision of workers in respect to their journey home following a shift block and to identify opportunities for interventions, further discussion will centre on these cognitive decision models and their applicability to the specific context of mine workers' commuting behaviour. The following sections discuss well-known theories and concepts in the road and workplace safety fields: (1) the Theory of Planned Behaviour (TPB); (2) the health belief model; (3) the social norms approach; (4) the theory of interpersonal behaviour; (5) the reasoned action approach; and (6) the integrated behavioural model. Considering the current research examines safety-related behaviours, this section also discusses safety climate and culture in respect of these decision models. Each theory is discussed to further understand the factors that influence workers' commuting decisions immediately following shift blocks. Many of these theories describe behavioural outcomes in similar ways, with the conceptualisation of the antecedents presenting the most noteworthy divergence.

2.9.1 Theory of Planned Behaviour

The TPB is a theoretical framework which has frequently been adopted to explain behaviour in a road and workplace safety context (e.g., Evans & Norman, 2003; Fogarty & Shaw, 2010; Poulter, Chapman, Bibby, Clarke, & Crundall, 2008; Warner & Åberg, 2006). Road safety literature recognises that a combination of factors and conditions influence driving behaviour, including decisions to engage in risky driving behaviour (e.g., speeding or fatigued driving). There are many practical applications of the TPB across a range of topics in road and workplace safety, such as the qualitative examination of the intention of people to commit driving violations (Forward, 2006), the behaviour and compliance of truck drivers (Poulter et al., 2008), and the relationship between driver behaviour and safety climate for work-related driving (Wills, Watson, & Biggs, 2009).

The TPB was conceptualised to explain and describe the internal and external influences on individuals' intentions and resulting behaviours (Ajzen, 1991). The model assumes that individuals make rational decisions about the target behaviour and its consequences (Maddux, 1993). The original TPB framework is illustrated in *Figure 2-2*.

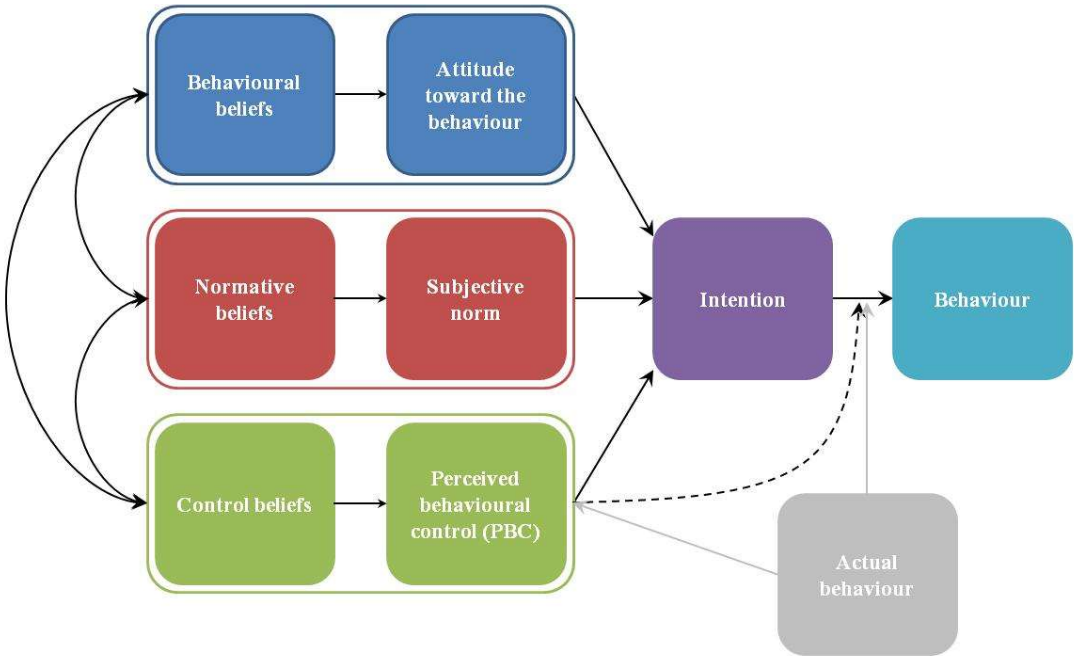

Figure 2-2: **Theory of Planned Behaviour (Ajzen, 2002a)**

The TPB attempts to explain behaviour by suggesting that behaviour is a function of intentions and perceived behavioural control (PBC) (Ajzen, 1991). According to the TPB, intentions are influenced by three constructs, including: (1) attitudes toward the behaviour; (2) the perceived social pressure to engage in the behaviour (subjective norms); and (3) an individual's perceptions of their ability to perform the behaviour (PBC) (Ajzen, 1991). These antecedents are informed by underlying beliefs (Ajzen, 1991).

Behaviour-intention relationship

The predictive ability of the TPB constructs varies for different behaviours, which is important to understand in determining the predictive utility of the TPB as a framework, but also when developing interventions. A meta-analysis examining distinctions in behaviour assessed predictive utility across various behaviours, such as health promoting and risky behaviours, frequently performed and discrete behaviours, behaviours undertaken for the first time and ongoing behaviours, and behaviours associated with emotions (McEachan, Conner, Taylor, & Lawton, 2011).

The meta-analysis found differences between the predictive strength of individual TPB variables depending on the behavioural context.

The TPB highlights that it is important to gain an understanding of intentions to engage in the target behaviour. However, there is ongoing debate in academic literature which argues that intentions may not be a good predictor of behaviour (De Cannère, De Pelsmacker, & Geuens, 2009). This discrepancy may be due to the poor operationalisation of the behavioural construct. From a road safety research perspective, this operationalisation issue can be readily identified in the reliance on self-reporting of crash and/or near misses in an attempt to operationalise the dependent behavioural variable (Elliott, Armitage, & Baughan, 2007). A conceptual and empirical review of the intention-behaviour relations posited that, on average, intentions explain 28% of the variance in future behaviour (Sheeran, 2002). This meta-analysis empirically examined ten meta-analyses of the intention-behaviour relationship between 1993 and 2000. Sheeran (2002) argues that this outcome is 'good' when taking account of the sample-weighted average correlation of .53, considered a large effect size based on Cohen's (1992) recommendations.

From a theoretical perspective, it is important to note that there is a period of time (either a split second or longer) whereby a person engages in an active decision process converting influences into intentions and subsequent behaviour (Ouellette & Wood, 1998), which conceptually foregrounds the importance of the inclusion of intentions in a cognitive decision model. This assumes that individuals make a decision in the same way each time they are faced with a set of circumstances, even if those circumstances are the same. For example, this perspective implies that mine workers process a decision to drive immediately following shifts each time the shift nears its end. While some circumstances may change (i.e., the workers' family insist they return home immediately), generally the decision is very similar to the last time they were confronted with the end of a shift.

Attitudes and the TPB

Attitudes are associated with the evaluation of the behaviour – whether the perception is positive, negative or otherwise (Ajzen, 1991). Meta-analyses support the relationship between attitudes and intentions, reporting a correlation of between 0.49 and 0.57 in the reviewed studies (Armitage & Conner, 2001; McEachan et al., 2011). Attitudinal perception is based on underlying behavioural belief relating to the advantages and disadvantages of performing the behaviour (Ajzen, 1991; von Haeften, Fishbein, Kasprzyk, & Montano, 2001). Behavioural beliefs link the behaviour to favoured behaviours through preconceived positive or negative evaluation. The evaluation links the behaviour to a certain outcome or attribute, such as the costs associated with performing the behaviour. As a result, individuals favour behaviours that result from positive evaluations and form unfavourable attitudes with behaviours evaluated negatively (Ajzen, 1991). Behavioural research identifies that it is important to examine underlying attitudes toward the behaviour in order to understand the drivers of individual decisions (Bobbitt & Dabholkar, 2001). Fishbein and Ajzen (1975, p. 6) define an attitude as “a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object”. Comparatively, other definitions describe attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (Eagly & Chaiken, 2007:598). Ajzen and Fishbein (2011, p. 3) suggest that the term attitude “refers[s] to the evaluation of an object, concept, or behaviour along a dimension of favour or disfavour, good or bad, like or dislike”, which extends beyond favour and disfavour.

Subjective norms and the TPB

Subjective norms refer to the perception that those who are important to the individual either encourage or discourage the performance of a behaviour. In meta-analyses, subjective norms frequently are found to be less important than the other two TPB predictors and reached statistical significance less often (Godin & Kok, 1996). Some studies have removed subjective norms from their analysis (Armitage & Conner, 2001). Armitage and Conner (2001) posit that the weakness in the predictive power of the subjective norms construct as evidenced by their meta-analysis may be associated with the frequent use of single-item measures. The operationalisation of subjective norms as contemplated by the TPB takes a global view of social pressures and does not distinguish between groups. Understanding the influence of specific groups has prompted researchers to examine subjective norms with a focus on individual perceptions of specific reference groups in line with a social norms approach (e.g., White, Smith, Terry, Greenslade, & McKimmie, 2009).

Subjective norms are based on the underlying normative belief that engaging in the target behaviour is approved or disapproved of by specific reference groups (Ajzen, 1991; von Haeften et al., 2001). The strength of the influence of the reference group is measured by assessing individuals' motivation to comply and align their behaviour with the approval (or otherwise) of the referent, and the value placed on the approval of that reference group (Ajzen, 1991).

Perceived behavioural control (PBC) and the TPB

PBC is the perceived amount of control one has over performing the target behaviour. PBC is said to directly influence both intentions and behaviour (Ajzen, 1991). The TPB prescribes that individuals rely upon a perception of behavioural control in order to structure their attitude and behavioural intention (Albarracín et al. 2005, Ajzen, 2002). The original framework by Ajzen, the Theory of Reasoned Action (TRA), was extended to describe a person's perceptions about their capabilities and their ability to exercise control over a certain task (Ajzen, 2002, Bandura, 1977). This construct attempts to describe the individual's perception of the ease or difficulty in performing the behaviour (Ajzen, 1991). The extension of the framework to include PBC is supported by meta-analyses which demonstrate that the addition of PBC, while controlling for attitude and subjective norms, explains, on average, 6% more variance in intention (Armitage & Conner, 2001).

Underlying the perception of control are internal factors perceived by the individual as facilitators or barriers to engaging in the target behaviour. The importance of those facilitators and barriers is contingent on the perceived frequency of their occurrence (Ajzen, 2002b; von Haeften et al., 2001). Control beliefs are also associated with the power the individual perceives they have over performing the behaviour. Perceived power is influenced by "factors that increase or reduce the perceived difficulty of performing the behaviour in question" (Ajzen, 1991, p. 196). Some examples of these factors include past experience with the behaviour, or relying on the experiences of others. Perceived difficulty is reduced with increased resources and opportunities and fewer obstacles and impediments. The reduction of perceived difficulty in performing the behaviour results in increased perceived control over the behaviour (Ajzen, 1991).

2.9.2 Health Belief Model

The health belief model was originally developed to understand and assess the value of public health programs by attempting to understand the beliefs that should be targeted to effect positive health behaviours (Rosenstock, 1974). The beliefs examined in the health belief model consider the likelihood of developing a condition, or perceived susceptibility, the perceived seriousness of the condition, the perceived benefits/barriers in taking action, and events or cues that trigger a response to act (Rosenstock, 1974). The application of the model typically is associated with assessing the value of public health communication programs, and thus has received little attention as a model to assess other behaviours (Maddux, 1993). Those studies that have used the model beyond the original application have done so to explain health related behaviours, such as vaccinations, early detection of disease, and exercise behaviours (Corwyn & Benda, 1999).

The Health Belief Model (HBM) is an extension of risk homeostasis, whereby individuals weigh up positives and negatives to draw a conclusion. Risk homeostasis argues that behaviour is based on risk perception or the analysis of the costs and the benefits of that behaviour (Wilde, 1998). For example, if the perceived risks to engage in the behaviour are higher than acceptable, then the behaviour may not occur (Wilde, 1998). Likewise, if the perception is that there is little or no risk in performing the behaviour, then it is likely that the behaviour will occur. The underlying theory is important for further discussion in this research, particularly the conceptual alignment between perceived benefits and barriers in taking action of the HBM, and control beliefs as contemplated by the TPB (Ajzen, 2002b). Further supporting the focus on these two concepts are meta-analyses which report limited support for the model as a whole, but a strong predictive utility of benefits and barriers with behaviour (Carpenter, 2010; Harrison, Mullen, & Green, 1992).

2.9.3 Social Norms Approach

Social norms assist individuals to make decisions by defining certain situations in line with peer influences. Peer influences are based on two aspects, what we think others believe and do (the "*perceived norm*") and real beliefs and actions (the "*actual norm.*") (Berkowitz, 2004). Actual norms exist at the collective level and can be identified in group, community or cultural levels. Actual or collective norms provide sets of behaviours or 'codes of conduct' that individuals can follow; however, these norms are not explicitly stated but are interpreted by the individual (Berkowitz, 2004). The way an individual interprets these collective norms is known as perceived norms. Perceived norms are operationalised by measuring individual perceptions as they exist at the individual, psychological level (Lapinski & Rimal, 2005). In understanding the individual perceptions of a group, perceived norms may be aligned with supervisors and co-workers, particularly considering the strong community sense on a mine site.

The interpretation of 'codes of conduct' by individuals is only important if that individual believes that not complying will result in some type of social sanction (Lapinski & Rimal, 2005). Thus, descriptive and injunctive norms extend the concepts of perceived and actual norms. Descriptive norms provide information about what is common practice at a community level, or in this case an individual's perception of the prevalence of the behaviour in the industry (Lapinski & Rimal, 2005; White et al., 2009). Information used to decide what to do is based on the opinions and actions of significant others (Rivis & Sheeran, 2003). For example, individual perceptions may be that it is common practice in the industry to leave work immediately following a shift block. Action is motivated by the perception that enacting the behaviour is likely to be effective, adaptive and appropriate (White et al., 2009).

The perception of a social sanction is incorporated through the concept of morality and conceptualised as injunctive norms. Injunctive norms indicate what ought to be done (White et al., 2009). The primary difference is that descriptive norms do not involve social sanctions for non-compliance with the norm. However, it is often the case that injunctive and descriptive norms are congruent (Lapinski & Rimal, 2005). Injunctive norms can be separated into two categories, personal and social. Individual perceptions of what significant others think one ought to do are described as social injunctive norms (White et al., 2009). The perceived social pressures by significant others to perform particular behaviours is also evident in the subjective norms definition of the TPB (White et al., 2009). The potential social rewards or punishments for performing the behaviour motivate action (Lapinski & Rimal, 2005).

Personal injunctive or moral norms are related to what the individual believes is the right thing to do, or their 'moral compass' (White et al., 2009). The influence personal injunctive norms have over enacting a behaviour is associated with self-approval or disapproval, and is independent of the influence of significant others or reference groups. Research has found that moral norms are important in predicting behaviour where there is a moral or ethical component to the decision, for example recycling waste (Cialdini, Reno, & Kallgren, 1990). In the case of leaving immediately following a shift with the knowledge that the individual is fatigued, it could be argued that there is a significant moral component to the commuting decision, suggesting the importance of the inclusion of moral norms for consideration in this research program.

Social factors are important in this context because of the individual factors discussed earlier in this chapter (see Section 2.4). The influence of family on workers' residential location, engaging in long distance commuting for work, as well as the influence of the work community on the worker, suggest the need to consider social influence on decisions about driving immediately after a shift. However, examination of social norms is a complex task involving an understanding of the perceptions of multiple layers of reference groups, including significant others (e.g., family, co-workers and supervisors), community and industry. Understanding the influence of these reference groups is further complicated by individual perceptions of what others believe and do, as well as the perceived social sanction in not enacting the 'appropriate' behaviour. Subjective norms, as contemplated by the TPB, assess individual perceptions about significant others without providing an understanding of the influence of the industry, and focus only on the perceived social pressures to perform the behaviour (or otherwise) (White et al., 2009). From the perspective of commuting behaviours in the mining industry, both the pressure to engage in the behaviour (or otherwise), as well as the perceived social sanctions and morality associated with engaging in the behaviour, are relevant considerations but are not specifically contemplated by the traditional conceptualisation of the TPB (Park & Smith, 2007; White et al., 2009).

2.9.4 Alternatives to the TPB

The TPB has been used as a foundational model and extended to include additional explanatory variables. The Theory of Interpersonal Behaviour (TIB) and the Integrated Behavioural Model (IBM) both hold similarities with the TPB. All of these frameworks posit attitudes, perceived social influence and control over performing the behaviour, and influence intention, which in turn predicts behaviour. These frameworks, however, attempt to address some criticisms of the TPB and propose varying approaches. These alternative approaches attempt to address the limited consideration of: (1) environmental factors or situational conditions; (2) knowledge and skills to perform the behaviour; (3) prior experience or habit; and (4) the salience of the behaviour.

Theory of Interpersonal Behaviour

The TIB and the TPB use similar concepts. Both models propose that attitudinal and perceptual responses influence individual decisions (despite variance in the terms which describe specific constructs, e.g., affect and attitude). The TIB was developed by Triandis in 1977 and presented at the *Nebraska Symposium on Motivation* in 1980, and has been adopted in research focusing on: (1) the criminal behaviour of software piracy (Limayem et al. 2004); (2) the study of telemedicine adoption by physicians (Gagnon et al., 2003); and (3) mode of transport options (Verplanken, Aarts, & Van Knippenberg, 1997). Similar to the TPB, Triandis (1980) states that three levels influence intentions and resulting behaviours. Firstly, personal characteristics and prior experiences shape attitudes, beliefs, and social norms related to the target behavior. Next, cognition, affect, social determinants, and personal normative beliefs influence the formation of behavioural intention. Finally, Triandis (1980) proposes that behavioural intentions, prior experience, and situational conditions predict behaviour engagement (Triandis, 1980). It is the inclusion of prior experience and the impact of the social or physical environment that are noted as effective in explaining more complex cognitive behaviours (Milhausen, Reece, & Perera, 2006: 98).

There are three identifiable differences between the TIB and the TPB. Firstly, the TIB explicitly considers roles, self-concept, and norms as drivers for social factors. This consideration is more implicit in the TPB. The TPB accounts for these social factors through consideration of subjective norms and attitudes toward behaviour (Ajzen, 1991). According to Triandis, intention is explained by relevant social factors. The TIB describes social factors as personal norms, role beliefs about the appropriateness of the behaviour for one's perceived social role, interpersonal agreements, and self-definitions (Bamberg & Schmidt, 2003). Triandis' conceptualisation of social factors includes norms, roles and self-concept. These three factors are *similar* to the TPB's construct of subjective norms; however, they more closely align with the social norms approach discussed earlier. The social factors posited by the TIB relate to individual internalisation of reference groups norms, roles, and self-concept in specific social situations, more specifically, consideration of behaviours which are appropriate, desirable and morally correct (Triandis, 1980).

The second difference between the TPB and the TIB is the consideration of behaviour as a function of intention and habitual response. The popularity of the TPB in various attitude-behaviour relational studies has resulted in an underestimation of the importance of considering behaviours as habitual and repetitive (Verplanken et al., 1997). Habits are those behaviours that are performed repeatedly, and thus are not subject to, or preceded by, stringent decision processes (Aarts, Verplanken, & Knippenberg, 1998; Verplanken et al., 1997).

The TPB accounts for the influence of previous behaviour on subsequent behaviour through the presumption that the experiential influence feeds back to influence attitudes, subjective norms, and perceptions of behavioural control (Ajzen, 1991). More specifically, repeat behaviour is strongly correlated with the PBC construct, given the enhanced perceptions of control afforded by the repetition (Ajzen, 1991). However, research examining past behaviour supports the consideration of past behaviour given past behaviour contributes between 10% and 19% additional variance in predicting behaviour when controlling for other TPB variables (McEachan et al., 2011).

The TIB assumes that behaviour in any situation is partly a function of intention to perform the behaviour, habitual responses, as well as situational constraints and conditions (Triandis, 1980). Habit is more strongly associated with those behaviours that are performed frequently, such as the target behaviour of the current research. Thus, the development of habit results from an initial, rational decision that is superseded by an automatic response to situational cues (Maddux, 1993). Ouellette and Wood (1998) draw comparisons between wearing a seatbelt (an everyday occurrence for most people) and getting a flu shot. Research predicting car seatbelt use in university students, a behaviour that is arguably highly automatic when engaging in a journey, reported that 51% of variance was explained by habit (after controlling for behavioural intention) (Bamberg & Schmidt, 2003). However, in some instances, when a significant period of time has elapsed, past behaviour is not a clear indicator of actual behavioural outcomes (Ouellette & Wood, 1998). For example, the university student in Bamberg and Schmidt's research had not travelled to university for the last 10 weeks because of a semester break. Therefore, while the habitual behavioural response is *relatively* automated, it is still driven by positive previous experiences as a result of an individual's response to a specific, goal-directed task, and hence not completely automatic (Aarts et al., 1998).

The final difference between the TIB and the TPB is the explicit inclusion of facilitating conditions as a moderating factor. Facilitating conditions are external factors that are outside the control of an individual but either enhance or diminish the likelihood of a behavioural outcome (Triandis, 1980). Facilitating conditions are taken into account in TPB through the consideration of external factors affecting PBC (Aarts et al., 1998). However, the TPB specifically argues that these external influences directly influence behavioural outcomes or are mediated by behavioural intentions.

Reasoned Action Approach

The Reasoned Action Approach (RAA) was developed as an extension to the TPB. The RAA holds the same goals as the TPB and other cognitive decision models whereby it attempts to explain intentions and resulting behaviour through the explanation of beliefs and perceptions relating to: (1) attitudes toward the target behaviour; (2) normative influences; and (3) the level of control over engaging in the target behaviour (Head & Noar, 2013). The RAA sets itself apart from the TPB through the inclusion of past behaviour and intervention. The RAA formally adopts past behaviour as an influence, suggesting that frequent adoption of a behaviour may influence one's beliefs about the behaviour, and therefore affect intentions and resulting behaviour (Fishbein, 2008: 838). The RAA also proposes that environmental factors, and skills and abilities moderate the intention-behaviour relationship. The inclusion of environmental factors, and skills and abilities is an extension beyond the traditional TPB to include constructs that are considered by models such as the TIB. The factors which are unique to the RAA also extend beyond the construct of self-efficacy in an attempt to understand the educative and pre-existing knowledge influencing the target behaviour (Head & Noar, 2013). However, knowledge and skills to perform the behaviour and environmental constraints are treated in a very cursory manner (Head & Noar, 2013).

Integrated Behavioural Model

The IBM was developed as an extension to the TRA and TPB. The IBM proposes that intention is a function of attitudes, perceived norms, and personal agency (Montaño & Kasprzyk, 2008), which is similar to the TPB model (Ajzen, 1991). As with the TPB and RAA, attitudes, perceived norms, and personal agency (PBC) are influenced by underlying, salient beliefs. Each of the cognitive decision models presented proposes that perceptions and underlying beliefs about the target behaviour inform behavioural intentions.

Using elements from the TPB (Ajzen, 1991), social cognitive theory (Bandura, 1991), the theory of interpersonal behaviour (Triandis, 1980), the health belief model (Becker, 1974), and the RAA (Kasprzyk, Montaño, & Fishbein, 1998), the IBM posits that four factors directly influence behaviour. These factors include: (1) knowledge and skills to perform the behaviour; (2) salience of the behaviour; (3) environmental constraints; and (4) habit. These additions are extensions from models such as TIB (Triandis, 1980). This framework suggests that a person must have the knowledge and skills to perform the behaviour, and the performance of the behaviour should hold some type of importance for them. Finally, the behaviour is influenced by environmental constraints, as well as how habitual the behaviour has become (Montaño & Kasprzyk, 2008). If the behaviour is habitual, then intention may be less important when considering the target behaviour (Montaño & Kasprzyk, 2008; Triandis, 1980). For example, workers may place a high level of importance on commuting home immediately following a shift block, and leaving immediately after shift is a behaviour that is performed each time a shift concludes. Given the nature of the target behaviour in this instance, it is assumed that the workers have the knowledge and skills to drive home after shift. However, there may be some environmental constraints on the journey; for example, the worker may have lost their licence resulting in an inability to drive.

2.9.5 Safety climate and culture

Commuting home from work, despite occurring off-site and in personal time (in some instances) is inextricably linked to workplace and organisational requirements. The safety of an employee travelling home from work following a shift block is contingent on a variety of factors, some of which can be linked to organisational operations and safety policies. The discussion thus far describes individual perceptions as the key influence on decisions to commute home immediately following a shift block. These perceptions include environmental and situational facilitators or barriers. However, the discussion is limited in the consideration of specific organisational influences on individual decisions. Safety climate is typically related to general safety in the organisation. Both concepts have previously been considered in respect to work-related driving (Amponsah-Tawiah & Mensah, 2016; Newnam, Griffin, & Mason, 2008). However, these concepts have not been applied to safety behaviours of workers in situations where safety management systems and organisational policies do not strictly apply to the risk, such as driving a private car home, outside of work hours.

There are significant risks to the safety of workers who operate in this industry. As such, the industry began to investigate system approaches to developing safe work environments (Joy, 2004). A large proportion of sites adopted safety management systems approaches to manage workplace health and safety. The mining industry is generally perceived as a very safety conscious industry, with clear approaches and guidance (Joy, 2004). “The norms and rules governing safety within an organisation, whether explicit or tacit, are at the heart of a safety culture” (Pidgeon, 1991, p. 135). The discussion of a safety conscious industry indicates the potential for strong safety cultures to exist within the industry and on sites.

This research uses the concept of safety climate in order to understand the influences of the organisation on commuting behaviours from a safety perspective, beyond the implementation of safety practices and procedures on-site. Research investigating safety perceptions refers to two concepts: (1) safety culture; and (2) safety climate. Researchers exploring these concepts debate the definition and distinction between these terms, particularly due to the interrelated nature of the organisation’s social structure (Ekvall, 1996). Values, beliefs, and underlying assumptions about the organisation are contributed to through the organisational culture, climate and structure, as well as social structures within the organisation (Ekvall, 1996; Flin, Mearns, O'Connor, & Bryden, 2000). While these characterise the organisation, “organisational culture expresses itself though organisational climate” (Guldenmund, 2000: 221). Group or organisational climate is the shared perceptions within the organisation (Griffin & Curcuruto, 2016). Comparatively, psychological climate refers to individual perceptions (Neal & Griffin, 2006). The importance of describing this concept from a higher organisational level indicates that, while perceptions are both individual and shared, safety culture is also multifaceted and is contributed to by structures, values, beliefs, underlying assumptions, and organisational structures, all of which are expressed through safety climate (Griffin & Curcuruto, 2016). Therefore, in order to understand safety-related behaviours associated with commuting it is also important to examine safety climate.

Additionally, due to the focus on individual decisions, the examination of safety climate should occur at the individual and group level.

As with organisational culture and climate, safety culture and climate are not interchangeable concepts (Clarke, 2000). Safety culture refers to the beliefs and attitudes exhibited as a result of the policies, practices, and structures expressed through safety climate. Comparatively, safety climate is a descriptive measure relating to perceptions and beliefs of the conditions of a working environment relating to safety (Clarke, 2000; Williamson, Feyer, Cairns, & Biancotti, 1997). Practically, worker beliefs and attitudes ultimately affect safety performance (Griffin & Curcuruto, 2016; Niskanen, 1994). For example, a positive safety culture leads to a decrease in adverse safety-related outcomes (Amponsah-Tawiah & Mensah, 2016; Clarke, 1999).

In order to operationalise the safety climate concept, researchers have developed measures based on tasks to measure an individual's perceived level of individual safety performance and how it is expressed by the overall group safety climate (Neal, Griffin, & Hart, 2000). From an individual perspective, the concept of perceived safety performance incorporates two dimensions of compliance and participation (see *Figure 2-3*). These concepts are individual perceptions of how well they contribute to safety on site. *Safety participation* is about how the individual contributes to an environment that supports safety, and *safety compliance* is what individuals *must* to do remain safe (Neal & Griffin, 2006). These performance outcomes are contributed to by *safety motivation* and *safety knowledge*. *Safety motivation* is "an individual's willingness to exert effort to enact safety behaviours and the valence associated with those behaviours" (Neal & Griffin, 2006: 947). Finally, *safety knowledge* is the information required to be safe (Neal et al., 2000). Pigeon (1991) supports the proposition that workers, as well as the organisation, contribute to workplace safety culture. Pigeon (1991) suggests that the elements of safety culture are associated with three important factors. The first factor is associated with the type of attitude workers have toward safety, including beliefs concerning risks and motivation to act on those beliefs. The second factor concerns employees' responsiveness to safe work practices. The final element is based around safety climate contributing to culture, whereby it is suggested that norms and rules for defining risks are based on explicit or tacit guidelines (Pidgeon, 1991).

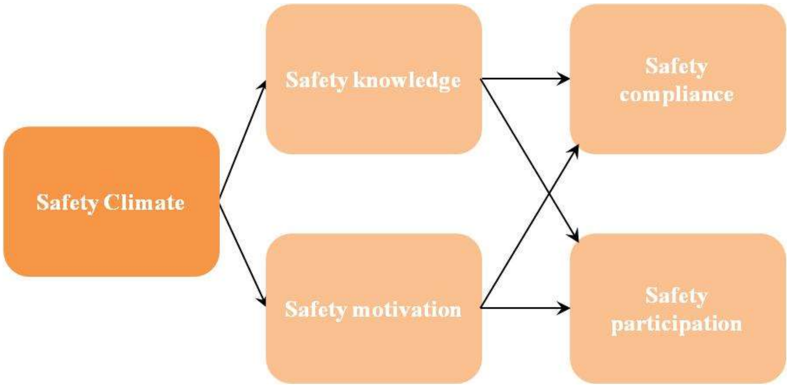

Figure 2-3: **Task-related safety behaviours (reproduced: Neal et al., 2000)**

Commuting home from a mine site, while occurring after the conclusion of the shift, is still linked to work, and considering the close proximity of the journey to the conclusion of shift, it is posited that safety behaviours exhibited on site will be maintained so as to stay safe during the journey home. In order to understand the transference of this behaviour to an off-site related behaviour, further consideration of safety climate is important.

Safety climate does not explain behaviours in environments where there is a positive safety culture, but unsafe behaviours intentionally occur. Commuting home following extended work hours is a clear example of engaging in unsafe behaviours intentionally (Fogarty & Shaw, 2010). As previously mentioned, the mining industry is a safety conscious industry: assuming that the high-level of safety consciousness translates into a positive safety culture, the journey following work can be seen as evidence of engaging in unsafe behaviours. Therefore, the consideration of both safety climate and a volitional decision making model like the TPB allows the explanation of workplace behaviours that are intentional but unsafe (Fogarty & Shaw, 2010). From the perspective of responding to the research objectives, previous research suggests that the TPB is a valid framework to assist in the explanation of unsafe workplace behaviours, where the worker intends to engage in safe practices (Fogarty & Shaw, 2010).

2.9.6 Research approach and proposed theoretical framework

There is a significant amount of research relating to engaging in a mining role where long distance commuting is required, but limited research about the decisions relating to the commuting task itself. This research details three influences which need further examination (see *Figure 2-1*). These influences include individual and social factors, the risks associated with the journey, and organisational factors. The discussion of theoretical perspectives regarding decision-making models above canvasses limitations in each model; however, these frameworks guide the exploratory nature of this research.

The TPB provides a solid foundation for the initial exploration of the issue of mine workers leaving immediately following a shift. Decisions regarding leaving site immediately following shifts can be regarded as volitional; however, there are factors which influence the behavioural outcome. The parsimonious nature of the framework means that it is useful in applied settings, such as the current research program, and is well-suited to assist in designing evidence-based interventions (McEachan et al., 2011). The TPB has been applied frequently in research relating to driver behaviour (e.g., Scott-Parker, Hyde, Watson, & King, 2013; Warner & Åberg, 2006) and workplace safety related research (Fogarty & Shaw, 2010; Wills et al., 2009) – topics which directly relate to the research program. There is a large body of previous research which describes a strong predictive ability of the TPB and related constructs in a road and workplace safety contexts. Some examples include intention to speed (54%) (Elliott et al., 2007), intention to cross the road without using a pedestrian crossing (37%) (Evans & Norman, 2003), intention to violate safe work procedures (47%) (Fogarty & Shaw, 2010), and intention to drive while intoxicated (65%) (Rivis, Abraham, & Snook, 2011).

The TPB provides the opportunity to extend the framework in order to consider factors which fall outside the scope of the original model. Ajzen (1991, p. 199) explicitly stated that *"the theory of planned behaviour is, in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behaviour after the theory's current variables have been taken into account"*. There is considerable support for augmenting the TPB framework in order to consider additional factors. Bamberg and Schmidt (2003) compared three cognitive decision models, two of which are the TIB and TPB. Their research concluded that the models should not be viewed as alternatives to choose between, but that each model presents an opportunity to supplement the other depending on the context under investigation (Bamberg & Schmidt, 2003). Examples of research augmenting the framework include the introduction of additional normative measures adopting the social norms approach to predict propensity to engage in household recycling (White et al., 2009), the inclusion of safety climate to understand safety behaviours in a work context (Fogarty & Shaw, 2010), and the role of habit on speeding behaviours (De Pelsmacker & Janssens, 2007).

Based on a review of the current research about long distance commuting and the mining industry in Australia, there are three key limitations of the TPB. These limitations include: (1) the influence of specific reference groups as contemplated in the social norms approach; (2) the influence of individual perceptions of safety on site; and (3) the role of habit considering the frequency of the commute (see *Figure 2-4*).

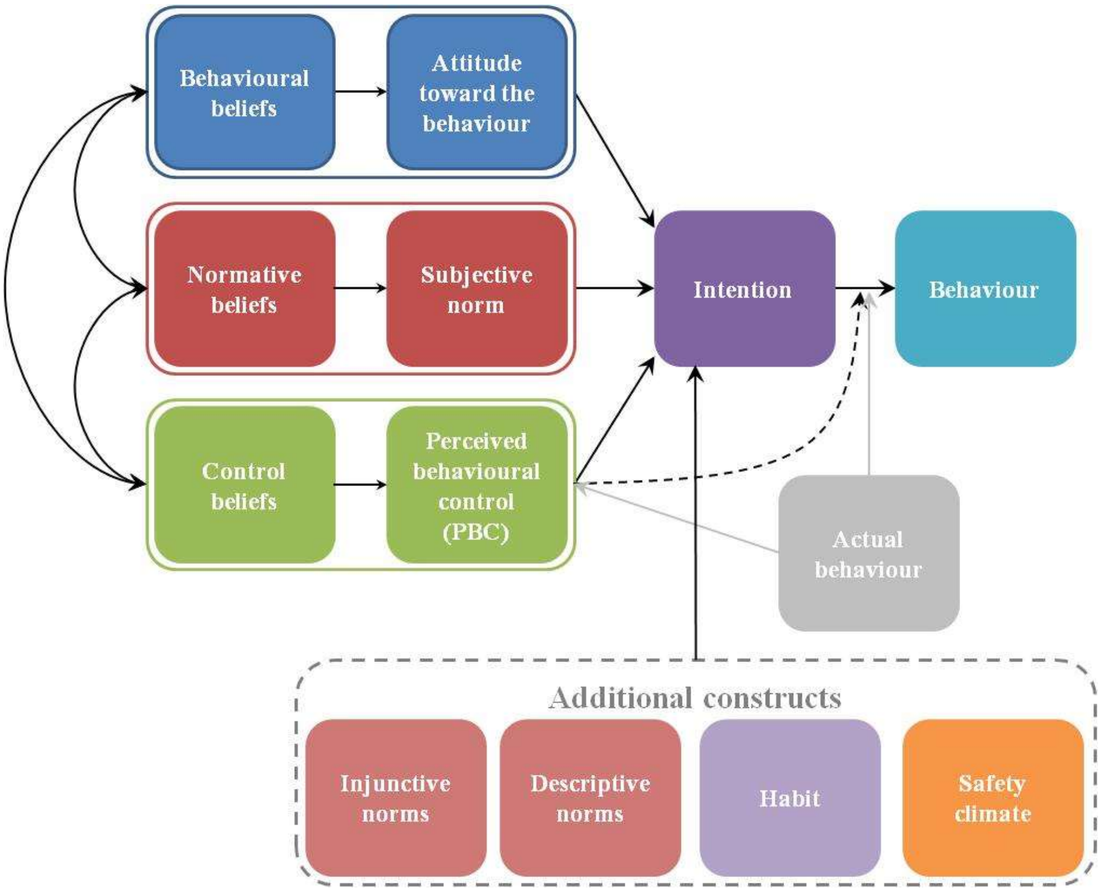

Figure 2-4: **Extended TPB examined in the research program (adapted: Ajzen, 2002a)**

Note: the additional constructs presented in the figure above each influence behavioural intentions individually, but they have been presented grouped for simplicity.

The TPB does not account for the influence of specific reference groups individually. Families and co-workers have very different motivations in respect to workers leaving site immediately; therefore it is likely that perceptions will differ between reference groups. The unitary approach adopted by the TPB does not consider the variation in differences in perceptions between reference groups, except for examining the normative beliefs associated with individual perceptions of a reference group approving (or otherwise) of engaging in the behaviour. Normative beliefs are similar to social injunctive norms. The TPB also presents limitations in respect of considering the morality of the behaviour in question. Since there is a risk of injury involving other road users, it is important to assess individual perceptions of right and wrong, from individual and social perspectives. The traditional TPB does not specifically examine morality. The community-type relationships developed on site also indicate that it is important to take account of the influence of work-based reference groups on the decision, through the consideration of descriptive norms. Meta-analyses of the predictive power of the TPB with the inclusion of descriptive norms report a 5% increase in the variance of intention after controlling for attitude, subjective norms and PBC (Rivis & Sheeran, 2003). Overall, the social norms approach provides the foundation for the further exploration of social influences on the decision to drive home immediately following shifts (see *Figure 2-4*).

While commuting may be considered a non-work related activity, a link between work and the commute should be further investigated. The TPB considers attitudes about the target behaviour, whereas in the case of this arguably work-related activity, attitudes and perceptions about work safety practices are also important. While the social norms approach serves to examine individual worker perceptions about what is the right thing to do and what behaviour others engage in from a working relationship perspective, individual perceptions about the safety performance of the organisation, including participation and compliance with site expectations, are not explicitly presented in the TPB. As such, the consideration of safety climate in this research program is important in order to understand worker motivation to act safely in commuting home immediately following shifts, responsiveness towards safe work practices, and the explicit nature (or otherwise) of the guidelines associated with leaving site immediately following shifts (see *Figure 2-4*).

Habits, as contemplated by the TIB and IBM, provide the ability to assess the influence of past behaviour, frequency of behaviour and the automaticity of decisions. While TPB theorists debate whether habit and past behaviour are considered through changing attitudes, subjective norms and PBC (Ajzen, 1991), previous research supports the consideration of past behaviour as a predictor of behaviour (Bamberg & Schmidt, 2003; McEachan et al., 2011). It is argued that commuting is a frequently performed behaviour, as is the decision to leave immediately at the end of a shift. Therefore, the research framework guiding further exploration of this phenomenon should include the role of habit in the decision to leave immediately.

Finally, while the alternative frameworks to the TPB, such as TIB and IBM, presented environmental and situational influences, knowledge and skills to perform the behaviour and salience of the behaviour, the proposed theoretical framework does not explicitly address these constructs. In most instances, knowledge and skills to perform behaviour and environmental constraints are treated in a very cursory manner (Head & Noar, 2013). Salience of the behaviour is captured through the TPB consideration of behavioural beliefs, or the advantages and disadvantages of engaging in the behaviour. Knowledge and skills to perform the behaviour are captured through the PBC construct in the TPB. Environmental constraints, or external factors, as contemplated by the IBM and TIB respectively, are captured through control beliefs in the TPB. Hence additional consideration of these concepts is not necessary in the exploration of this phenomenon.

Considering the primary objective of the current program of research is to understand the key influences affecting workers' decisions to travel extended distances home from the worksite immediately after a shift block, the original conceptualisation of the TPB fits relatively neatly with this objective. Additionally, the parsimonious nature of the TPB means that it is more readily suited to augmenting the framework than frameworks like the TIB or IBM. The flexibility and structured approach the TPB offers provides a solid foundation to explore the issue of mine workers leaving immediately following shifts, and to guide the studies within this research program.

2.10 CHAPTER SUMMARY

Mine workers' driving behaviours have become more frequently researched since the increase in the mining effort across Australia. While some sites are implementing alternatives to driving, such as FIFO, workers are still driving considerable distances to home or the airport. To date, the author is unaware of an exploration of worker decisions post-shift which encourage the journey to commence immediately. In order to understand potential influences, this chapter explored why workers engage in DIDO work, some of the issues and risks faced during the journey, and the characteristics of long distance commuting within Australia; including individual pressures and organisational influences. Using this understanding, this chapter then provided an overview of key decision-making frameworks used to guide the exploration of this phenomenon. The chapter highlighted the exploratory nature of the research using these theories to guide the direction of that exploration. The next chapter will describe the methodological approach adopted for this research program, as well as the four studies which contribute to the overall research program.

Chapter 3: Research Program and Design

3.1 INTRODUCTION

This chapter describes the research design adopted to achieve the Research Objectives outlined in Section 1.5. These objectives are to *examine the key influences affecting workers' decisions to drive home from the worksite, immediately after a shift block*. The location of the target mine site is described in Section 3.2. This chapter then provides an overview of the research paradigm which seeks to guide analyses (Section 3.3). The orientation of the researcher is presented in Section 3.4. The research plan which describes the structure of the research program and provides an overview of each of the four studies is presented in Section 3.5, and Section 3.6 summarises the chapter.

3.2 LOCATION OF RESEARCH

Queensland, Australia is a unique example of a mining region given the high number of operations across a large geographical area. The state currently has 43 open-cut and 13 underground mines (Department of Natural Resources and Mines, 2016); the majority of these sites fall within a region referred to as 'the Bowen Basin' (see *Figure 3-1*). The Bowen Basin runs as far north as Collinsville, as far south as Theodore and as far west as Emerald. This region covers an area of 60,000 square kilometres (Bowen Basin Open Cut Geotechnical Society, 2013). "The Bowen Basin in central Queensland produces about 85% of the coal in Queensland, with most of it being exported through ports at Gladstone, Mackay and Bowen" (Rolfe et al., 2007, p. 138). The significant distances in the Bowen Basin result in a large number of mine sites sourcing workers from coastal communities. While there is a large proportion of FIFO workers in the Bowen Basin, the closest airports are still often a significant distance from the site, resulting in long driving commutes even to fly home.

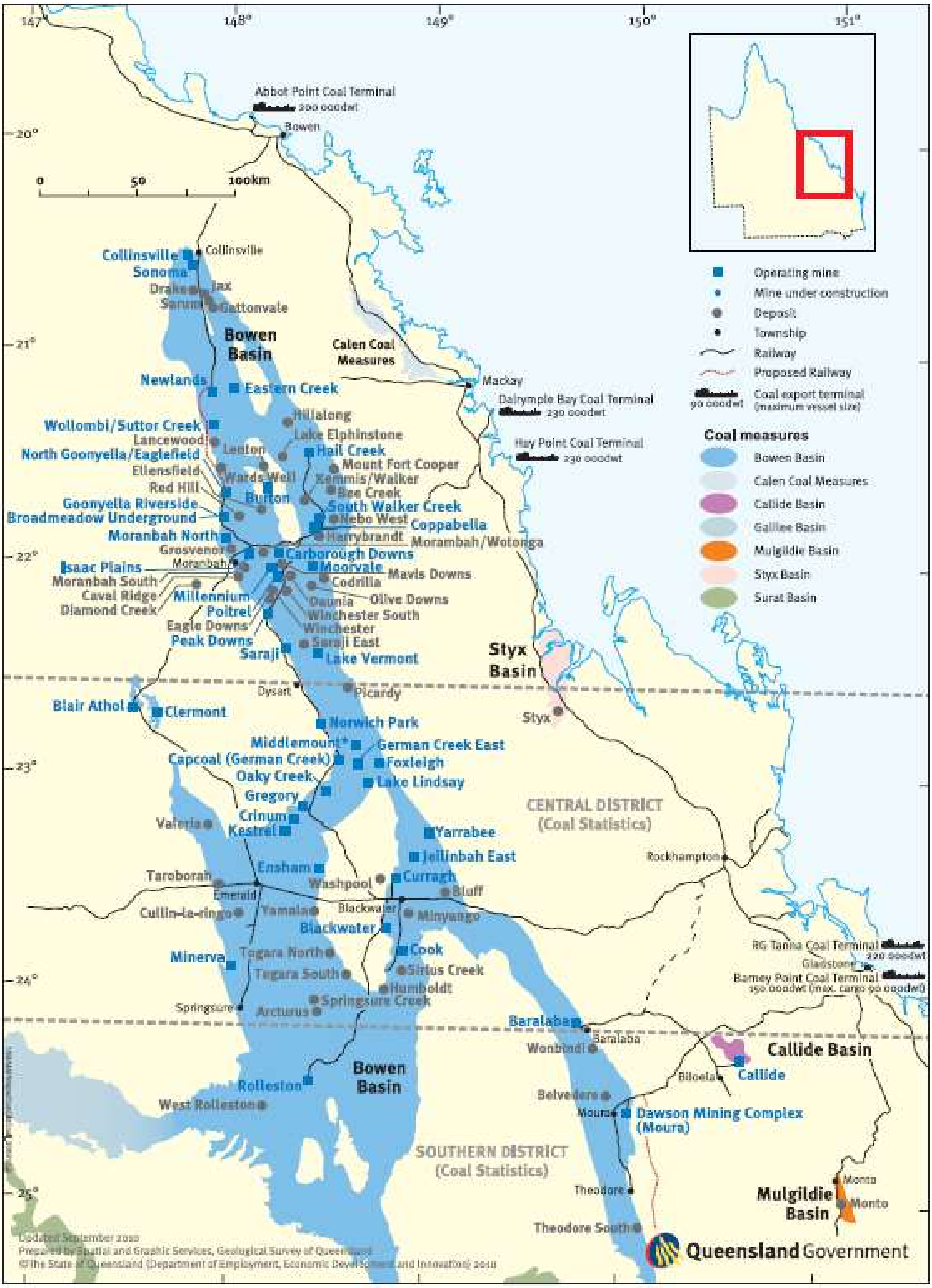

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Figure 3-1: **Central Queensland Coal Map**
(reproduced: Queensland Government, 2010)

The current research program focuses on one major site located in the Bowen Basin, approximately 4 hours from the east coast of Australia and approximately 2 to 4 hours from any major airport. The focal mine site employs approximately 600 workers. The closest settlement is almost 80kms away from the site, with approximately 13% of workers advising that they reside in that settlement. Hence the majority of workers drive long distances (over 150 kilometres) to either commute home or commute to other forms of transport, e.g., an airport. Section 2.5.1 describes that shift work and consecutive shifts are a significant predictor of near misses with major incidents occurring shortly after commencing the driving task (Åkerstedt et al., 2005; Di Milia et al., 2012; Di Milia et al., 2011). This risk is compounded due to sleep debt resulting from consecutive 12 hour shifts (Di Milia, 2006; Tucker et al., 1996). Given the risks identified in previous research associated with driving following shift work in rural and remote areas, the small number of daily commuters within the sample will be treated as a single group. Further, given the lack of investigation of commuting behaviour in previous research, the concentration on one site for the purpose of this research effort is justified for two key reasons: the research is able to explore the phenomenon with adequate depth, and if investigation covered multiple sites, the depth of the influence that on-site safety has on commuting behaviours would be lost. Secondly, the doctoral program had limited resources.

3.3 INTERPRETIVE FRAMEWORK AND RESEARCH PARADIGM

It is important for researchers to describe the framework in which the research was designed and analysis conducted. The interpretive framework provides an explanation of the researcher’s thought processes and the chosen direction, and underpins the data analysis and presentation of each chapter. The paradigm upon which the research is conducted serves to identify and guide the formulation of the theory by either deductive or inductive reasoning.

There are four dominant paradigms, namely positivism, postpositivism, constructivism and critical theory (Ponterotto, 2005). Simplistically, the dominant paradigms can be divided into two categories, functionalism and interpretivism. Functionalists are characterised by an objective, structured approach, and interpretivists by a more subjective, unintentional approach.

A paradigm guides the types of methods used throughout the research project and frames the assumptions made throughout the research process, the selection of methods and of participants in the study (Hall, 2008; Ponterotto, 2005). The following section justifies the selection of a mixed method approach to respond to the aim and key objectives of the research program.

3.3.1 Mixed method approach

Mixed method research advocates a more pragmatic approach to conducting research, seeking guidance from both functionalism and interpretivism by encouraging deduction, hypothesis testing, prediction, and confirmation, but still advocating exploration, discovery, hypothesis generation, and induction (Johnson & Onwuegbuzie, 2004). Mixed method research combines qualitative and quantitative approaches across a program of research. The benefit of adopting a mixed method approach from a methodological perspective is the ability of the researcher to overcome the weaknesses of one method and test a more encompassing array of research objectives. The outcome of each study informs the focus for subsequent studies (Haslam McKenzie, 2010). A mixed methodological approach does not neatly fall into either the functionalism or interpretivism category and is arguably avoided by researchers compelled by a particular paradigm (Hall, 2008; Johnson & Onwuegbuzie, 2004). Mixed method research has become more widely adopted as a technique, as researchers seek to integrate inductive and deductive approaches, which are typically confined to either qualitative or quantitative research. The adoption of a mixed method approach guides more rigorous investigations and more informed theory development. In line with the recommendations of Johnson and

Onwuegbuzie (2004, p. 17), the logic of inquiry will include the use of "induction (or discovery of patterns), deduction (testing of theories and hypotheses), and abduction (uncovering and relying on the best set of explanations for understanding one's results)".

3.3.1.1 Rationale for using a mixed method approach

A mixed method approach seems conceptually appealing due to the practical nature of this research, with interested parties from academic and industry backgrounds. As discussed earlier, the review of the relevant literature highlights the need for further exploratory investigation. Each stage of the research program guides further investigations. For example, for more exploratory research objectives, analysis assists to induce meaning from qualitative data to inform further the quantitative direction of the research effort, guided by theory. Furthermore, given the context-specific nature of this research, an exploratory approach seems appropriate considering the limited nature of previous research. Overall, the research questions and resulting objectives support the mixed method approach.

3.4 ORIENTATION OF THE RESEARCHER

The research approach adopted throughout this thesis is influenced, if subconsciously, by the experiences of the researcher. The researcher has experience in a workers' compensation and compulsory third-party claims environment in Queensland. Given this exposure, there may be some natural biases throughout the thesis; however, these biases were not readily identified by the author or the supervisory team. The application of a rigorous scientific approach and method to undertake this research program will limit the impact of potential biases.

3.5 RESEARCH PLAN

The following section briefly discusses the structure of the research program providing an overview of the entire project applying the mixed method paradigm. The Research Objectives presented in Chapter 1 are linked to each study and a rationale for the selection of each research method is provided. This chapter does not provide an overview of the hypotheses, research procedure, or participants involved in each study. An in-depth outline of each study's research procedure is presented in the associated research chapters (see Chapters 4 – 10).

3.5.1 Structure of research program

The current research extends and contributes to current academic and industry inquiry through four complementary studies. In line with the mixed method approach, each study complements subsequent studies to build further inquiry in order to achieve the Research Objectives presented in Chapter 1 (see *Figure 3-2*). *Figure 2-1* provides the foundational framework on which each study within the research program is based. The individual and organisational factors, as well as journey characteristics, are iteratively reviewed following each study to identify the most salient influences on the travelling workforce. How these factors are iteratively reviewed and investigated throughout the research program is illustrated in *Figure 3-2*. Study 1 provides an overview of crash circumstances and workers' compensation costs associated with journey claims in Queensland. Study 2a is an in-depth critical review of the relevant legislation, industry standards, and organisational policy documents. Study 2b compares and clarifies the outcomes of the critical review through a focus group session with eight site safety experts from the focal organisation. In line with the main objective of this research, the in-depth interviews in Study 3 *explore(s) the key influences affecting workers' decisions to drive home from the worksite, immediately after a shift block*. Finally, Study 4a and Study 4b statistically examine the relationships identified in Study 2 and Study 3 in order to determine the most salient and statistically significant influences, and the impact of those influences on the immediacy of the commuting decision. The combination of these four studies identifies relevant factors that influence workers' commuting behaviour, as well as the effect of various direct and indirect influences on the individual decision-making process associated with driving home immediately after shift.

Figure 3-2: **Structure of the research program and relationship of each study with key influences on the travelling workforce**

3.5.2 Study 1: Descriptive study

The objective of Study 1 is to examine the frequency and circumstances of motor vehicle crashes associated with the mining industry workforce in Queensland and to understand the costs incurred by industry as a result of workers' compensation journey claims. Using journey claim data for crashes associated with the mining industry in Queensland from June 2009 – July 2013, the analysis focuses on crash mechanism, time of crash, and location of crash to identify journey characteristics or situational factors of importance (Research Objective 3). This study also provides an overview of commuting and a measure of one financial impact within the Queensland mining industry to provide an objective measure of resulting consequences to identify more salient situational factors relating to commuting (Research Objective 1).

3.5.2.1 Descriptive study rationale

The literature discussed in Chapter 2 outlined the limitations of previous research in respect of DIDO workers. As such, there are few studies which have provided a thorough exploration of the commuting problem, particularly in respect to situational influences affecting journeys in line with *Figure 2-1*. Access to the workplace health and safety journey claim data allows the problem to be explored. Workers' compensation data were a highly relevant data source given that they were easily accessible and relevant to the workplace focus. Police crash data, for example, are less accessible (i.e., not publicly available) and do not necessarily reveal crashes associated with commuting journeys.

The primary collection purpose of the data used in Study 1 is the ongoing management of workers' compensation claims. The extent of analysis is limited given the secondary nature of the data. This study describes the circumstances and frequency in which commuting-related crashes are occurring in the mining industry in Queensland and provides insight into the potential journey characteristics or situational factors (see *Figure 2-1*) which may influence commuting decisions. Given the nature of the dataset, information about associated workers' compensation costs is also provided. Previous descriptive analyses have been limited to self-reported data which are sometimes collected a significant time after a crash. While the claims data are also self-reported, they are collected shortly following the crash. Moreover, the data may be more reliable given the statutory obligation of the injured worker to provide correct information.

3.5.3 Study 2a and Study 2b: Critical review and focus group

The objective of Study 2 is to understand and define the parameters surrounding external influences on workers' decisions in a Queensland context. This study is defined by two distinct parts. The first part of Study 2 is an in-depth examination of the relevant legislation, industry standards and organisational policy documents. This review provides a contextual understanding of the issue of commuting following shift blocks in the mining industry to explain what commuting behaviour is encouraged or discouraged under legislation and organisational policy. This contextual understanding contributes to the understanding of organisational influences on the travelling workforce (see *Figure 2-1*) by critically examining the legislation, national standards and industry policies which impact workers' commuting decisions. Industry-based measures and interventions employed by organisations to reduce fatigue risk related driving are also examined.

The second part of this study explores the outcomes identified in the first part of Study 2 and seeks confirmation of those findings via a focus group. The focus group consisted of eight site safety experts from the target site. The objective of adopting this qualitative method was to gain an understanding of the perceptions of organisational safety controls in respect of commuting in the Queensland mining industry. Both parts of Study 2 contribute to addressing Research Objectives 2 and 3. The literature review highlighted the need to examine the environment in which commuting behaviour occurs.

3.5.3.1 Critical analysis and review rationale

A key component of the environment on a mine site in Australia is the legislation and policy which govern the safety practices on site. To date, there has been no examination of the legislation and policy documents within this environment in respect to commuting following a shift or shift block. A primary aim of this research program is to identify opportunities for interventions (Research Objective 4), with a specific focus on the current legislative landscape in which commuting occurs. A review of the legislation and policy framework provides insight into the foundation of current behaviours in respect to commuting.

The purpose of adopting a systematic approach to reviewing the relevant legislation and policy documents was to identify the documents involved in the review, identify the scope of the review, and the means by which the documents were analysed. Given the vast amount of literature on safety practices within the Queensland mining industry, this structured approach was adopted to distil large amounts of relevant information into specific categories and themes used in the later stages of the research program, as well as in the discussion of Research Objective 4. The critical review provided a structured, informed framework used to *guide* Study 2b and the adoption of mixed methods to address a specific research objective.

3.5.3.2 Focus group rationale

The purpose of the focus group in the current research was to clarify the key points of difference between the legislation and an organisational view of safe commuting behaviour. The outcome of this comparison provides input into understanding the safety culture that exists on site and further defines the organisational factors presented in *Figure 2-1*. Focus groups seek the perceptions of a group of people through a planned discussion on a pre-defined topic (Sim, 1998). The primary purpose of this research method was to enable participants to explore the topic being studied (Peek & Fothergill, 2009). Thus the involvement of the researcher is often minimal and relatively unstructured (Peek & Fothergill, 2009). Focus groups enable the researcher to gather a variety of perspectives to explore the ideas and feelings of a sample group to uncover factors that influence opinions, and gain insights into a particular topic, where limited information is available (Breen, 2006; Peek & Fothergill, 2009).

The focus group method sought to confirm the information presented in the critical review and provide a brief overview of the problem from the perspective of safety professionals. To understand the key points of difference, the questions asked during the focus group session were generated from the outcomes of the critical review. A detailed explanation of the topics included in the interview schedule is presented in Chapter 6. Study 2a and 2b flesh out the perception of the issues associated with a commuting workforce within the industry.

3.5.4 Study 3: In-depth interviews

The objective of Study 3 was to gain an understanding of the key influences on workers' intentions in this context. As presented in Chapter 2, influences on individuals vary across contexts. In line with the main objective of this research, the in-depth interviews explore the interrelations and relationships between the *individual*, *social*, and *organisational* influences, and the role these play in workers' commuting decisions and resulting behaviour (Research Objectives 3 and 4). Given the mixed method approach adopted for the research program, the literature review and the outcomes of Study 2 were used to develop the interview protocol for Study 3. In line with a mixed method approach, the exploratory in-depth interviews were used to shape the quantitative component of the research and define a conceptual model to be quantitatively tested.

3.5.4.1 In-depth interviews rationale

It is suggested that the interview is one of the most widely used methods in social research (Hall, 2008). In-depth interviews obtain qualitative data from participants through *relatively* unstructured means (Monette, Sullivan, & DeJong, 2013). This method provides the interviewer with an opportunity to 'probe' the participant for further information (Gray, 2007). The goal of this method is to explore the thoughts and perceptions of the respondent, without pre-defined categories (Monette et al., 2013). The current research program requires in-depth exploration of the phenomenon given the limitations of previous research. As such, using in-depth interviews to explore this topic using theory to guide the exploration in a semi-structured approach provides a way to gain insights quickly. Using the framework presented in *Figure 2-1*, these in-depth interviews will contribute to a response to Research Question 4, identifying opportunities for interventions in line with Research Objective 4. Researchers continue with interviews until such time as they have reached *saturation*, which refers to the point in data collection where there is no significant incremental gain from further interviews (Singleton & Straits, 2005). This approach aligns with the research objective to explore influences on workers' decisions.

3.5.5 Study 4a, Study 4b, and Study 4c: Survey

The primary objective of Studies 4a, 4b, and 4c is the statistical exploration of the relationships between constructs identified to determine the most salient and statistically significant influences and the impact of those influences on the immediacy of the commuting decision. In line with Research Objective 3 and based on the conclusions drawn in Study 1, Study 2 and Study 3, a series of hypothesised relationships were quantitatively tested. The data for the quantitative component of this study were collected using a survey instrument developed from (1) the outcomes and analysis of the critical review and a focus group; (2) the in-depth interviews; and (3) the theoretical underpinnings of relevant psychological frameworks discussed in Chapter 2 (e.g., the TPB). This study draws together the outcomes of all four studies (Research Objective 3) in an attempt to identify opportunities for interventions (Research Objective 4) which may be beneficial to address the issue of commuting home from site immediately following a shift block.

3.5.5.1 Survey rationale

In line with a mixed method approach, the data for the quantitative component of this study were collected using a cross-section survey instrument developed from (1) the outcomes of the overview of current crash information drawn from the journey claim data; (2) the outcomes of the critical analysis and review; (3) the in-depth interviews; and (4) the theoretical underpinnings of relevant psychological frameworks (e.g., TPB). The quantitative component of this research was adopted to test and further explore the findings of the previous study across a large number of respondents. The survey statistically explores and operationalises the identified influences to determine the relationships and interrelationships between the key elements identified in previous studies within the research program. An understanding of these relationships provides a structured approach to statistically identify opportunities for interventions using the most salient influences. This study specifically responds to Research Question 5 which ultimately supports Research Objective 4, to identify opportunities for interventions.

3.5.6 Overall research objective

The core research objective of this program was to examine the key influences affecting workers' decisions to drive home from the worksite immediately after a shift block and to identify opportunities for interventions. Each study in this program of research has been designed to gain an understanding of individual, social, organisational and situational factors contributing to this decision. By considering these four factors using a mixed method approach, this research will form the basis of a holistic understanding of factors that influence commuting home immediately after shifts and will contribute to identifying opportunities for interventions to change this behaviour.

3.5.7 Ethical considerations for the research program

Applications for ethical approval were submitted for each stage of the research program. Applications were not finalised until just prior to the data collection effort, given the research program was a mixed method approach with each study building on the results of the previous study. Relevant application numbers are noted in study chapters. Overall, however, there were some program-level ethical considerations, which influenced the overall design of the research program.

This research was conducted on a single mine site. The predominant focus of the research was safety-related concepts. Throughout the research, participants were asked to talk about engaging in risky behaviours and behaviours that may not be considered to be consistent with organisational policy. Confidentiality was important given that the behaviour of the worker may contravene site policies. Complete anonymity was not possible because some organisational contacts were aware of participation due to organisational and scheduling requirements. However, as outlined in the application for ethical clearance, only aggregated data was provided to the site, thus maintaining confidentiality. At the commencement of all studies, participants were advised that only aggregated data would be provided to their employer and participants were provided with the researcher's contact details. When collating data and categories, small subsets of cases were reviewed and the data were aggregated to higher categories to ensure confidentiality. Finally, informed consent was sought verbally.

3.6 CHAPTER SUMMARY

Chapter 3 described the aims of the research project and provided an overview of the research questions and methodology for all studies in this research program. This chapter provided a brief outline of the geographical location of the research and an overview of the type of organisation in which the research occurred. This chapter also described the research lens through which this program was conducted, the orientation of the researcher, and outlined the mixed method approach to each complementary study.

The following chapter reports on the results of Study 1 of the research program. Through the analysis of Queensland workers' compensation journey claims data for claims between June 2009 and July 2013, Study 1 provides an understanding of the circumstances in which crashes occur, as well as an understanding of the costs associated with these claims from a compensation perspective.

Chapter 4: An Analysis of Queensland Workers' Compensation Journey Claim Data

4.1 INTRODUCTION

Chapter 4 reports on the first study of the research program. The aim of this study was to provide an overview of workers' compensation journey claim data for crashes associated with the mining industry workforce in Queensland from June 2009 – July 2013. There is little known about the circumstances of commuting crashes and resulting costs in the mining workforce, given the limited research examining driving-related commuting. The analysis of Queensland workers' compensation claims data provides self-reported data regarding the nature of crashes, including mechanism, time and location in order to understand the circumstances in which driving-related commuting crashes occur. An understanding of these circumstances identifies journey characteristics or situational factors which may influence the immediacy of workers' commuting behaviours. Study 1 of this research program also examines the workers' compensation claims costs associated with journey claims. Research Objective 1 was addressed by examining secondary data provided by Workplace Health and Safety – Queensland.

This chapter provides an overview of Queensland's workers' compensation scheme and journey claims in Section 4.1.1. Section 4.2 presents the study specific questions which seek to address Research Question 1. The method and analysis are presented in Section 4.3. The results of Study 1 provide an overview of the sample characteristics, the crash characteristics and resulting workers' compensation costs (Section 4.4). Section 4.5 provides a discussion of the results of Study 1 by responding to the study specific questions; Section 4.6 is the chapter summary.

4.1.1 Workers' compensation in Queensland

The Queensland Workers' Compensation Scheme provides compensation to those injured while at work – where work was a significant contributing factor to the incident. Compensation under the Scheme includes medical, rehabilitation expenses and wage expenses. From an Australian perspective, Queensland is a unique example of workers' compensation, as it is one of three states and territories in Australia to provide cover to workers for injuries sustained during the journey to or from work (Finance and Administration Committee, 2013). A worker is covered if the event (injury) occurs during the journey between a worker's home and place of employment – provided there has not been a substantial delay before the worker starts the journey, or a substantial interruption of, or deviation from, the journey[6] (Finance and Administration Committee, 2013). The provision of compensation means that those involved in motor vehicle crashes on their way to and from work can claim compensation to cover loss incurred. WorkCover Queensland and a number of self-insurers manage workers' compensation in Queensland. Most importantly, in the Queensland scheme, employment does not need to be a contributing factor to the injury in respect of a journey claim. Queensland operates a "no fault" journey claim scheme, which means claims relating to journeys to and from work, provided they fall within the definition of the legislation, are covered for medical, rehabilitation and wage expenses (Finance and Administration Committee, 2013).

Return to Work (RTW) is a significant consideration for employers and insurers. The greater the time a worker spends away from their place of employment and performing their duties (time lost), the greater the downtime for the business. Time lost claims are defined as those claims where there is a period of time away from normal employment as a result of the incident or injury (Q-COMP, 2012). There are also factors associated with training new employees if the injured worker fails to return to the same position or fails to return to work at all. From an insurance

[6]Section 36(2) of the Workers' Compensation and Rehabilitation Act 2003.

perspective, an employee's positive return to work is important to limit exposure to past and future economic loss expenses (e.g., lost wages), as well as for the ongoing psychological health of the worker. Return to work timeframes, as well as claims-related compensation expenses, provide an overview of one measure of the financial impact associated with journey-related road crashes, as well as positive outcomes associated with rehabilitation post-injury.

There were approximately 80,000 Queensland workers' compensation claims accepted in 2011/12 (Q-COMP, 2012) with an average claim cost of $12,427.00 (Q-COMP, 2012). Claims accepted during this period resulted from on-site workplace incidents and journey claims. Claims resulting from fatalities were represented by 0.1% of the sample (n=80). Time lost claims represented approximately 45% of claims (n=36,000). Approximately 35% of claims did not result in time lost (n=28,000), and of those injured workers who spent time away from work, 96% returned to some type of employment.

4.2 STUDY AIM AND RESEARCH OBJECTIVES

The current study has two parts. Part one explores the circumstances of commuting related crashes in the mining industry over the period 1 July 2009 to 30 June 2013. While workers' compensation data is an incomplete picture of the problem, it presents an opportunity to examine specific costs associated with work journey related crashes and the need for further examination of driving-related commuting in the mining industry in Australia. The first part of Study 1 is an exploratory study designed to describe driving-related commuting crash circumstances during the sample period. Part two of this study explores the compensation costs associated with journey claims in the Queensland mining industry in order to understand the RTW outcomes and costs. Given the similarities between legislation and functions across the mining industry in Australia, this chapter presents results that encompass all mining industry segments. The second part of Study 1 explores cost per claim, including the average compensation paid, the amount of time lost, and the number of workers who returned to work following their injury. Given the exploratory nature of this study, it responds to a series of study specific questions rather than hypotheses. The results of this study were used to identify potential risks associated with commuting in order to identify those characteristics of the journey which may impact on the decision to commute immediately following shifts. The study also describes the financial impact of these crashes through examining compensation costs, providing an objective measure of the consequences associated with commuting related risks (situational factors). Understanding the financial implications further supports the need for this research and assists in identifying those situational factors which may have a stronger influence on commuting decisions due to associated consequences.

4.2.1 Commuting crash circumstances

The first part of this study addresses Research Question 1: *what are the circumstances in which crashes are occurring during mine workers' journeys home from the mine site?* The study provides an examination of crash circumstances and relies on data reported by the person involved in the crash to a claims representative of the workers' compensation authority in Queensland. Study 1 explores this self-reported data to identify common crash circumstances associated with a sample of journey claims in the Queensland mining industry.

The literature review presented in Chapter 2 identified a number of risks that may be encountered while commuting from mine sites. These risks include: (1) fatigue; (2) monotony/distraction; (3) wildlife and livestock; (4) shift length/time of driving; and (5) the location of the mine site. This section describes the crash mechanism, the direction of travel, the type of vehicle (e.g., car or motorcycle) being driven at the time of the crash, and some other factors of interest based on the literature investigating the DIDO workforce. These factors include time of day, journey remoteness, fatigue and distracted driving (see Section 2.5). As such, this study seeks to respond to the following questions:

Study Question 4.1: What are the risk factors when travelling from worksites after shifts and when do these risky situations occur?

Study Question 4.2: What time of day or night are drivers and riders more likely to be involved a crash?

The time of day and night categorised for the purpose of examining timing was undertaken in line with normal shift hours in the Bowen Basin identified in previous research (Di Milia, 2006). Categorising shift start and finish times in line with previous research, as a representation of the Queensland mining industry, was used as a proxy for identifying those workers travelling following night shifts and day shifts. Based on this categorisation, Study 1 compares night time (18:00 – 05:59) and day time (06:00 – 17:59) claims. These times align with approximate shift times confirmed by the target mine site, as well as the average shift start and finish time for research examining shift workers in the Bowen Basin (Di Milia, 2006).

Given the nature of the workforce, the length of time of a regular shift and the variation in the hours these workers sleep across a four-week period, fatigue is a key risk and an important factor in this research. While the risk identified is associated with both shift length and time driving, there are limitations in respect to secondary data, and no data is available in respect to the shift length before the crash occurred. However, fatigue will be identified as a contributor if reported, but there may be under-reporting of fatigue-related crashes given the reliance on self-reported data. This limitation is considered in the discussion of the data. Nevertheless, it is important to explore the contribution of fatigue to these workers' compensation journey claims by examining:

Study Question 4.3: What percentage of these crashes are self-reported as fatigue-related?

Fatigue and distraction are separated out in the literature, despite being intrinsically linked (see: Beanland et al., 2013). Distraction is also closely linked to the monotonous nature of the roads these workers travel. As demonstrated in the literature review, distraction is often a crash factor, with some studies suggesting it is a key contributor to a crash in approximately 58% of cases (Beanland et al., 2013).

The present study examines distraction as a contributor to commuting-related crashes by exploring:

> *Study Question 4.4: What percentage of these crashes are self-reported as distraction-related?*

The remote location of most mine sites means that these workers are travelling monotonous roads for significant distances (see Section 1.2). Research reports that time in monotonous driving tasks decreases the level of driver vigilance (Schmidt et al., 2007). Remote Australian roads are typically long and straight, adding to monotony. The location of mine sites and the distances travelled supports further examination of remoteness of crashes:

> *Study Question 4.5: How many of these crashes are occurring in remote locations?*

While this question does not specifically address the risk associated with the particular location of the mine site, it does address the frequency of crashes occurring within a remote or rural area in the context of journey claims in the mining industry.

An additional risk factor associated with travelling on rural and remote roads is wildlife and livestock (see Section 2.5.2.1). Anecdotal evidence suggests that the involvement of animals in crashes typically occurs during dawn, dusk and night time. Therefore:

> *Study Question 4.6: What is the involvement of animals in crashes and at what time are these crashes occurring?*

4.2.2 Workers' compensation costs

The second part of this study explores the compensation costs associated with Queensland workers' compensation journey claims, including the number of days away from work. Given the focus on positive RTW outcomes, the two key aspects of compensation costs and time off are explored in conjunction with RTW outcomes. This descriptive study addresses Research Question 2: *what is the cost of motor vehicle crashes associated with the drive-in/drive-out workforce in Queensland from the perspective of workers' compensation costs incurred by industry?*

4.3 METHOD

The following sections describe the overall study design. A detailed overview of the primary purpose of the data used in Study 1 is provided. The method also details data cleaning and treatment of missing data. Finally, this section describes the method applied for data coding, analysis and relevant ethics considerations.

4.3.1 Workers' compensation data collection

The Queensland Workers' Compensation Regulator (Q-COMP) and Workplace Health and Safety – Queensland provided workers' compensation journey claims data at the written request of the researcher. The Queensland Workers' Compensation Regulator monitors all workers' compensation claims in Queensland. The primary purpose of the data is to manage the progression of a claim. The claim data is collected when the person making the claim ("the claimant") contacts the insurer and provides information about an incident which has caused injury – including time, location, description of incident, nature of injuries and a medical certificate. The applicant has 7 days to report the crash following its occurrence. The information provided to the regulator is standardised and each insurer must meet specific reporting requirements. The dataset includes those who have made a claim as a result of an incident; however, it does not include those incidents that have not been reported or if the relevant insurer has not been notified (i.e., a compensation claim has not been lodged which might occur if the worker is not aware of their right or need to claim compensation).

4.3.2 Data cleaning and missing data

The dataset provided contains 533 cases of injuries which occurred during the period June 2009 – July 2013. The data were cleaned and cases were analysed if they related to (1) crashes occurring in Queensland, and (2) crashes involving a car or motorcycle. Incidents involving pushbikes, pedestrians and non-vehicle related (e.g., lifting luggage from bus) journey claims were removed from the dataset, resulting in

282 relevant cases. The dataset was also manually coded to reveal crash circumstances, location of crashes using the Accessibility/Remoteness Index of Australia (ARIA), and if the crash occurred during the day or night.

4.3.2.1 Identifying crash circumstances

The dataset provided detailed crash descriptions. The descriptions consisted of one to two sentences which provided details about the crash circumstances. Each description was read and analysed to support inclusion or removal of individual records. Crashes were excluded if the person making the claim was not in a vehicle or on a motorcycle at the time of the crash. For example, *"lifting bag into overhead locker on plane trip home"* (Male, 65 – 69 years of age, Technicians and Trades Workers) was excluded for the purpose of the analysis, as the injury did occur as a result of a motor vehicle crash.

The descriptions were standardised into categories to record information including (1) direction of travel (e.g., to work, from work or unknown), and (2) type of incident (e.g., single vehicle/lost control, distraction/not paying attention, hit animal/animal on the road, actions of another driver, debris on road/road issue and fatigue). Each case was manually coded for these categories to assist with further analyses. Categories were determined by thematic analysis conducted while reviewing the description of each incident (see Table 4-1). A new category was added when the description provided did not fit within the existing categories (Howitt & Cramer, 2014). Following the initial coding, the categories were reviewed to ensure they were mutually exclusive and the coding was reviewed to ensure validity. In instances where there was a double up, the primary reason for the crash was used. For example, *"travelling to work hit kangaroo lost control car rolled over landing in gully on roof"* (Male, 45 – 54 years of age, Labourer) would be coded as 'hit animal, animal on road as opposed to single vehicle, lost control'.

As described in Section 4.4.1, Queensland operates a "no fault" journey claim scheme. As such, the description provided in the data may not always describe crash causation. Hence there were instances where there was insufficient information to determine an appropriate code. For these cases, the direction of travel or type of incident was recorded as unknown. When considering crash circumstance in any analysis, 131 of these unknown cases were excluded. Missing values were excluded pairwise. It is noted that missing values were only prominent where coding from the crash description provided limited or no information to be analysed, for example journey direction and crash mechanism. The results section of this chapter presents analyses where cases have been excluded on the basis of missing data.

Table 4-1.

Coding description for crash mechanism

Code	Definition	Example description
Single vehicle/lost control	No vehicle, pedestrian, animal or road issue identified as a key cause of the crash	*Riding motorbike home from work, fell off motorbike in middle of corner* (Male, 25 – 34 years of age, Machinery Operators and Drivers)
Distraction/not paying attention	Driver (claimant) failed to obey traffic signs resulting in the crash or distraction identified as the key cause of the crash	*Driving to work, collided with car in front* (Female, 45 – 54 years of age, Professionals)
Hit animal/animal on the road	An animal (livestock, kangaroo etc) identified as the key cause of the crash	*Whilst travelling to work I was hit by a kangaroo cutting diagonally across the road, at the time I was riding my motorcycle directly to work* (Male, 45 – 54 years of age, Machinery Operators and Drivers)
Actions of another driver	Another vehicle (car, motorcycle etc) failed to give way or stop causing the crash	*Driving to work when a car went through a stop sign without stopping and I collided with the front passenger side of the car* (Male, 45 – 54 years of age, Machinery Operators and Drivers)
Debris on road/road issue	Something on the road (e.g., oil) or some other road issue identified as the key contributor of the crash	*Travelling home from work on my motorbike, rear wheel caught in rute (sic), washed out, and flung bike sideways, threw me onto the bitumen, on my left side* (Male, 35 – 44 years of age, Technicians and Trades Workers)
Fatigue	Driver (claimant) falling asleep/micro sleep is identified as the key cause of the crash	*Rolled car whilst driving after a microsleep* (Male, 55 – 59 years of age, Machinery Operators and Drivers)
Unknown	No information to identify the cause of the crash	*Driving home from work – motor vehicle accident* (Male, 25 – 34 years of age, Machinery Operators and Drivers)

4.3.2.2 *Location of crashes*

An identifiable risk associated with commuting from mine sites is the remoteness of the site. The data provided by WPHS included the approximate postcode of the crash. The postcodes were segmented using the ARIA classification. The remoteness classification or ARIA was developed by the Australian Bureau of Statistics (ABS) to allow the categorisation of postcode for statistical comparisons between city and country. Categories are determined by the remoteness of the location from goods and services (ABS, 2003; Census Paper No. 03/01: 1). The ARIA provides five regional categories for geographical segmentation. These geographical regions are: (1) Major Cities of Australia, (2) Inner Regional Australia, (3) Outer Regional Australia, (4) Remote Australia, and (5) Very Remote Australia. These geographical regions are commonly used as geographical segmentations, particularly when considering crashes occurring in remote locations (see: Steinhardt et al., 2009).

4.3.2.3 *Time of day*

Research indicates that there are a number of risks associated with travelling at different times of the day: for example, there are significant impacts on a person's ability to function appropriately when activities are performed during normal sleeping hours (Di Milia, 2006), and an increased crash risk involving animals around dawn and dusk (Rowden et al., 2008). However, the categorisation of driving risk hours varies between these two risks. As such, to aid discussion, this thesis categorises time in respect to shift finishing times (see Section 2.5.1.1).

4.3.2.4 *Mining industry segment classification*

There are significant similarities between mining industry sectors, demonstrating the need to understand the commuting issue across the industry. The data provided by WPHS classified employing organisations using the Australian and New Zealand Industrial Classification (ANZSIC) 2006. The ANZSIC 2006 identifies groups of businesses which undertake similar economic activities and is used for the production and analysis of industry statistics (Australian Bureau of Statistics, 2006a). This classification enabled the segmentation of the data into five categories, including: (1) coal mining, (2) oil and gas extraction, (3) metal ore mining, (4) non-metallic mineral mining and quarrying, and (5) exploration and other mining support services.

4.3.3 Statistical analyses

Data were analysed using IBM SPSS Version 22.0. Given the nature of the dataset and the objectives of this study, the data were analysed using frequencies and cross tabulations. Cross tabulations revealed small cell sizes in most cases; therefore, further statistical analyses (e.g., chi-square) were not possible.

4.3.4 Ethical clearance

Approval was sought from the Queensland University of Technology Human Research Ethics Committee for an exemption. The exemption was granted on 11 February 2014 and the relevant approval number is 1400000086.

4.4 RESULTS

The results of analysis of the workers' compensation data are presented as they relate to the study specific research questions. Crash characteristics are presented first. These results report the location, time, and recorded mechanism of the crash. Workers' compensation costs are then examined. These analyses are all descriptive in nature, so frequency data and graphs are used to describe the findings.

4.4.1 Sample characteristics

Based on manual data coding, there were 282 journey claims in the Queensland mining industry accepted between July 2009 and June 2013 with most of these claims coming from the coal mining sector (n=138; 49.0%), even though that sector constitutes only approximately 32% of the mining industry in Queensland

(Australian Bureau of Statistics, 2006b). Exploration and support services represented the second highest frequency of claims (*n*=65; 23.0%). In 2006, 33% of workers across the mining sector in Queensland worked in metal ore mining (Australian Bureau of Statistics, 2006b). Despite its being the largest sub-industry, the number of claims seen from this sector was low (*n*=44; 15.6%). Other mining sub-industries represented include non-metallic mineral mining and quarrying (*n*=29; 10.3%), and oil and gas extraction (*n*=6; 2.1%).

Machinery operators and drivers represent the highest number of claimants by occupation (*n*=145; 51.4%). The remaining claims are represented by occupation, with labourers (*n*=43; 15.2%) and technicians and trades workers (*n*=40; 14.2%) contributing to the number of claims. The remaining numbers are from white-collar workers such as clerical and administrative workers (*n*=23; 8.2%), professionals (*n*=20; 7.1%), and managers (*n*=10; 3.5%).

Table 4-2.

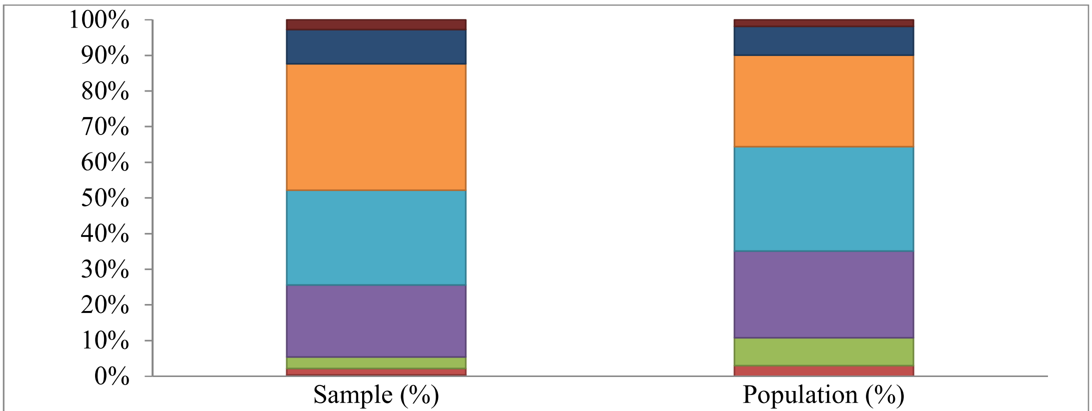
Age and gender of claimants

	Gender			
	Male		Female	
Age (in years)	***n***	**%**	***n***	**%**
15 – 19	7	2.9	1	2.4
20 – 24	20	8.3	7	16.7
25 – 34	79	32.9	21	50.0
35 – 44	67	27.9	8	19.0
45 – 54	52	21.7	5	11.9
55 - 59	9	3.8	0	0.0
60 - 64	5	2.1	0	0.0
65 - 69	1	0.4	0	0.0
Total	240		42	

Analysis of Confidential Unit Record Files (CURF) from the 2006 Australian Census indicate that in Australia approximately 85% of those working in the mining industry are male (Australian Bureau of Statistics, 2006b). The sample reported 85%

of males claiming compensation as a result of a crash during their journey to or from work(n=240). As such, the predominance of males is generally representative of the mining industry working population.

Claimants aged between 25 and 34 years are the most frequently represented age group in the sample (n=100; 35.5%) (see Table 4-2), revealing a 10 percentage point disparity between the sample and the population parameters (see *Figure 4-1*). Ages falling in a range greater than the age of 35 are under-represented in this sample when compared with the proportion of Australia's mining population (Australian Bureau of Statistics, 2006b). Conversely, claimants aged 34 years and younger were over-represented within the sample, possibly demonstrating a higher crash rate in these age groups. While the comparisons drawn are between a Queensland-based sample and the Australian mining population, there is no indication that the distribution of age and gender within Queensland would be different from the Australian mining population.



	Sample (%)	Population (%)
15 - 19	2.8	1.9
20 - 24	9.6	8
25 - 34	35.5	25.7
35 - 44	26.6	29.3
45 - 54	20.2	24.3
55 - 59	3.2	7.8
60 - 64	1.8	3
65 - 69	0.4	0

Figure 4-1: **Age comparison: sample vs. population of mine workers in Australia**[7]

[7] Data from CURF from the 2006 Australian Census (Australian Bureau of Statistics, 2006b). More recent data was not available for analysis in a microdata format for analysis.

4.4.2 Crash characteristics

This section reports on crash circumstance relating to the journey claims in accordance with part one of the study. Of the 282 cases examined, there were seven fatalities. The results show that crash claimants were driving cars (*n*=223; 79.1%) or motorcycles (*n*=59; 20.9%). In the sample of 282 cases, direction of travel was identified for 182 cases. Of these 182 cases, 108 (59.3%) claims related to injuries sustained while travelling to work and 74 (40.7%) claims related to injuries sustained while travelling home after work. Given crash reporting occurs when an injured party makes a claim for compensation, there may be under-reporting of crashes during the homeward journey. The under-reporting may be associated with the employer's awareness of crashes occurring on the way to work because the worker is due to commence a shift. The employer is obliged to report an incident to the insurer. By comparison, the employer may not be aware of crashes occurring on the journey home as the employee may not be aware of their ability to claim for compensation for homeward journeys and therefore may not advise the employer of the crash.

4.4.2.1 Crash location

Figure 4-2 identifies that the highest number of crashes occur in outer regional Australia (*n*=103, 37%) within the sample of 282 cases, with most crash locations being in regional areas (*n*=204, 73%). It is assumed that crashes occurring in major cities of Australia are associated with professional workers commuting to head offices of mining companies (*n*=74; 26%). However, it should be noted that postcode 4000 (Brisbane CBD) was used as a default entry for missing data. Unknown (*n*=4; 1%) locations made up 1 per cent of the data. As such, there is an over-representation of the major cities of Australia and an under-representation of unknown regions. Inner regional Australia represented 22% of crashes resulting in a workers' compensation claim in the relevant period. Finally, 14% of journey claims between 1 July 2009 and 30 June 2013 occurred in remote Australia (*n*=37; 13%) and very remote Australia (*n*=2; 1%).

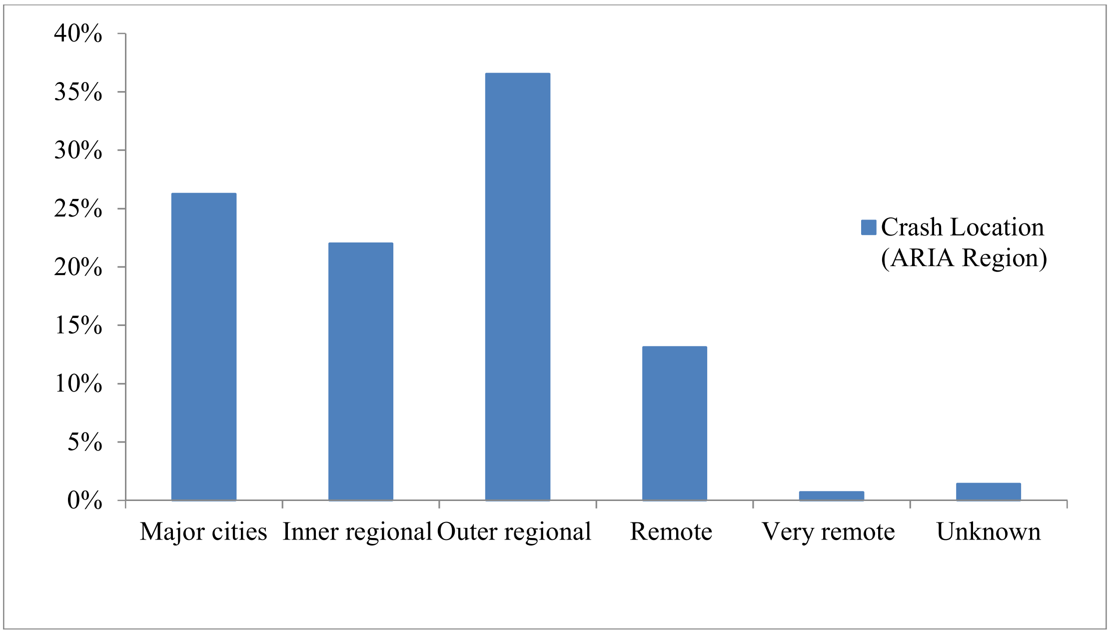


Figure 4-2: **Sample crash location for mining industry journey claims (ARIA Region)**

4.4.2.2 Time of crashes

The data report that a larger proportion of crashes occurred during the daylight hours (*n*= 149; 52.8%). However, a high number of crashes occur between midnight and 6.00am (*n*=90; 31.9%). This finding is closely followed by 6:00am to midday (*n*=78; 27.7%). The remainder of crashes resulting in a compensation claim occurred between midday and midnight, with 25.2% (*n*=71) of crashes occurring between midday and 6.00pm, and the final 15.2% (*n*=43) occurring between 6.00pm and midnight. The high percentage of claims falling between midnight and 6:00am may be due to 00:00 being used as a default to accommodate for missing data, resulting in this time period being over-represented in the data. Figure 4-3 reports the distribution of crashes across a 24-hour period. As can be seen, the overall pattern is consistent with previous research describing a morning and afternoon peak in crash numbers corresponding with peak hour traffic (S. S. Smith et al., 2008).

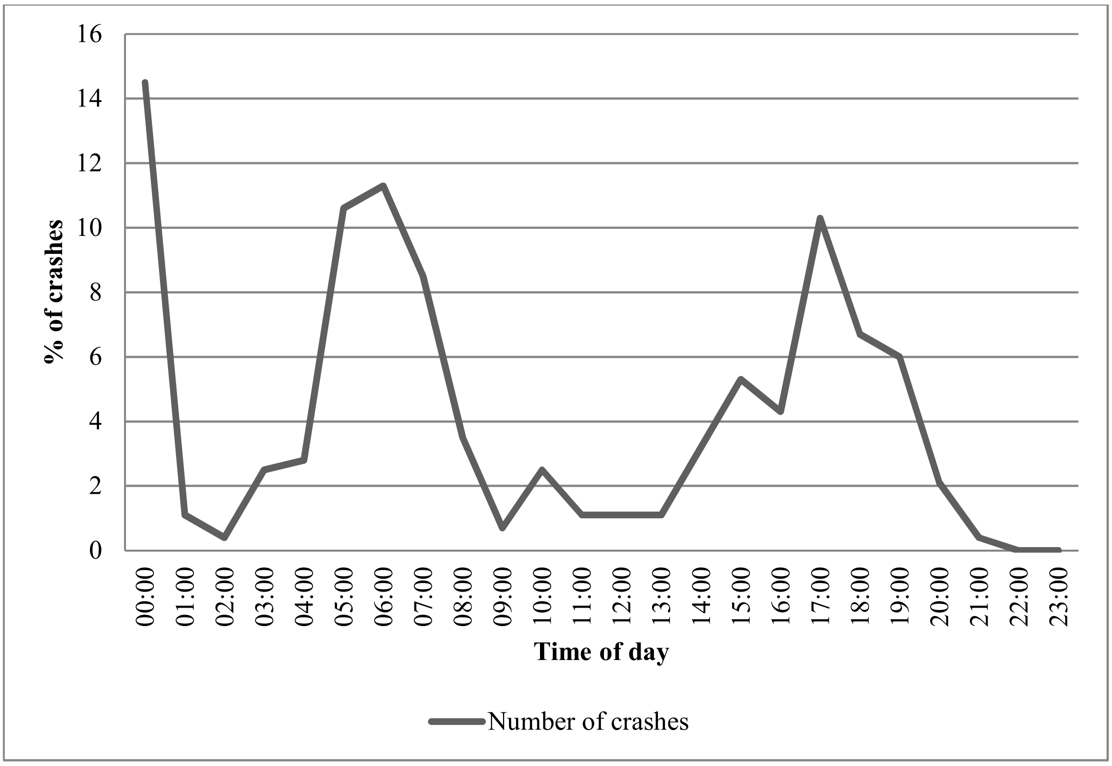


Figure 4-3: **Crashes by hour of day for mining industry journey claims**

4.4.2.3 Crash mechanism

Of the 282 relevant claims for compensation, 131 cases provided a description for crash mechanism that was unable to be coded (see Table 4-1) and were not included in the analysis. Of the 151 remaining cases, Table 4-3 reports collisions with animals (29%), single vehicle crashes (24%), and the actions of another driver (31%) as the most notable contributors to crash mechanism. Car drivers were involved in more crashes involving animals on the road, compared with motorcycle riders. For those categories where the driver was at fault for the crash (i.e., fatigue, distraction, single vehicle), a single vehicle losing control is the most highly represented, with 67% of claimants driving a car at the time of the crash (see Table 4-3). Finally, distraction/not paying attention, debris on road/road issue and fatigue were crash mechanisms that were not as frequently identified as the key cause of the crash, representing 17% of all crash types. When comparing vehicle type and these three crash mechanisms, a larger percentage of car drivers were involved in fatigue-related and distraction-related crashes. Motorcycle riders were involved in the majority of crashes where debris on the road or a road issue was identified as the key contributor to the crash (see Table 4-3).

Table 4-3.

Crash mechanism: by car and motorcycle

	Crash mechanism (*N*)*					
	Fatigue	**Debris/ road issue**	**Actions of another driver**	**Animal**	**Distraction**	**Single vehicle**
Car (*n*=108)	9	1	37	29	7	25
Motorcycle (*n*=43)	0	7	10	14	1	11
Total (*n*=151)	6	8	47	43	8	36

**151 cases were considered as this variable was manually extracted from description of crash qualitative data. There were instances where this information was inconclusive; therefore, the crash mechanism was recorded as unknown.*

Age group and crash mechanism

Table 4-4 describes the distribution of crash mechanism (where identified) amongst age groups. Crashes where the actions of another driver were the primary cause represent the highest reported crash mechanism for age group 25 – 34 years (38%). For categories where the driver was at fault for the crash (i.e., fatigue, distraction, single vehicle), crashes occurred more frequently in the age groups of 20 – 24 and 25 – 34 years (*n*=34; 64%) – with single vehicle crashes being the largest contributor (see Table 4-4). Fatigue-related crashes are most noticeable in the age group 20 – 24, representing 55% of the total number of crashes of this type. However, the sample size is quite small (*n*=9). Table 4-4 reports the distribution of crash mechanism amongst age groups within the sample. Approximately 80% of journey claims were made by those between the ages of 25 and 54 years old.

Table 4-4.

Age group (in years) and crash mechanism

	Crash mechanism (*N*)*					
Age (in years)	**Fatigue**	**Debris/ road issue**	**Actions of another driver**	**Animal**	**Distraction**	**Single vehicle**
15 – 19 (*n*=3)	0	0	1	2	0	0
20 – 24 (*n*=18)	5	0	3	2	1	7
25 – 34 (*n*=55)	2	1	21	12	3	16
35 – 44 (*n*=35)	0	3	9	13	0	10
45 – 54 (*n*=33)	1	4	11	12	3	2
55 – 59 (*n*=6)	1	0	2	2	0	1
60 – 64 (*n*=1)	0	0	0	0	1	0

**151 cases were considered as this variable was manually extracted from description of crash qualitative data. There were instances where this information was inconclusive; therefore, the crash mechanism was recorded as unknown.*

ARIA region and crash mechanism

As reported in Table 4-5, crashes where actions of another driver were the primary cause had an equal chance of occurring in more populated regions (e.g., major cities and inner regional) and rural areas (outer regional and remote) of Queensland. As expected, crashes involving animals were more common in regional areas, with 79% of all crashes involving an animal occurring in inner and outer regional Queensland. Crashes where fatigue were identified as the key contributor to the crash were also more common in the regional areas (89%); however, the sample size was quite small.

Table 4-5.

ARIA region and crash mechanism

ARIA region**	Crash mechanism (*N*)* Fatigue	Debris/ road issue	Actions of another driver	Animal	Distraction	Single vehicle
Major cities (*n*=24)	0	0	12	5	1	6
Inner regional (*n*=36)	1	1	11	13	2	8
Outer regional (*n*=63)	6	1	17	21	4	14
Remote (*n*=26)	2	6	6	4	1	7
Very remote (*n*=1)	0	0	0	0	0	1

**151 cases were considered as this variable was manually extracted from description of crash qualitative data. There were instances where this information was inconclusive; therefore, the crash mechanism was recorded as unknown.*
***One case was in an unknown area and was excluded from the analysis.*

Time of day and crash mechanism

Section 4.4.2.2 reported a peak in crash numbers in the morning and afternoon. Table 4-6 further explains these peaks by providing an understanding of crash mechanism. The sample describes a high number of crashes involving animals (*n*=43; 29%), with 74% of crashes of this type occurring between 6.00pm and 6.00am. This finding may be associated with animals feeding at the roadside between dawn and dusk. The distribution of single vehicle crashes was fairly consistent throughout a 24 hour period (see Table 4-6). Crashes involving the actions of another driver as the primary contributor occurred more frequently during daylight hours (*n*=33; 70%). This finding is consistent with an increase in traffic on the road during daylight hours and thus an increase in exposure. Finally, Table 4-6 shows that fatigue related incidents are relatively evenly spread across a 24-hour period; however, the number of reported fatigue-related crashes was low.

Table 4-6.

Time of occurrence and crash mechanism

Time	Fatigue	Debris/ road issue	Actions of another driver	Animal	Distraction	Single vehicle
	Crash mechanism (*N*)*					
00:00 - 05:59 (*n*=45)	3	1	9	18	1	13
06:00 - 11:59 (*n*=46)	2	3	17	8	4	12
12:00 - 17:59 (*n*=35)	2	2	16	3	3	9
18:00 - 23:59 (*n*=25)	2	2	5	14	0	2

**151 cases were considered as this variable was manually extracted from description of crash qualitative data. There were instances where this information was inconclusive; therefore, the crash mechanism was recorded as unknown.*

Journey type and crash mechanism

Table 4-7 draws comparisons between vehicle type and the direction of travel at the time the crash occurred with crash mechanism. As highlighted earlier, there may be under-reporting of crashes during the homeward journey as the worker may not advise the employer of the crash. This postulation is supported when considering the difference between at-fault and not-at-fault crashes. Where a claimant is not at fault for a crash, it is likely that there will be a claim for compensation which results in the event being reported. In this instance, the data report a higher incidence of crashes occurring during the journey home where the actions of another driver contributed to the crash (57%). However, for all other crash mechanisms there was a higher incidence of crashes occurring on the way to work. In the sample, motorcyclists were not involved in any fatigue-related crashes. Car drivers contributed to all fatigue-related crashes reported, with 80% of these occurring during the journey to work (see Table 4-7).

Animals on the road were frequently identified as a key contributor to crashes within the sample (*n*=43; 29%). Where animals were involved in the crash, direction of travel could not be identified in seven cases. Car drivers were involved in collisions with animals on the road more frequently on the trip to work than on the trip home. The higher level of reporting for incidents involving animals during the journey to work was the same as for motorcycle riders (see Table 4-7).

Motorcycle riders were the only vehicle type involved in crashes where debris or a road issue was identified as a key contributor to the cause of the crash. While some of the single vehicle crashes may fall within this category, the description for the single vehicle crashes did not specifically reference any debris on the road or a road issue as a key contributor to the crash. As with the other at-fault incidents, there is a higher reporting of single vehicle crashes associated with the journey to work (n=16; 76%), compared with the journey home (n=5; 24%).

Table 4-7.

Journey direction: car vs. motorcycle

Vehicle type and journey direction	Crash mechanism (N)*					
	Fatigue	**Debris/ road issue**	**Actions of another driver**	**Animal**	**Distraction**	**Single vehicle**
Car – to work (n=45)	4	0	10	18	2	11
Car – to home (n=30)	1	0	16	6	3	4
Motorcycle – to work (n=21)	0	2	5	8	1	5
Motorcycle – to home (n=11)	0	2	4	4	0	1

**107 cases were considered as this variable was manually extracted from description of crash qualitative data to determine crash mechanism and direction of travel. There were instances where this information was inconclusive; therefore, the crash mechanism or direction of travel were recorded as unknown and excluded from the analysis.*

4.4.3 Workers' compensation costs

The following sections report on the compensation costs and time lost in accordance with part two of this study. Table 4-8 shows the distribution of worker's compensation statutory costs and the number of days off work as a result of injuries sustained. Based on the analysis of the claims data, it was determined that the total statutory cost across the mining industry in the sample period was $7,587,177.70. This expenditure includes lost wages, rehabilitation and medical expenses for medical expense-only claims, temporary impairments, permanent impairments and fatalities[8]. The average cost is $26,904.88 (*SD* = $80,060.99) with an average of 37 work days lost.

Table 4-8.

Workers' compensation costs and time lost

	Statutory Costs	Time lost (work days)
Mean	$26,904.88	37
Median	$2,670.00	3.5
Minimum	$0.00	0
Maximum	$653,772.12	815
25th percentile	$416.50	0
75th percentile	$14,466.67	29.5
Sum	$7,587,177.70	

4.4.3.1 Statutory claims versus journey claims

There were approximately 80,000 statutory claims during the financial year 2011/2012 (Q-COMP, 2012). Comparatively, the sample drawn for the purpose of this study identified 282 relevant claims in the period July 2009 – June 2013. This comparison is drawn between statutory claims occurring in one financial year and journey claims over the period of five years. Where relevant, comparisons were drawn using the weighted average of the journey claim data across the five year period. Additionally, the journey claims presented are a subset of the statutory claim data. However, the overlap is inconsequential given the difference in size of the two datasets.

A difference of 19 percentage points was revealed when considering the number of statutory time lost claims during 2011/2012 and the weighted average of

[8] "A permanent impairment is one that remains stable and stationary after a period of time and is not likely to improve with further treatment" (WorkCover Queensland, 2016, p. 2). A temporary impairment is one that the injured worker suffers for a period of time that resolves with treatment.

journey time lost claims during the period July 2009 – June 2013. Journey claims achieved a higher return to work rate (M = 97%) compared to statutory claims (M = 96%). Finally, the average cost of statutory time lost claims for the 2011/2012 financial year was $12,427. Comparatively, the average cost for journey time lost claims from 2009 – 2013 was $32,033.82, a considerable difference when compared to the workplace statutory claims costs.

Table 4-9.

Comparison of journey claims and statutory claims

	Statutory claims 2011/2012	**Journey claims 2009 - 2013**
Number of claims received	≈80,000	282
Fatality	≈80 (0.1%)	7 (2.5%)
Time lost claims	≈36,000 (45%)	180 (64%)
Time lost claims return to work	≈34,560 (94%)	275 (97%)
Average cost of time lost claims	$12,427.00	$32,033.82

4.4.3.2 Time away from work

Times lost claims are frequently considered as a measure (albeit inadequate) of safety performance. Those claims with one or more days away from work (time lost claims) represented 63.8% of claims (n=180) at an average cost of $32,033.82 per claim (see Table 4-10). Those claimants away from work for 28 days or more represented 39.4% of time lost claims at an average cost of $68,555.63, which represents a significant loss for industry.

Table 4-10.

Average compensation costs and time lost (days)

Time lost	***N***	***M***	***SD***	**Median**
0 days	102	\$17,853.81	\$79,956.66	\$275.00
1 – 7 day/s	66	\$1,793.25	\$1,617.13	\$1,193.25
8 – 14 days	17	\$4,208.40	\$2,047.49	\$3,762.35
15 – 21 days	16	\$35,242.60	\$114,299.94	\$6,516.16
22 – 28 days	10	\$14,485.88	\$12,523.87	\$8,154.66
28+ days	71	\$68,555.63	\$105,103.40	\$33,389.95

4.4.3.3 Return to work outcomes

The data reports a high level of positive return to work outcomes following journey-related injuries, with 246 (87.2%) workers returning to the same job with the same employer or a different employer. Only a small number (*n*=3; 0.01%) returned to work in a different job, performing different tasks to what they had prior to the injury. Finally, there were only a few instances that resulted in a failure to return to work or an alternative outcome (*n*=19; 6.7%).

4.4.4 Crash characteristics and workers' compensation costs

The crash mechanism resulting in the highest average claim cost was distraction/not paying attention (*n*=8; *M* = \$116,811.17; *SD* = \$204,864.29). Crashes involving animals on the road resulted in the highest number of average days away from work (*n*=43; *M* = 45; *SD* = 110). Table 4-11 shows that crashes with fatigue identified as the key contributor have a low claim cost (*M*= \$10,965.98; *SD* = \$2,671.25), as well as a fewer number of days away from work (*M* = 18; *SD* = 25). Crashes involving debris on the road or a road issue had the lowest average claims cost (*M* = \$10,266.76; *SD* = \$2,771.27). This is surprising considering that these crashes typically involved motorcycles (see Table 4-3).

Table 4-11.

Average compensation cost and time lost (days): crash mechanism and vehicle type

Crash mechanism*	*N*	*M* (cost)	*SD* (cost)	Mean (days lost)	*SD* (days lost)
Single vehicle/lost control	36	$14,495.06	$30,837.50	23	33
Distraction/not paying attention	8	$116,811.17	$204,864.29	9	14
Hit animal/animal on the road	43	$16,907.77	$36,122.12	45	110
Actions of another driver	47	$11,377.42	$28,266.26	19	60
Debris on road/road issue	8	$10,266.76	$2,771.27	12	13
Fatigue	9	$10,965.98	$2,671.25	18	25

**151 cases were considered as this variable was manually extracted from description of crash qualitative data. There were instances where this information was inconclusive, therefore the crash mechanism was recorded as unknown.*

In general, however, crashes where the claimant was riding a motorcycle resulted in a higher average claims cost and a longer period away from work when compared to crashes where the claimant was driving a car (see Table 4-12).

Table 4-12.

Average cost and days lost: car vs. motorcycle

Vehicle	*N*	*M* (cost)	*SD* (cost)	Mean (days lost)	*SD* (days lost)
Car	223	$26,108.82	$2,192,11	36	100
Motorcycle	59	$29,913.74	$5,563.38	41	90
Total	282				

4.5 DISCUSSION

Study 1 reviews the influences on the travelling workforce presented in *Figure 2-1*. This study aimed to empirically explore the circumstances of commuting related crashes in order to understand the situational factors which may influence worker commuting behaviour and the decision to commute immediately following shifts. The second part of Study 1 aimed to explore the workers' compensation costs associated with commuting-related crashes, further justifying the need for this research. The following section provides a discussion of how the results relate to each Study Question presented in Section 4.2.1 and Section 4.2.2, as well as theoretical and practical implications. Finally, strengths, limitations and future research opportunities are presented.

The findings in this chapter support the further examination within this program of research of rural and remote driving (e.g., kangaroos), fatigued driving, monotonous driving and individual characteristics of drivers (based on sample characteristics) (see *Figure 4-4*). *Figure 4-4* details the progressive iterative review of the influences identified in this research program and highlights the factors identified in Study 1. The influences identified in Study 1 are signified using darker text and are discussed further in the following sections.

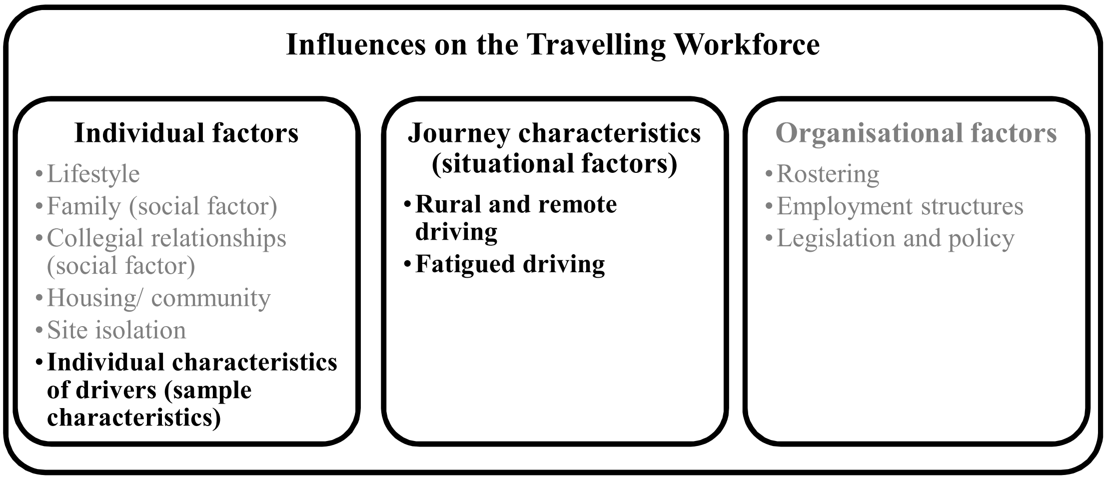


Figure 4-4: **Identified influences on the travelling workforce identified following an analysis of Queensland workers' compensation journey claim data**

4.5.1 Sample characteristics

The data reveal that journey compensation claims from the mining industry only make up a small proportion of claims, when compared to the overall number of claims accepted each year. The majority of these claims came from coal mines, despite coal mining not representing the largest employer of the sub-industries in the mining sector (Australian Bureau of Statistics, 2006b). Machinery operators represented the highest occupational group to claim compensation for journey-related injuries.

As outlined in Chapter 2 and earlier in this chapter, the mining industry in Australia is a male dominated industry. Therefore, it is not surprising that males are highly represented in this sample. There is a higher representation of 25 – 34 year olds in the sample when compared to the population distribution of the mining workforce in Australia (see *Figure 4-1*). It should be noted that the contribution of age to crash risk becomes less relevant when drivers are travelling significant distances during the year (Hakamies-Blomqvist, Raitanen, & O'Neill, 2002). As such, it is posited that due to the distances travelled by these workers each year (i.e., approximately 13,000 kilometres per year[9]), the variation between the sample and the population has little influence on crash risk.

4.5.2 Crash circumstances

The first part of this study explored circumstances of commuting related crashes in the mining industry in response to Research Question 1. The results revealed a higher number of claims are associated with trips to work rather than trips home. This finding is inconsistent with the concerns about commuting home outlined thus far in this thesis. However, there may be an over-representation of journey to work claims in this data, as it may be more likely that the employer will learn about the crash. If the crash occurs on the way home, the worker may not report it, because he or she might consider that the organisation is not responsible for crashes during the journey home, which may also explain the under-reporting in these figures. One-fifth of the reported crashes involved the claimant riding a motorcycle, which poses specific risks such as road surface, instability and animals (Blackman et al., 2009). While motorcycles only account for 4.5% of registered vehicles, they contribute 15% of the annual road toll (Blackman et al., 2009). Rural and remote research describes an increase of motorcycle use within recent times, associated with recreational riding

[9] Approximate distance calculated based on a 7 days on and 7 days off roster in line with the average distance travelled of 240 kilometres (Di Milia, 2006)

(Blackman et al., 2009). Such relatively high rate of motorcycle crashes in the present study was not expected, considering the data related to journeys to and from work, not for recreation, as well as the significant distances travelled.

4.5.2.1 Location of crashes

As detailed in Chapters 1-3 above, there are risks associated with driving in remote locations, including crash involvement with animals (Siskind et al., 2011). A large number of commuting-related crashes occur in inner regional and outer regional Queensland, consistent with workers commuting from remote mine sites to inner regional areas. In response to Study Question 4.1, the sample reported that a large proportion of incidents occurring in inner and outer regional areas are associated with animals, the actions of another driver and single vehicles losing control. As previously reported, there was a limited number of fatigue-related crashes, which is probably due to a self-desirability bias: the information reported by the claimant would be presented to the insurer in the most positive light.

4.5.2.2 Animals

Given the rural and remote location of the majority of the mine sites in Queensland, it is not surprising that collisions with animals or swerving to avoid an animal on the roadway were among the highest contributors to crash mechanism. Incidents occurring in outer regional and remote areas made up 16% of the sample. Taking the inner regional area into consideration, 25% of the claims involved animals. While the inner regional categorisation includes some more populated areas, e.g., Rockhampton, it is suggested that crashes falling in this category are likely to be a combination of domestic and wild animals. That aside, research investigating the involvement of animals in rural and remote areas suggests that this crash mechanism accounted for about 5.5% of serious and catastrophic injuries/fatalities (Rowden et al., 2008). In response to Study Question 4.6, the sample describes a much higher figure (25%), with 15% of animal-involved crashes occurring in outer regional or remote Queensland. Research suggests that there is a higher occurrence of crashes involving animals during dawn, dusk and night time hours compared to daylight hours (Rowden et al., 2008), which supports the present finding of a higher occurrence of crashes involving an animal during night hours.

4.5.2.3 Day time versus night time

Previous research reports a general pattern of crashes during the day, peaking around 9am and 3pm. These peaks typically coincide with peak hour traffic due to increased exposure. Study Question 4.2 seeks to determine approximate time of crash. The typical location of crashes described by the sample would not be in areas where peak hour traffic results in traffic gridlock. However, consistent with previous research investigating rural crashes, the sample lacks an afternoon peak in crashes, which would be seen in major cities or towns with larger populations. The crash times identified in the sample are shortly after the end of shift times (see: Di Milia, 2006) which potentially represents a higher number – and therefore higher exposure – of workers on the road at these times. Previous research reports that crash risk is typically lower during the night due to decreases in the number of vehicles on the road (Steinhardt et al., 2009).

4.5.2.4 Fatigue versus distraction

Study Question 4.3 and Study Question 4.4 seek to identify, based on self-reported data, if fatigue and distraction are key contributors to crashes within the sample. Overall, only a small number of crashes were attributable to fatigue and distraction in this data. However, single vehicle crashes represented a high proportion of crashes where the circumstances could only be attributed to the driver of the vehicle. Few conclusions can be drawn from the findings of the current study regarding fatigue and distraction given the limited sample size and brief description provided by claimants. The small numbers reported here are inconsistent with previous research (Åkerstedt et al., 2005; Armstrong et al., 2010). The literature presented in Chapter 2 suggests that fatigue could be attributable to 10% – 60% of crashes (Dawson et al., 2014) (see Section 2.5.1). Hence previous research would indicate that further consideration should be given to fatigue-related crashes in subsequent studies in this research program, despite the findings reported in this chapter. As discussed in Section 4.5.2.1, it should be acknowledged that there are limitations with this data due to self-desirability bias.

4.5.3 Workers' compensation crash costs

The second part of this study explored cost per claim – including average compensation paid, the amount of time lost and the number of workers who return to work following their injury. This focus was to address Research Question 2 in an attempt to understand the potential costs associated with crashes occurring during the journey home, providing an objective measure of the consequence associated with commuting related risks. The data reported a high level of positive RTW outcomes, meaning that following the crash the claimant was likely to return to the same occupation as before the crash. However, despite this positive outcome, there is no indication of the length of time the claimant remained employed in that position following the closure of the claim. There is also limited information in respect of the nature of tasks performed, or other information that is important when considering the success of rehabilitation and RTW efforts.

There is a large difference between the compensation paid for those involved in a workplace incident when compared to those involved in a journey claim. According to this sample, journey claims result in a higher amount of compensation and a longer period away from work. The possible reason for the increased average of time lost and rehabilitation costs might be the serious nature of car crashes versus more frequent insignificant incidents at work (e.g., slip and trip). The longer time away from work has a negative impact on the employer attempting to backfill the injured worker's position until they are able to return to work. Other outcomes include the high costs associated with rehabilitation.

4.5.4 Implications

The findings in this study highlight potential considerations for situational factors which may impact on commuting behaviour (e.g., animals, rural and remote driving, as well as other drivers). These situational factors will assist in understanding the types of factors examined further in Study 4, which are considered by these workers prior to the journey home. These factors may impact driving home immediately after shifts (e.g., time driving, fatigue, driving in regional areas and distraction).

These results demonstrate that crashes occur predominantly around dawn and dusk. There could be a number of reasons for the peak in crashes around these times. Previous research demonstrates that there is a marked increase in crashes around peak hour traffic times in the morning and afternoon (S. S. Smith et al., 2008), providing support for the peak identified in the current study. However, the peak identified is slightly later, which is consistent with the longer shift times operating in the mining industry (Di Milia & Bowden, 2007). While there are some differences in the location of crashes (i.e., remote versus urban areas), the peak times are consistent with average shift end times in the Queensland mining industry.

The problem of driving-related commuting is readily identifiable by presenting the financial impacts associated with journey claims costs. The findings of this study demonstrate that workers' compensation claims costs are considerably higher for journey claims compared to average claim cost (see Section 0).

4.5.5 Strengths, limitations and future research

The use of crash data such as the workers' compensation claim data used in this study provide a snapshot of adverse outcomes of driving-related commuting in rural and remote areas. Analysis of commuting-related claims data provides insight to road and workplace incidents in the context of commuting and contributes to understanding the risks faced by these workers. The use of secondary workers' compensation claims data has limitations and constraints which should be considered. A key strength of using workers' compensation journey claim data is that the data readily identify crashes resulting from driving-related commuting. Identifying the purpose of a journey may not be as readily identifiable in other secondary data (e.g., police crash data).

A key limitation with secondary datasets is that the data has been collected for a purpose other than the research question; therefore, the data may not be sufficient to respond directly to the research question or may have significant shortcomings. These shortcomings include limited incident descriptions, resulting in causation being difficult to assess in some circumstances. The method through which the data are collected may not be as rigorous as research-specific data collection; therefore, there may be limitations in respect to reliability and validity. The data included in WPHS claims data are limited to (1) those submitting a claim for compensation; and (2) employers fulfilling their obligation to report incidents. Employers fulfilling their obligation and reporting crashes to and from work also relies on the worker reporting the incident. As such, there is a possibility that the crash is not reported because it may have been relatively minor in nature; it was during the journey home and the employee was not required to explain a late arrival to work; or the employee may fear punishment if they were to disclose a crash, especially if they were at fault. Furthermore, the crash may only be reported to the employer/insurer if it was reported to the police following a serious incident. As such, this limitation has implications for the reporting of crashes during homeward bound journeys, the severity of reported crashes, and the number of incidents reported where another driver was the primary contributor to the cause of the crash. Furthermore, these limitations may have an impact on the average compensation paid per claim.

The information provided to the insurer is based on the recollection of the person making the claim for compensation. The description of the crash provided by the claimant may be presented in a way that reflects positively on them in respect to the crash. This positive reflection also potentially over-represents the number of incidents reported where another driver was the primary contributor to the cause of the crash.

There are limitations which have been previously reported in the results section of this chapter regarding data entry and missing data. Where information has not been relayed fully by the claimant, the data have been entered using a default entry. For example, the location of the crash has been entered using the postcode 4000, which is a major city location according to the ARIA coding used for the purpose of analysis. The time at which the incident occurred has been entered as 00:00, over-representing crashes occurring during the night. Furthermore, these data do not detail if the worker was driving following a day or night shift; therefore, crash characteristics identified in these results cannot distinguish between shift types.

The data used for the purpose of this study relate to journey claims occurring in Queensland. Given Queensland is one of the few states in Australia to offer compensation for incidents occurring during a journey to or from work, it is unclear how representative this data is of other states in Australia, especially considering the limitation of reporting crashes in a positive light because of an impending compensation claim. However, the data paint a picture of the issues associated with long distance commuting, particularly in respect to the high proportion of journey claims associated with the mining industry and the high cost of those claims in comparison with other types of claims, which indicates potentially more severe injuries requiring longer rehabilitation and longer time away from work.

A further limitation is the measure of financial impact considered in this chapter. As highlighted earlier, compensation cost is one measure of the financial impact associated with these crashes; however, these costs do not consider expenses associated with lost time and production resulting from the absence of an employee. This financial impact is limited only to the employer and only covers paid rehabilitation expenses.

The purpose of this study was to explore potential situational factors involving mine workers during their journey to and from home to direct the research effort of this program. The study also details a financial measure of compensation costs which has the ability to provide some context around the financial impact of these crashes on industry. The findings presented in this chapter were used to guide the exploration of the situational factors associated with commuting behaviour in subsequent studies in the research program.

4.6 CHAPTER SUMMARY

Study 1 presents an overview of workers' compensation journey claim data for crashes associated with the mining industry workforce in Queensland over a five year period. The chapter reported crash mechanism and compensation costs associated with these crashes. The current study was designed to explore the first two research questions of the research program which are associated with crash circumstances and costs. The claims data identified the situational factors of animals, rural and remote driving and other drivers as important situational factors that may influence driving intentions immediately following shift. From the perspective of financial impact, crashes resulting from journeys represent a higher average cost and time lost when compared to statutory claims (i.e., claims resulting from workplace incidents). While there are limitations in the data, there is a large difference between costs and time lost between these claims types, which further highlight the serious nature of this issue and the need for research to investigate commuting behaviours.

The following chapter reports on the critical analysis and review of organisational journey policy and legislation, the first part of Study 2. The analysis critically examines relevant legislation, industry standards, regulated policy documents and site-based policy to understand current legislative controls and industry-based guidelines which may promote safe commuting behaviours.

Chapter 5: Critical Analysis and Review of Legislation and Organisational Journey Policy

5.1 INTRODUCTION

Chapter 5 reports on the first part of Study 2 within this program of research. Given the limited research investigating the commuting behaviour of mine workers, this study was designed to explore the context in which worker commuting behaviour operates. The study is made up of two parts. The first part (Study 2a) critically examines the legislation, internal and external policies associated with safe work systems within the coal mining industry in Queensland. It presents the legislative framework which governs commuting in the Queensland mining industry. The second part of Study 2 (Study 2b) examines the perceptions of site safety experts regarding the legislation and commuting issue via a focus group, further defining the organisational factors presented in *Figure 2-1*. Study 2b is discussed in Chapter 6.

The first part of Chapter 5 presents the aims of Study 2a (Section 5.2). Section 5.3 provides an overview of the legislative framework of mining in Queensland, as well as the structure of the regulatory environment. The chapter then describes the method adopted to examine legislation and policy, including the relevant literature search structure, as well as inclusions and exclusions of qualitative data (Section 5.4). The results of the critical review are reported and discussed in Sections 5.5 and 5.6; Section 5.7 summarises the chapter.

5.2 STUDY AIM AND RESEARCH OBJECTIVES

The rationale for Study 2a stems from the comments made by the Queensland Coroner in reference to safe commuting behaviour following the Coronial Inquiry discussed earlier (see Section 1.4). The Coroner's comments describe inconsistencies in fatigue management systems across the mining industry.

> *At present there are no consistent Fatigue Management Systems in place across the mining industry. While some sites appear to be quite proactive with their development of Fatigue Management Systems, others appear to be engaged only in the minimum required. This is in contrast to what is in place in many other industries, such as the rail industry, where there is a national recommendation for the management of fatigue across different companies and organisations. (Coroner of Queensland, 2011: 32)*

The purpose of this critical analysis was to *examine the parameters of legislative requirements in respect to commuting within a Queensland and Australian mining context* in line with Research Objective 2. This research objective contributes directly to understanding the organisational factors that influence the immediacy of workers' commuting behaviour after shifts. As highlighted in the literature review, it is important to understand organisational factors such as the legislative environment, facilitators and barriers that influence workers' commuting decisions in order to explain what commuting behaviour is encouraged or discouraged in order to contextualise post-shift travel. The focus of safety practice within the Australian mining industry and the alignment with fatigue management indicates the need to explore the policies and practices which are currently in place to respond to post-shift travel. The objective of Study 2a is to address Research Question 2: *what are the current legislative controls, as well as industry-based guidelines, employed by organisations/operations to promote safe commuting behaviour?*

A further objective of the critical review is to understand and highlight the safe on-site operating policies and procedures for work duties that relate to fatigue management, as well as any policies and procedures concerning commuting. The discrepancy between on- and off-site behaviour is important to consider to inform further discussion regarding the decisions made by workers in respect of their commuting behaviours. The results in this chapter were used to inform the design of the focus group session.

5.3 LEGISLATIVE FRAMEWORK IN QUEENSLAND MINING

The legislative framework governing the mining industry in Australia varies from state to state. As such, responsibilities for safety and health for mining companies and employees (e.g., managers, contractors and workers) vary depending on the location of the operation (Gunningham, 2006). The focal site is based in Queensland, Australia. Therefore, the review primarily focuses on legislation in Queensland.

There are national and state-based not-for-profit organisations, government organisations and for-profit organisations that contribute to the legislative and policy framework that governs the mining industry in Queensland (see Table 5-1 and Table 5-2). The relevant players contribute to the development of legislation, industry standards and general/specific organisational policies and procedures. The websites of these key players were searched for relevant documents. Relevant contributions to legislation or guidelines are discussed in the following sections.

Table 5-1.

Key players of legislative and policy framework nationally

Key Players		**Organisational purpose**	**Legislation**	**Guidelines**	**Safety focus**	**Industry focus**
Nationally	Minerals Council of Australia	The Minerals Council of Australia “advocate[s] public policy and operational practice for a world-class industry that is safe, profitable, innovative, environmentally and socially responsible, attuned to community needs and expectations” (Minerals Council of Australia, 2012).		✓		✓
	Safe Work Australia	“Safe Work Australia was established by the *Safe Work Act 2008* with primary responsibility to lead the development of policy to improve work health and safety and workers’ compensation arrangements across Australia. It performs its functions in accordance with strategic and operational plans agreed annually by the Select Council on Workplace Relations” (Safe Work Australia, 2015).		✓	✓	

Table 5-2.

Key players of legislative and policy framework in Queensland

Key Players		Organisational purpose	Legislation	Guidelines	Safety focus	Industry focus
Queensland	Department of Natural Resources & Mines (DRNM)	"DNRM is an economic development agency that enables the productive and responsible use of our natural resources—water, land, mineral and energy resources" (DNRM, 2015). This department also oversees safety and mining related safety legislation in Queensland.	✓	✓	✓	✓
	WorkCover Queensland (WorkCover)	WorkCover is an independent government owned statutory body responsible for providing workers' compensation insurance to businesses across the state.	✓	✓	✓	
	Queensland Resource Council (QRC)	"The Queensland Resources Council is a not-for-profit peak industry association representing the commercial developers of Queensland's minerals and energy resources" (QRC, 2015).		✓		✓

5.3.1 Key players nationally

The Minerals Council of Australia is a not-for-profit organisation representing Australia's exploration, mining and minerals processing industry, nationally and internationally (Minerals Council of Australia, 2012). "The [Mineral Council of Australia's] strategic objective is to advocate public policy and operational practice for a world-class industry that is safe, profitable, innovative, environmentally and socially responsible, attuned to community needs and expectations" (Minerals Council of Australia, 2012). The Council has been involved in developing resource documents and industry standards in respect of health and safety issues such as work design, shift structure and issues related to fatigue (see: Baker & Ferguson, 2004). The Queensland Resources Council is the state equivalent to the Minerals Council of Australia. The Queensland Resources Council is also a not-for-profit peak industry association representing the commercial developers of Queensland's minerals and energy resources (Queensland Resources Council, 2012).

5.3.2 Key players in Queensland

Safety in the mining industry falls within the jurisdiction of state legislation. The key Queensland Government Department involved is now the Department of Natural Resources and Mines (formerly Department of Employment, Economic Development and Innovation). This department oversees Queensland Mining and Safety and the Queensland Mines Inspectorate (QMI), along with the Office of the Commissioner for Mine Safety and Health. According to the *Coal Mining Safety and Health Act 1999 (QLD),* these government departments: (1) provide safety information, alerts and bulletins to mine sites; (2) develop recognised industry standards; (3) advise the Minister for Employment, Skills and Mining of general mine health and safety matters; (4) monitor and report to the Minister and to parliament on the administration of provisions about safety and health under the *Coal Mining Safety and Health Act 1999 (QLD)* and the *Mining and Quarrying Safety and Health Act 1999 (QLD);* (5) report to the Minister on the performance of the Department of Natural Resources and Mines in regulating mine safety; and (6) advise, mentor and educate the mining industry about safety and health.

5.3.3 Structure of regulatory environment in Queensland mining

Identification of the state and national authorities that govern the regulatory environment in the Queensland mining industry describes four layers of safety legislation and policy. Key players outlined above contribute to each layer within the Queensland mining industry. Based on a review of the regulation, the responsibility for managing the journey home can be categorised into four layers: (1) regulatory responsibility; (2) industry guidelines; (3) company responsibility; and (3) individual responsibility. The regulatory responsibility comprises two parts: firstly, the legislation itself, and secondly, the safety policies which are required to be in place due to legislative requirements. Industry guidelines are those documents which complement and contribute to safety frameworks within the organisation. Organisational policies are documents which are specific to the requirements of the organisation and extend beyond the regulated policy. Finally, individual responsibility is associated with the worker and their decisions. These four levels of responsibility further highlight the contribution this study makes to the overall research program, demonstrating the significant involvement of organisations in this issue. *Figure 5-1* illustrates that the preceding layer informs each layer of the legislative framework; the requirements outlined in relevant documents become more specific as they approach the organisation. For example, the legislation provides broad risk management guidelines, and the internal organisational policy is related to the nuances of the organisation, its operating environment, and its workers.

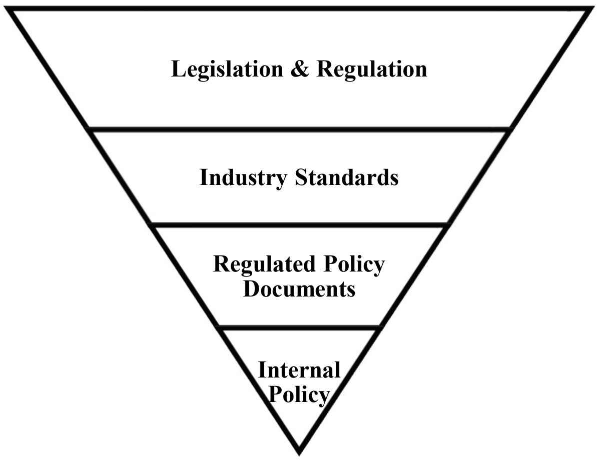


Figure 5-1: **Structure of Queensland legislative framework**

5.4 METHOD - CRITICAL DOCUMENT ANALYSIS

Chapter 5 comprises a qualitative review of the legislation and policy documents which are relevant to commuting and journey management within the Queensland mining industry. The review presents general observations in respect of the legislative framework which governs commuting in the Queensland mining industry. Finally, the review assesses the policies internal to the focal organisation and how these policies are informed by the legislation in Queensland.

5.4.1 Search procedure and timeline

A comprehensive search was conducted for legislation and regulation, industry standards and regulated policy documents. Drawing on Gunningham's (2006) review on Australian mining reforms and using commuting relevant terms, search terms were established for the purpose of sourcing relevant documents. The websites of the key players (with a focus on Queensland) were searched using the terms: *'workplace safety'*, *'occupational health and safety'*, *'journey management'*, *'commuting'*, *'safety policies'*, and *'fatigue management'*. If the website was not mining-specific, the terms *'mining'* or *'resource'* were included in the search to further narrow the results. While these terms are not an exhaustive list, they are broad enough to catch the type of document required to address the research questions. Furthermore, given documents are more specific as they approach the organisation, more specific search terms were used when searching documents 'closer' to the organisation. These more specific search terms were combinations of the search terms drawn from the literature review and Gunningham's (2006) review. In respect to the organisational policies, these documents were not obtained using the search method described above. The organisation's representative released the internal policy documents to the researcher for inclusion in this study. The representative was briefed in respect to the requirements of the study and relevant internal policies were sent to the researcher via email.

Legislation and policies are superseded and updated relatively frequently in accordance with document control within the organisation. As such, versions and dates of these documents are typically clearly marked on the cover or in the footer of each page. Given the purpose of this review, the documents included in the study will be the most up-to-date version at the time of writing. Accordingly, while the search was not limited by dates, consideration was given to the relevance of the information in the sourced document. If the information was not considered up to date, then it was not reviewed for the purpose of this critical review.

5.4.2 Inclusion criteria

To be included as a key document in the study, the document must be related to organisational compliance with the legislation (see Figure 5-1*)*. Each document was read and a preliminary analysis performed to ensure each publication encompassed the key themes of interest. A document was included in the review if it referred to commuting (FIFO or DIDO), it was relevant to a Queensland mining context, and it referred to one of: (1) risk management; (2) fatigue management; (3) safety management systems; and/or (4) safety or compensation legislation. These were broad categories in order to capture all the relevant documents.

5.4.3 Analysis

Relevant legislative and policy documents were sourced for the purpose of the critical review using the method described above. Relevant documents were considered in a hierarchical manner using a top-down approach consistent with the structure presented in *Figure 5-1*. The legislation and regulation were reviewed first; the industry standards and the regulated policy documents were then considered. Finally, the review considered internal organisational policy. The findings from the review of the top layer (the legislation) were used to critically assess the following layer, and so on. This process was adopted in order to examine linkages between legislation and policy and to confirm the inclusion of relevant documents. The structure of legislation means the systematic approach adopted to analyse these documents was warranted.

5.4.4 Ethical considerations

Considering the involvement of internal organisational documents and the subsequent focus group, ethical clearance was sought from the Queensland University of Technology Human Research Ethics Committee for Study 2a and 2b prior to commencing the review of organisation-specific documents. The relevant approval number is 1300000349.

5.5 CRITICAL REVIEW

Following a search of the websites of the key players identified above, seven documents were identified and reviewed, including:

- *Coal Mining Safety and Health Act 1999 (QLD)* and the *Coal Mining Safety and Health Regulation 2001 (QLD)*;
- *Workers' Compensation and Rehabilitation Act 2003 (QLD)*;
- *National Minerals Industry Safety and Health Risk Assessment Guidelines* (Minerals Council of Australia);
- *QGN16 Guidance Note for Fatigue Risk Management 2013* (Queensland Government, 2013);
- *Guide for Managing the Risk of Fatigue at Work 2013* (SafeWork Australia, 2013)
- *Minerals Explorations Safety Guidance Note* (Queensland Resource Council);
- Work Design, Fatigue and Sleep: a Resource Document for the Minerals Industry; and
- Organisational Fatigue Management Plan (FMP) (internal document).

Table 5-3 identifies how each document reviewed for the purpose of this study fits within the legislative framework depicted by *Figure 5-1*. The majority of the information presented in this review was drawn from industry standards/guidelines.

Table 5-3.

Application of legislative framework to reviewed documents

	Legislation	**Industry Standards (Guidelines)**	**Regulated policy documents**	**Training & internal documents**
Coal Mining Safety and Health Act and Regulation	✓			
Workers' Compensation and Rehabilitation Act	✓			
National Minerals Industry Safety and Health Risk Assessment Guidelines		✓		
QGN16 Guidance Note for Fatigue Risk Management 2013		✓		
Minerals Explorations Safety Guidance Note		✓		
Work Design, Fatigue and Sleep: a Resource Document for the Minerals Industry		✓		
Organisational fatigue management plan (internal document)			✓	✓

5.5.1 Statutory law applicable to the mining industry in Queensland

The mining industry in Queensland is governed by the Queensland State Government; as such, any statutory law resulting from recommendations of the Office of the Commissioner for Mine Safety and Health must be passed in the Queensland State Parliament. From a Queensland perspective, the mining industry is governed by separate legislative requirements to those imposed on other industries[10]. However, in Queensland, mining safety and related matters do not fall within the ambit of the *Workplace Health and Safety Act 2011.* Statutory law concerning workplace health and safety of mines and mine workers in Queensland is dependent on the type of exploration/mining being undertaken. Relevant statutory law includes the:

- *Coal Mining Safety and Health Act 1999 (QLD)* and the *Coal Mining Safety and Health Regulation 200*1 *(QLD)*;
- *Mining and Quarrying Safety and Health Act 1999* and the *Mining and Quarrying Safety and Health Regulation 2001*; and
- *Petroleum and Gas Production and Safety Act 2004*.

The mining-specific legislative documents are similar in structure and generally have the same objectives: (1) general risk management approaches (such as those which require duty holders to identify hazards and assess and control risks); (2) more detailed and onerous risk-based requirements (such as obligations to establish major hazard management plans including specified critical controls); and (3) a more holistic and systematic approach to managing safety through the creation of safety and health management systems (Gunningham, 2006: 43). Considering the context of this research, the conduct of the mine site involved in this research falls within the ambit of the *Coal Mining Safety and Health Act 1999 (QLD)*.

From the perspective of the *Coal Mining Safety and Health Act 1999 (QLD)*, these general objectives and duties owed to employees (and others who may be

[10] In Queensland, the primary legislation concerning the health and safety of workers and workplaces is the *Workplace Health and Safety Act 2011.* In 2011, Queensland participated in the national harmonisation of occupational health and safety (OH&S) legislation by enacting the *Workplace Health and Safety Act 2011,* mirroring other states and territories (e.g., New South Wales, Northern Territory and ACT).

affected) are summed up by Section 6 of the *Coal Mining Safety and Health Act 1999 (QLD)*, which specifies that an employer must protect the safety and health of workers and that any risk of injury is at an acceptable level[11]. In order to achieve these two objectives, a number of measures must be put in place by the coal mine to ensure the health and safety of its workers. One key measure is the implementation of a safety and health management system[12]. This system outlines that the organisation must assign and implement: (1) a site safety and health representative[13]; (2) site specific standard operating procedures[14]; and (3) training schemes relevant to the safety and health management system (see *Figure 5-2*). These measures are in place to manage the level of risk faced by mine workers in an operational environment. However, the safety and health management system relates to the operation of the coal mine, which generally relates to on-site operations. The legislation as it currently stands in Queensland refers to the implementation of a safety and health management plan for *site-related* activities (i.e., those activities on an area of land which fall within the definition of a coal mine[15]).

The *Coal Mining Safety and Health Regulation (2001)* prescribes more specific risk management requirements relating to: (1) risk identification; (2) hazard analysis; (3) hazard management and control; and (4) reporting requirements. Each part of the regulation deals with a specific component of mining operations. Part 6 of the *Coal Mining Safety and Health Regulation 2001* deals with a person's fitness for work and outlines requirements to produce safety management systems in respect of: (1)

[11] Section 29(1) and (2) of the *Act* defines an acceptable level of risk as operations being conducted in a way that the level of risk from the operation is: (a) within acceptable limits; and (b) as low as reasonably achievable. This is measured by having regard to (a) the likelihood of injury or illness to a person arising out of the risk; and (b) the severity of the injury or illness.
[12] Section 62(1): a safety and health management system for a coal mine is a system that incorporates risk management elements and practices that ensure safety and health of persons who may be affected by coal mining operations.
[13]A *site safety and health representative* for a coal mine is a coal mine worker elected by other workers to inspect the coal mine and assess whether the level of risk to coal mine workers is at an acceptable level, to review procedures, to detect unsafe practices and conditions at the coal mine are at an acceptable level and to investigate complaints from coal mine workers (s28 & s99).
[14]Section 14: A standard operating procedure at a coal mine is a documented way of working, or an arrangement of facilities, at the coal mine to achieve an acceptable level of risk, developed after consultation with coal mine workers.
[15] Section 9 of *Coal Mining Safety and Health Regulation 2001.*

carrying out an activity, or entering a place, while under the influence of alcohol[16]; and (2) personal fatigue and other physical and psychological impairment, and drugs[17] (see *Figure 5-2*).

Figure 5-2: **Structure of commuting-relevant safety legislation**

5.5.2 Industry standards and regulated organisational policy

National and Industry standards typically adopt a broad risk management approach or are focused on a specific issue (e.g., fatigue management). The Minerals Council of Australia and the Queensland Resource Council have both published guidelines in general health and safety, as well as risk management. Examples of these guidelines include: (1) *National Minerals Industry Safety and Health Risk Assessment Guidelines* (Minerals Council of Australia); and (2) *Minerals Explorations Safety Guidance Note* (Queensland Resource Council). Generally, these industry-specific guidelines are based on risk management process models designed and presented in the National Standards, similar to the model depicted in *Figure 5-3*. These national standards provide *general* guidelines of risk management processes and steps: (1) identify the risk; (2) analyse and evaluate the risk; (3) treat the risk; and (4) monitor and review (e.g., State of Queensland, Department of Natural Resources and Mines, 2013). This iterative process requires continuous

[16] Section 40 and 41 of the *Coal Mining Safety and Health Regulation 2001.*
[17] Section 42 of the *Coal Mining Safety and Health Regulation 2001.*

communications with key stakeholders and an ongoing monitoring and review process.

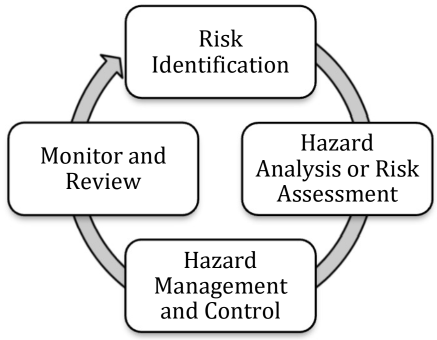


Figure 5-3: **Risk management process**
(State of Queensland, Department of Natural Resources and Mines, 2013: 31)

5.5.2.1 Standard operating procedures and fitness for work

Standard operating procedures are typically site-specific and deal with specific issues. Policies and procedures become more specific as they move closer to the organisation. The *Coal Mining Safety and Health Act 1999 (QLD)* prescribes that organisations must have standard operating procedures in place, with a key focus on fitness for work. The capacity in which an employee undertakes their duties is significantly related to this provision. *Figure 5-4* highlights the interrelation between the legislation (as previously presented), industry standards and guidelines, as well as regulated organisational policy. Despite the complex relationships, two key factors of commuting safety are fitness for work and fatigue management.

A consideration relating to fitness for work and fatigue management includes strategies for workers to manage fatigue during on-site operations and during their daily routine. These fatigue management plans (FMPs) contain information regarding: (1) the number of hours the employee can work in a shift block or day; (2) minimum rest periods between work; and (3) rest periods during working hours. Journey management plans also stem from the requirement for an employee to be fit for work and manage fatigue (Baker & Ferguson, 2004).

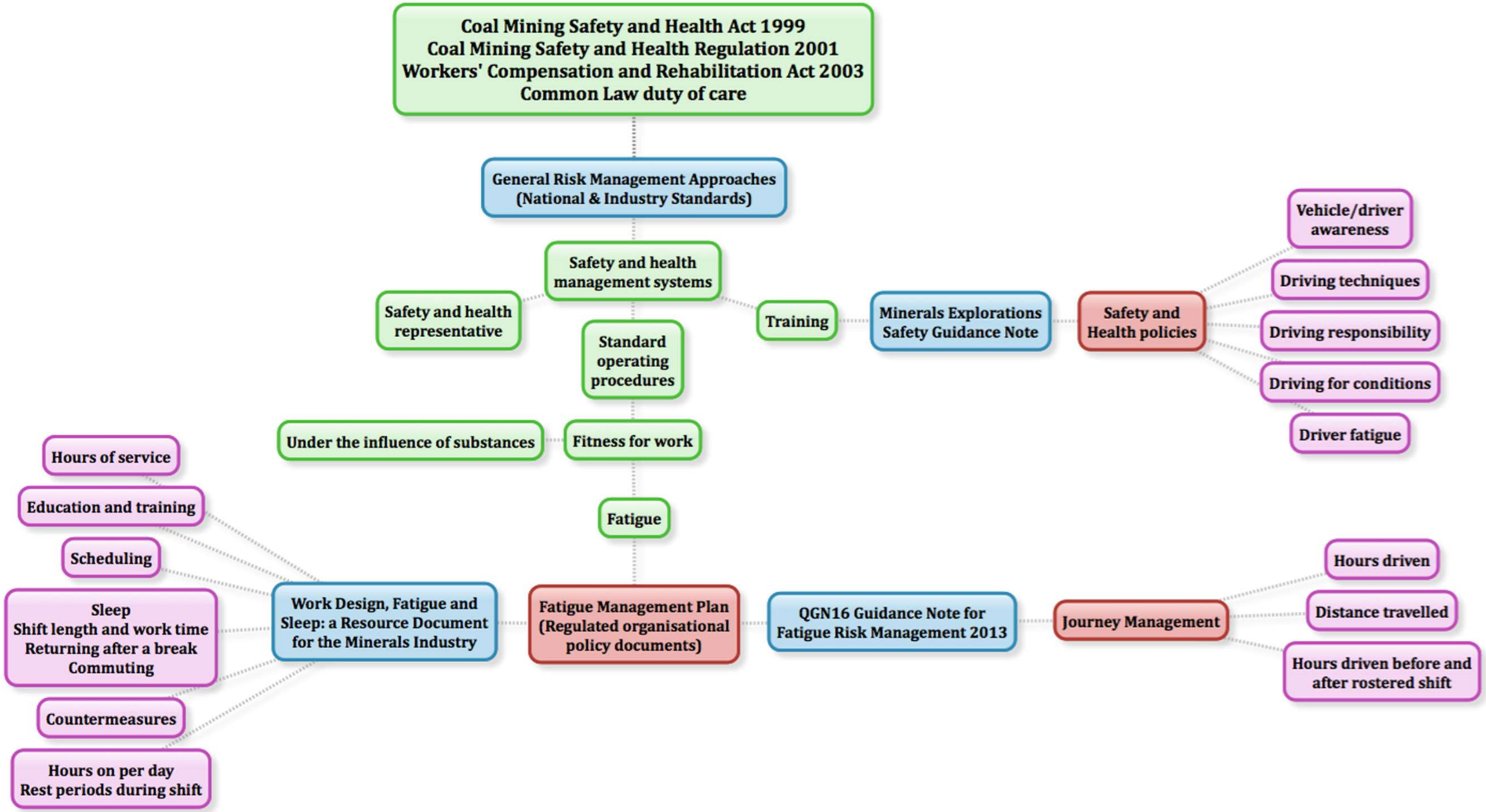


Figure 5-4: **Interrelations between legislation, policy and practice**

Resource documents such as *Work Design, Fatigue and Sleep: a Resource Document for the Minerals Industry* have been designed to assist those responsible for designing work arrangements (e.g., scheduling, hours of work, and rest periods). While this document specifies that it does not cover fatigue management strategies for driving-related commuting operations, the general work fitness provisions are relevant to ongoing risk management in respect to the condition or capacity in which workers leave mine sites. The document covers fatigue risk management in operational settings and provides an overview of the components of an FMP, with the key goals of maintaining or enhancing safety, performance and productivity (Baker & Ferguson, 2004: 32). The components of an FMP include: (1) education and training; (2) hours of service; (3) scheduling practices; (4) countermeasures (e.g., training, resources and an appropriate environment) (Baker & Ferguson, 2004; Rosekind & Gander, 1996). Further, as a component of rostering and fatigue, this document considers: (1) sleep; (2) consecutive night shifts; (3) early work start times; (4) shift length; (5) direction of rotation (i.e., between day and night shift); (6) overtime; (7) on-call work; (8) returning after a break; and (9) commuting duration. The only reference to commuting appears in general work fitness provisions, which relate to fitness to perform on-site duties.

In 2013, the Department of Natural Resources and Mines authored a document aiming to manage fatigue-related risks in the workplace titled *QGN16, Guidance Note for Fatigue Risk Management*. The concept of journey management first appears within this document and is a one of the few references to commuting in each layer of the legislation and policy. According to this guidance note, journey management is a risk management tool which seeks to control the commuting risk by managing and considering: (1) hours driven; (2) distance travelled; and (3) hours driven before and after a rostered shift (Queensland Government, 2013, p. 2). A plan is required when one or more pre-identified commuting risks are apparent. These pre-identified risks include: (1) residing more than an hour from site; (2) regularly working 12 hour shifts; (3) exceeding 16 hours of wakefulness while in control of a vehicle; or (4) identified as requiring a plan in *QGN16* risk factor tables. The focal organisation limits hours of work and commute time to not exceed a total of 14 hours in a 24 hour period. While these risk identifiers only discuss commuting-related risks, the overall document reveals that the focus of journey management is associated with ensuring that workers arrive *at* work refreshed and fit for work.

5.5.2.2 Training

The Minerals Exploration Safety Guidance Note is a tool authored in 2004 by the Queensland Resources Council and the Queensland Government to guide safety and health policies within the Queensland mining industry. This guidance note is one of the few documents which describe the *training requirements* of the Safety and Health Management System relevant to driving and commuting (see *Figure 5-4*). From the perspective of driving, this guidance note concentrates on training and induction, rather than a specific risk management approach. Of particular interest is the reference to vehicle/driver awareness and driving techniques as a suggested induction requirement. The tool recommends that induction include (1) attitudes to road safety, road rules, traffic laws and responsibility towards passengers and other road users; (2) driving practices for prevailing conditions; and (3) driver fatigue, safe driving periods and rest intervals. This document is one of the few that discusses road safety; however, it specifically relates to driving for work purposes rather than journeys between workers' place of employment and home. The training element, whether in respect to road safety or fatigue management, has the task of disseminating information to large audiences rather than approaching training through educative means and testing understanding. Nevertheless, this guidance note details several risk factors, other than fatigue and distraction, that can be associated with commuting long distances, particularly in rural and remote areas. These additional factors include conditions, time of day spent driving, and the impact of other drivers. The identification of these factors is particularly relevant given the findings of Chapter 4, which illustrated that animals and other drivers are also key contributors to crashes while commuting.

5.6 DISCUSSION

A review of the legislation and policy explained the purpose of each component of the legislative framework. The legislation prescribes what has to be done; the industry standards provide instructions on how it should be done and what an organisation should consider; and the regulated policy documents detail the actual considerations of the organisation. Once the employee leaves the confines of the mine site, there is no *clear* statutory duty for the employer to manage risks associated with the journey home. However, this strict interpretation is blurred by factors such as: (1) the employer's common law duty of care; (2) industrial negotiations (i.e., number of hours worked and rosters); and (3) general social responsibility. This strict interpretation results in a grey area whereby it is unclear where responsibility falls. As these safety and health plans are drafted in respect to on-site safety issues, it is difficult to locate specific policies in respect to commuting, except for organisational policy which restricts hours of work and commute time to a total of 14 hours in a 24 hour period.

Reviewing the legislation from the top-down provides an understanding of the key factors and influences in commuting safety policy at an organisational level. This understanding further contributes to the iterative development of the influences on the travelling workforce framework which underpins this research program, particularly in respect of organisational influences (see *Figure 2-1*). Fatigue Management Plans are the only regulated documents which promote safe commuting behaviour. However, the FMP predefines the risk of long distance driving as a fatigue-related risk, rather than a road safety risk. As a result, training and education of employees is situated in the context of on-site risks and hours of work, or work scheduling concerns to ensure fitness for work upon arrival on site. As can be seen in *Figure 5-4*, an FMP is a core legislative requirement making up a key component of a mining organisation's safety and health management system. The relevant legislation reiterates the focus on fatigue and fitness for work, and as a result there is a concentration on mitigating fatigue-related risks through scheduling (i.e., rosters), hours of service, and fitness to perform duties once on-site, rather than dealing specifically with driving-related risks. While the *Minerals Explorations Safety Guidance Note* recommends that induction deal with driving-related risks, there are no recommendations for ongoing assessment of risks as occurs in assessing fitness for work, particularly in respect to fatigue. Examination of the policies closer to the organisation, such as the standard operating procedures, indicates that responsibility generally falls to the organisation to ensure their FMP adequately addresses commuting safety. However, the association of an FMP with fitness for work results in a targeted journey management plan for journeys to work, but typically does not consider the journey home as closely. The concentration on the journey to work fails to consider if workers are fit to commute home.

5.6.1 Implications

Examination of these policies provides an understanding of the limitations of industry policy in respect of the issue of driving-related commuting. These policies provide context for why some sites are proactive in respect to commuting safety and why other sites are not as proactive. The recent introduction of the concept of journey management has moved the industry in the right direction in respect of the implementation of safety management plans associated with the journey home following shift blocks. The successful implementation of safety practices has the potential to influence safety culture in respect the driving related commuting. Safety management plans, as well as safety culture and climate, are central to the mining industry. The limitations of these fatigue management plans should be considered when discussing the impact of safety climate on behavioural outcomes within the industry, as well as in the development of interventions in response to this issue.

5.6.2 Strengths, limitations and future research

The purpose of this critical analysis was to *examine the parameters of legislative requirements in respect to commuting within a Queensland and Australian mining context*. A limitation of this study is the focus on the Queensland mining industry. Considering there are specific nuances with Queensland legislation, particularly in respect to workers' compensation and journey claims (see Study 1), it was important to understand the legislative requirements within the state in which this research program was conducted.

A further limitation is that this review was performed solely by the key researcher of this research program. However, Study 2b further analyses the findings of this study through a focus group with key experts on the site to confirm interpretation and conclusions drawn. Future research should compare policy from a number of sites rather than focusing on a single site. Additionally, future research should examine the differences between states and if differences in legislation have any influence on commuting behaviour. For example, anecdotally it is understood that there is no requirement in New South Wales to provide site accommodation to workers following shift, which encourages workers to drive home immediately following shifts.

5.7 CHAPTER SUMMARY

Chapter 5 demonstrates that a key consideration when discussing workers travelling from major centres to mine sites must be the legislative structure and policy implications faced by the organisation in order to understand and define the organisational influences on the travelling workforce. The purpose of the critical analysis and review was to understand and define the parameters and constraints of the legislative framework in Queensland through examination of: (1) journey/commuting safety considerations; (2) current regulation, national standards and industry policies; and (3) the current situation of mining health and safety legislation in Queensland. The overview of the external and internal documents relating to workplace health and safety requirements within the Queensland mining industry, and more specifically, at an organisational level, demonstrates that commuting safety is defined by on-site safety issues which are predefined as a fatigue-related risk rather than a road safety risk, resulting in policies concentrating on FMPs, hours of work, and scheduling concerns.

The following chapter reports on the second part of Study 2. An expert focus group was convened to seek informed opinion and perceptions of the findings of the critical review. Chapter 6 reports on the methods used for the focus group and the semi-structured interview process, as well as the findings of the focus group.

Chapter 6: Exploring Commuting Behaviour from an Organisational and Safety Perspective

6.1 INTRODUCTION

Chapter 6 reports on the outcomes of the expert focus group. The aim of Study 2b was to describe the key points of difference between the legislation and an organisation's view of journey management by comparing the outcome of the critical review presented in Chapter 5 to the findings presented in this chapter. Considering mining safety in Australia and Queensland is so heavily regulated, it is important to understand the measures that are currently in place and how these measures may be influencing the current commuting behaviours of mine workers through organisational policies and procedures. This insight provides an understanding of the safety culture on site and defines the organisational factors influencing the travelling workforce (see *Figure 2-1*).

This chapter first describes the alignment of the study with Research Objective 2 (Section 6.2). The method and approach of the focus group, including an overview of the recruitment of participants, as well as the proposed analysis technique, are detailed in Section 6.3. The results of the focus group including sample characteristics and an overview of the identified themes are reported in Section 6.4. Finally, the results, implications of the findings and strengths and limitations of the study are then discussed (Section 6.5), with a summary in Section 6.6.

6.2 STUDY AIM AND RESEARCH OBJECTIVES

The purpose of the expert focus group was to *examine the parameters of legislative requirements in respect to commuting within a Queensland and Australian mining context*. Study 2b completes the exploration of the context of commuting safety by exploring an organisational view of commuting safety within the industry. Study 2b highlights the key points of difference between the legislation and an organisational view of safe commuting behaviour.

Study 2b sought the expert opinion and perceptions of key safety personnel at the target mine site to: (1) identify the legislative controls from an organisational perspective that influence commuting behaviours; (2) identify the potential impact of organisational employment structures, policies, and operations on workers' decision-making and behaviour around driving to and from work sites; and (3) highlight the key points of difference between the legislation and an organisation's view of safe commuting practices from the perspective of site safety experts. As a whole, Studies 2a and 2b respond to Research Question 3.

6.3 METHOD

The following sections describe the study design and rationale, developing the interview schedule, the research procedure, the approach to data analysis and ethics approval.

6.3.1 Study design and general research strategy

This study uses a semi-structured focus group to examine the boundaries between the legislation and an organisational view of journey management and commuting following a shift block. The purpose of using a semi-structured method is to allow some flexibility in the direction of conversation while still maintaining direction and focus on the relevant topic. Furthermore, the use of this qualitative method is supported by the adopted of a mixed method approach and further refines the outcomes presented in Chapter 5. The primary reason for using a focus group method was to enable a thorough discussion of issues identified in Chapter 5. Using this method, further information could be gleaned in respect to the behaviour of mine workers in Queensland. Furthermore, focus groups enable a researcher to capitalise on interactions within the group (Breen, 2006; Sim, 1998), which may illustrate different views on an issue.

6.3.2 Developing the interview schedule

The topics discussed throughout the focus group were informed by the outcomes of the critical review presented in Chapter 5. As discussed in Chapter 5, the boundaries between the organisational view of safe commuting and the legislative view are blurred and indistinct. The key objective of Study 2b was to uncover the key points of difference between the legislation and an organisation's view of safe commuting behaviour, as well as to understand the perceptions of experts regarding commuting following shift blocks. The topics for discussion during the focus group were based on background information, such as general commuting information, site safety in general, company expectations and journey management (see Table 6-1). Information was obtained from the group using a series of open-ended questions in a semi-structured design (see Appendix A).

Table 6-1.

Topics covered in the focus group interview schedule

Background	**General site safety**
• General commuting information • Crashes • Reason for the drive • Individual perceptions	• Legislation • Education • Best practice • Transference of safety behaviour • Training and information dissemination
Organisational controls	**Journey management**
• Fitness for work • Commuting guidelines • Management expectations • Responsibility • Consequences	• Commuting legislation • Fatigue management

6.3.2.1 Background

Study 2b is the first in this program of research to explore commuting and commuting behaviour with workers in the industry. Therefore, there were questions regarding general commuting behaviour in the mining industry, what type of crashes are occurring, and what the site safety experts perceive to be the reasons why some workers commence their journey immediately after the end of a shift block.

6.3.2.2 General site safety

In order to understand the context in which the site-specific behaviour occurs, questions associated with general site safety were important. These questions asked about general safety behaviours were an attempt to obtain a general understanding of safety culture and safety behaviour on site in an operational environment, contributing directly to understanding the organisational factors associated with commuting decisions (see *Figure 2-1*). The discussion of general safety behaviours was used as a generic opening discussion, but was important in exploring the relationship between on-site and off-site safety behaviours.

6.3.2.3 Journey management

Journey management is a recent term originating from *QGN16* in an attempt to provide some control around commuting to and from work within the Queensland mining industry. The critical review found that journey management has a focus on on-site related behaviours to ensure that workers are fit for work once they are on-site. The focus group discussion regarding journey management specifically centred on what the site safety personnel thought journey management was about, how it related to other safety policies, and to demonstrate the relationship between organisational influences and commuting decisions.

6.3.2.4 Organisational controls

The control that an organisation places on commuting and safety is important to understand given the findings of the critical review. However, the FMP control described in the review is the theoretical approach to safety, not the implemented controls. The focus group questions address the key points of difference between the legislation and the implemented approach by understanding the organisation's view of commuting behaviour, including: (1) who is responsible; (2) how commuting behaviour fits within site procedures and legislative requirements; and (3) how commuting behaviour is influenced by organisational employment structures and operation schedules. Ultimately it is the organisation's responsibility to ensure that their FMP adequately addresses commuting safety in line with relevant guidelines such as *QGN16*. These questions address the organisational and management expectations and commitment to safety (safety climate), as well as responsibility of commuting following shift blocks. Understanding expectations includes knowing the consequences resulting from workers not complying with site requirements.

6.3.3 Sample and recruitment of participants

The focus group consisted of eight participants, drawn from a specific pool of site safety, health and safety, and mining safety representatives. There were limitations in the number of safety representatives available to participate. Given the purpose of the study was to discuss specific legislative requirements, it was necessary to involve those who had knowledge of safety legislation in the Queensland mining industry, how that relates to commuting within the industry, and how those requirements have been implemented into site practices. Participants were sourced using a purposive sampling technique referred to as expert sampling (Battaglia, 2008). Purposive sampling is beneficial when research seeks to elicit the views of those who have specific expertise in respect to a topic (Battaglia, 2008), which is consistent with the aims of Study 2b, as well as Research Objective 2. However, this sampling technique has its limitations in the available sample size in this instance, due to the restrictions placed on the pool of participants. It is likely that a different sample would be drawn by a different researcher due to the subjective nature of the sampling technique and differences in assessment of which participants could be categorised as 'experts' or otherwise (Battaglia, 2008). However, given the requirement for expert knowledge and because there is no intention to draw inferences from this study to the whole expert population, the use of this sampling technique was appropriate.

Following a discussion about the purpose of the research, participants were approached based on the recommendation of the Site Safety Manager. The Site

Safety Manager provided contact email addresses of potential participants, who were contacted via email and invited to participate. Of the ten participants invited, eight participated in the focus group. Details regarding the information sought were given to each individual prior to commencing the session. Informed consent was taken as granted if the participant presented at the meeting room. However, to ensure agreement to participate, each participant was reminded that participation was voluntary and they had the ability to withdraw at any time. The sample was small for this focus group given the objectives of this study and the availability and willingness of safety professionals on the target mine site.

Given the small numbers of safety representatives on site, conducting a pilot study was not possible for this study. To overcome this issue, the interview schedule was sent to the Site Safety Manager prior to the focus group in line with the recommendations of Breen (2006) to check that participants would not have any issues in responding to the proposed questions. This step resulted in no changes to the themes of the questions asked.

6.3.4 Research procedure

The focus group was conducted during a meeting with site safety officers; it lasted for approximately 60 minutes and was audio-recorded. The discussion was initiated by the researcher but was maintained by the participants with the occasional involvement of the researcher to maintain focus and ask additional questions in line with the questions presented in Appendix A. The interview occurred on-site, in a meeting room.

6.3.4.1 Data collection and confidentiality

Agreement to record the session was sought from all participants prior to commencing the discussion. The focus group was recorded and the recording was transcribed verbatim. The researcher kept additional notes during the focus group to ensure all information was recorded.

6.3.4.2 *Role of the moderator*

A moderator (the researcher in this case) is essential to provoke and facilitate active discussion amongst participants and to ensure quality data are collected. The role of the researcher/moderator was defined by Sim (1998). A moderator should: (1) enable a balance between actively participating and letting the discussion flow; (2) indicate to the participants that he/she is there to learn from them; (3) ensure discussion predominantly stems from the participants; (4) facilitate discussion where needed; and (5) allow group interaction (Sim, 1998).

During the focus group, participants were actively asking questions of each other and provoking discussion. Given the free discussion amongst participants, the researcher's primary role was to ensure that the discussion was on topic, while ensuring that most of the dialogue originated from the participants. The participants were informed that they had been invited to participate because of their expert knowledge in the area of safety in a mining environment. Therefore, they were aware that the researcher was interested in their thoughts about commuting and commuting safety.

6.3.5 Data analysis

The data were transcribed and organised using NVIVO 10.0. The data were analysed using thematic analysis, which is a method used to identify, analyse, and report patterns within data (Braun & Clarke, 2006). Thematic analysis is an appropriate approach for mixed method research given that it is not specifically linked to a specific interpretive framework or research paradigm (Braun & Clarke, 2006). Coding applied to the transcriptions was preconceived based on the outcomes of Study 2a, and drawn from the salient issues of the transcribed text.

6.3.5.1 *Theme development*

There are five phases of theme development as recommended by Attride-Stirling (2001, p. 391). *Reduction or breakdown of text* is the stage whereby codes and themes are identified and applied to the text. The coding framework was devised through an application of theoretical interests, salient issues identified in the text, or both (Attride-Stirling, 2001). These interests and issues were guided by the research questions which seek to identify the influences on worker commuting behaviours, particularly in respect to (1) current legislative controls; (2) organisational employment structures, policies and operations; and (3) the organisation's view of journey management. This coding framework was used to distil the text into manageable items in order to define themes and create a map of the data. These maps are then used to *explore the text* and provide guidance to the deduced conclusions and the *interpretation of patterns* identified (Attride-Stirling, 2001).

6.3.6 Ethical approval

Ethical approval was obtained from the Queensland University of Technology Human Research Ethics Committee on 26 June 2013 (approval number 1300000349).

6.4 RESULTS

The results of the focus group are presented as they relate to each theme identified following analysis and how it relates to organisational policies and procedures from the perspective of the site safety experts.

6.4.1 Sample characteristics

All participants worked in the mine administration area as safety or training professionals, from the mine site as well as the contracting companies engaged by the mine site. The participants ranged in experience and seniority, from graduate safety professionals to the regional safety manager; this spread of experience is reflected in the spread of age groups represented in Table 6-2. Specific roles are not detailed to protect confidentiality of participants.

Table 6-2.

Expert focus group sample characteristics

Gender	n
Male	7
Female	1

Age Group	n
20 – 29	2
30 – 39	2
40 – 49	3
50 – 59	1

Having direct involvement in the safety operations of the site has the potential to influence the discussion in relation to the site's overall safety performance. However, given that the purpose of this study was primarily to understand the site safety personnel's perceptions of commuting and the key points of difference between the safety legislation and the organisation's view of safe commuting behaviour, this limitation is inconsequential.

6.4.2 Relevant documents

Three main documents were focused on in the experts' discussion. These documents represented the high-level legislative requirements, general industry guidelines and internal organisational documents. The legislation referred to throughout the discussion was the *Coal Mining Safety and Health Act 1999 (QLD)*. From the perspective of relevant guidelines, the most up to date and most frequently referenced was the *QGN16 Guidance Note for Fatigue Risk Management 2013.* Finally, the internal FMP and its contents were also referenced when discussing site-specific procedures relating to safe commuting behaviour. These documents are consistent with the documents reviewed in the critical review.

A typical comment reveals experts' knowledge of the legislation:

> *"At a very high level the coal mining safety and health act requires that the site has a fatigue management plan which falls under fitness for work.*"

As found in Chapter 5, the legislation is broad and concerns general procedures that should be adopted when there is a risk:

> *"The intent of the legislation is that we need to address [safe commuting] within our systems and it needs to be risk-based*."

The introduction of the new fatigue management guideline *QGN16* highlights the concentration of the guidelines and legislation on site-based requirements. One site safety expert outlined their interpretation of *QGN16* about fatigue management and fitness for work:

> *"Guideline 16 is on camp accommodation, meals, availability of accommodation, risk matrix, there is nothing within that guideline specifically about commuting*."

6.4.3 Expectations and enforcement

Analysis of the focus group generated three themes: individual expectations about commuting, site expectations about commuting, and enforcement of commuting policies and legislation. As illustrated in *Figure 6-1*, the enforcement of commuting policies and legislation continually competes with the expectations of the workforce and the site.

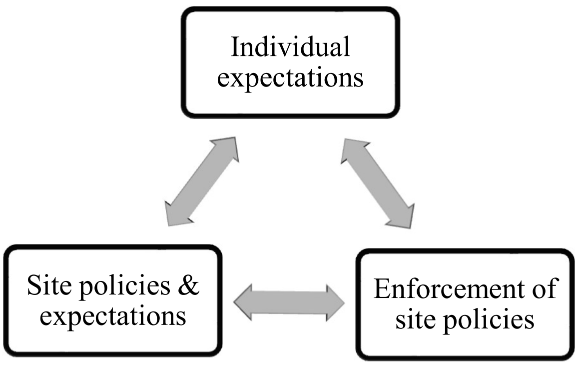


Figure 6-1: **Key thematic outcomes from expert focus group**

6.4.3.1 Theme 1: Site policies and expectations

The site safety personnel discussions primarily related to legislative and procedural compliance. There was general consensus that compliance with the legislation was *"up to the individual sites"* and that the legislation is *"at a very high* *level"* and *"broad in its requirements"*. For example, when explaining where journey management fits into the legislative guidelines, one safety expert described a general risk-based approach to journey management that is in line with the fatigue management policies:

> *"At a very high level the Coal Mining Safety and Health Act requires that the site has a fatigue management plan which falls under fitness for work. That's for the sites to adopt a risk based consultative approach and it's for all the sites to comply with the requirement [of that risk based approach], I suppose journey management would fall under that*."

However, given the reliance on the organisation to develop safety systems using broad guidelines, there is a perception that *"good sites"* will have effective systems in place, which alternatively, means that some sites' safety systems will be lacking, resulting in *inconsistencies between sites*. For example:

> *"The intent of the legislation is that we need to address it within our systems and it needs to be risk-based. Operations that take risk management seriously will generally have an effective safety system in place*."

In respect to journey management, the *inconsistencies between sites* given the generic and general approach become more apparent, resulting in limited detail:

> *"Journey management is very generic across the industry. There are no specific guidelines which is fairly common...I could speak for all of our operations that we don't go into a lot of detail regarding journey management*."

Even sites that take risk management seriously and implement effective safety systems have difficulties in respect to the broad approach in the legislation, particularly in respect to commuting after shift. One interviewee confirmed:

> *"There is an expectation that [the workers] have a rest period before [they drive home], but what is a suitable length of time for a rest break? We don't have anything documented*."

Despite this site's expectation of a rest break prior to the commute, there is confusion in respect to the specific requirements. This confusion stems from the reliance on guidelines, which are not specific in respect to the target safety practice. While it is acknowledged that the *"legislation is high enough"*, *"guidelines are guidelines"* and *"it's not as simple as policy"*, the issue in respect to safe commuting behaviour is that because there are broad guidelines, the issue is dealt with in a broad way. This broad approach results in workers perceiving that the *safety policies are malleable* in respect to safe commuting. There is a common conception that workers will bend the rules to get around any measures in place, to achieve something faster or do something the way they want it done, usually because of competing priorities (e.g., family at home or a social event). Bending the rules is particularly applicable to safety policies that are blurred and indistinguishable. For example:

> *"[The workers] deny that they are [driving the whole way home without stopping], they say that they are driving 20kms down the road and they say that they are having a sleep in their car, and we know that that's not true."*

Alternatively, the *rules are bent* due to enterprise agreements, which means that any changes *"must have the agreement of the workforce"*. Even the provision of incentives is not enough to maintain compliance with the safety policies within the organisation in respect to the issue of commuting. For example:

> *"You have your overarching procedure, but you also have the enterprise agreements. For example, if you don't pay them to stay, you can't insist that they stay a lot of the time. You can give them a financial reward and they'll take it, but still travel when they are not supposed to."*

There is further flexibility in respect to self-assessment, which is a risk mitigation technique adopted primarily for the management of fatigue. There is an expectation that the training and experience provided is sufficient for a worker to be able to judge their ability to return home safely, without contemplating competing priorities. Despite these journey management guides, a worker's assessment of their fitness to commute is left to self-judgement. For example:

> *"We tell our guys that they have to judge it themselves."*

Self-assessment hinges on an individual's difference in respect to sleep requirements, despite a large amount of scientific literature demonstrating that the variation in sleep requirements is minimal between adults (Dorrian et al., 2008; Reyner & Horne, 1998). Despite this evidence, safety managers cite fatigue management as it currently stands as a *one size fits all* approach:

> *"I think that the biggest thing is that the amount of sleep required varies between workers. For example, I can run on 4 hours sleep a night and that's fine for me. Fatigue management doesn't take this into account, it's the same approach for everyone and it just doesn't work.*"

6.4.3.2 Theme 2: Enforcement of site policies

The theme of enforcement is considered as a discrete theme because the safety experts mentioned it explicitly. They stated that enforcing a journey management policy is almost *unachievable* due to the nature of the journey. For example:

> *"We simply don't have much control over the time that the guys leave, they think, you can't make us stay, so why should we stay? But I don't think that they are fully aware of the risks sometimes.*"

The journey management policy is associated with the fit for work policy or FMP as discussed in Chapter 5. The safety experts suggest that the issue is the same regardless of the direction the worker is driving; however, the difference is that during the journey to work the worker has to show up fit to perform their duties.

> *"It's the same issue before and after shift. We have a fit for work policy, or fatigue policy, if they are travelling to work and they have an accident they are covered for workers' compensation. So we don't see why we can't enforce that fit for work on the trip home.*"

These safety managers think that the majority of the workers on-site are doing the right thing and taking a break following their shift prior to driving home, which is in line with the journey management plan that they have in place. However, there is *no punishment or repercussion* if these workers do not comply with the plan:

> *"We have a journey management plan, there is an expectation that they will use it. I do see some comply with it from time to time, but it's certainly not enforced if they don't comply with it."*

6.4.3.3 Theme 3: Individual expectations

Despite the rules in place to manage this issue, the site safety experts agree that control of this issue does not stem from the legislation or policy; rather the control (or lack of control) comes from the expectations of the workforce in respect to their commuting behaviour. There is an expectation that the workers come to work, work hard and have their time off for themselves. It is *"a cultural thing that the hours are*

12 hours per day"; this stems from changes in the rosters in the 1980s. Since then the *"lifestyle roster"* has been engrained in the workforce, despite the fact that each site has different hours and different lifestyle offerings. For example:

> *"There is a highly motivated workforce here that work long hours and they have an expectation of being here from 6 – 6 each day and then have their time off.*"

The motivations come from various sources, from recreational activities (e.g., camping, fishing and boating) to social influences (e.g., family and friends), which were given as a key reason for *"bending the rules"*. These motivations are some of the factors that contribute to enthusiasm to leave the site, further supporting the focus on the journey home from work. Family influence was a commonly cited as a pressure:

> *"The guys' families put massive amount of pressure on the guys to get home after shift, the wives spend all this time at home and they just want some quality family time*."

Given the desire not to waste time off, these workers change their commuting routines according to the *type of shift performed*. When finishing night shift, the workers are used to the night routine and it is easier to stay awake at night. However, a night routine does not fit in with the family routine. As such, the worker attempts to 'kickstart' a day routine by staying awake the first day off. By not sleeping after a night shift, the worker has the opportunity to get back to a normal sleeping routine. They achieve this by driving home immediately following their last shift:

> *"People are more likely to stay and sleep at the end of the day shift compared to the end of the night shift because they want to get their sleeping back to normal and don't want to waste time sleeping on their days off.*"

According to the site safety experts, workers are happy to drive during the day but not at night. When these workers finish a night shift, the journey occurs in the daytime, so there is a perception that it is safe to travel. As such, the journey is undertaken shortly following the shift. When finishing day shifts, the worker drives during the night, therefore it is less likely that workers leave immediately.

6.5 DISCUSSION

Study 2b examined the parameters of legislative requirements in respect to commuting within a Queensland and Australian mining context and revealed the key points of difference between the legislation and an organisation's view of safe commuting practices from the perspective of site safety experts. These key safety experts also: (1) identified the legislative controls from an organisational perspective that influence commuting behaviours; (2) identified the potential impact of organisational employment structures, policies, and operations on workers' decision-making and behaviour around driving to and from work sites; and (3) discussed the key points of difference between the legislation and an organisation's view of safe commuting practices. The findings in this chapter support the supposition that there is an expectation of safety awareness required in respect of the commute, suggesting further examination of site safety climate. The focus group also underlines the need for further examination within this research program of lifestyle, family and colleague influences, as well as the impact of rostering and site policy (see *Figure 6-2)*. *Figure 6-2* details the progressive iteration of the influences identified in this research program and highlights the factors identified in Study 2b, further developing the factors identified in *Figure 2-1* and *Figure 4-4*. These influences are signified using darker text and are discussed further in the following sections. The following also sections discuss the key outcomes from a practical and theoretical perspective. As with the previous chapter, strengths, limitations and opportunities for future research are presented.

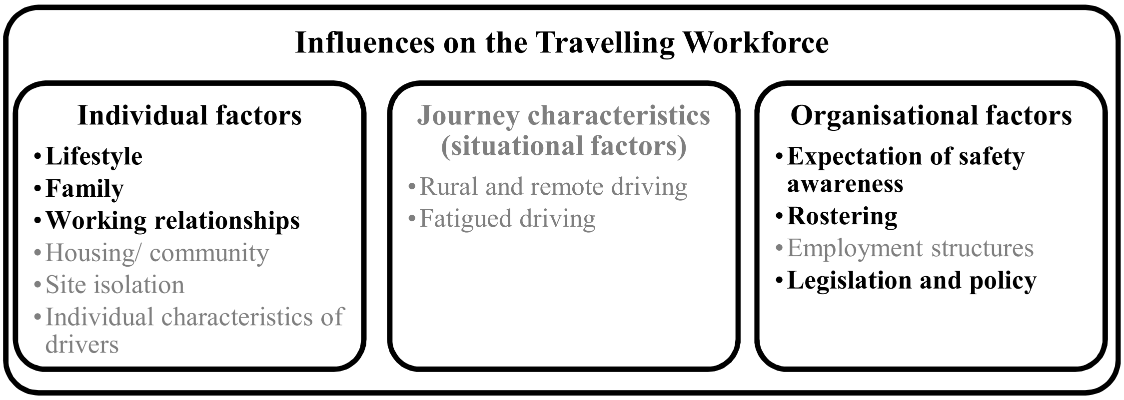


Figure 6-2: **Identified influences on the travelling workforce following the critical analysis and expert focus group**

The key themes identified when considering the legislation and policy in this environment are the safety experts' understanding of the key focus of how commuting behaviour is currently regulated in the industry based on site-related safety practices and policies. The focus group agreed that there is a concentration on fatigue management and fitness for work when examining journey management on-site and within the mining industry. Workers are left to self-assess safety on a range of risks, including commuting safety. As outlined in Chapter 2 (see Section 2.5.1) relying on this self-assessment technique has significant limitations, especially considering that some research indicates that over 80% of people continue to drive once they have noticed they are 'sleepy' (Armstrong et al., 2009).

Study 2b identified those legislative controls that influence commuting behaviours from an organisational perspective. The legislative controls for commuting are based around fatigue management frameworks and stem from the *Coal Mining Safety and Health Act 1999 (QLD)*, the *QGN16* and internal fatigue management plans. There is a concentration on fatigue management and fitness for work. The focus group supported that this focus results in concentration on the trip *to* work rather than the trip home, which supports the research rationale to focus on the trip home in this research program. The safety experts agreed that the journey home was not typically considered in journey management policies and that journey safety policies were to ensure that workers were fit to perform their duties at work. Finally, there was agreement that the policies were broad. These findings are consistent with the critical review in Chapter 5.

A further aim of this study was to identify the potential impact of organisational employment structures, policies, and operations on workers' decision-making and behaviour around driving home from work sites. The focus group reported that shift structure results in different commuting behaviour, with the type of shift and the shift length influencing decisions to leave site immediately following a shift block or not. The safety assessment of the journey home is left up to the self-assessment of the worker. However, enforcing any policies is difficult due to the broad approach adopted, and the lack of focus on safe commuting.

Finally, this study described the key points of difference between the legislation and an organisation's view of journey management. Firstly, the safety managers understand that the expectations of the workforce are an important consideration and that there are competing expectations of individuals and the mine site in enforcing policies associated with journey management. These expectations are further exacerbated by the influence of rosters on worker expectations, particularly associated with lifestyle and time away from work. It is the perception of the safety experts that enforcement is not achievable because the policies and site expectations are not in line with the expectations of the workforce. Workers are aware of the requirement to present fit to perform their duties on site. As such, a conscious effort is made to ensure fitness for work by driving to work the day before shift; however, there are no repercussions if the worker fails to comply with 'policy' on the journey home. Motivations change for the trip home. These motivations and expectations of the worker are not in line with journey policies. The expectation of the work force in regard to 'time off' is the key motivation for the decision to leave the site following a shift block.

6.5.1 Implications

Study 2b suggests that choosing to leave the site following a shift has two key facets: individual and site expectations. These factors are in line with the TPB, and again confirm that the application of the TPB to explain the behaviour of mine workers' driving behaviours immediately after shift is appropriate (Godin & Kok, 1996). The focus group pointed to the safety climate element to the journey decision, further supporting the exploration of the influence of organisational factors. Given that even the experts perceive that there is little or no control over the commute home, workers push the boundaries even when there are organisational policies which prescribe rest periods following shift. The perception that there is limited or no control over the commute home, despite the positive safety culture on-site, confirms the need to understand the decisions associated with the risk-taking behaviour exhibited. As outlined in Chapter 2, a key limitation is that safety climate does not explain behaviours in environments where there is a positive safety culture but unsafe behaviours intentionally occur, and supports the inclusion of safety climate concepts within the decision-making model. This finding further confirms the need for an understanding of those factors which influence the commuting decision.

6.5.2 Strengths, limitations, and future research

The limitations with using a focus group to explore an issue is predominantly associated with participants agreeing with others during the group session, 'groupthink', participants not wanting to participate in a group situation, confidentiality issues, and interviewer bias. While all these limitations are important to consider, the purpose of using a focus group for this study was to elicit agreement on the topic of commuting home after shift in order to discuss these issues further with interview participants in Study 3. Therefore, the focus group was used to explore the issue and further direct the research in Study 3 and Study 4.

A further limitation of this focus group was the size of the sample. Given there was one participating site, there was limited opportunity to increase the size of the group. There was a good spread of experience in the group and it served the purpose of exploring the issue and seeking confirmation of legislative and policy interpretation from an expert viewpoint. Additionally, the site is part of a large corporation and those involved in the focus group brought experiences learned from other sites in the corporation. There was only one researcher present due to the location of the site and the practicality of two researchers travelling; however, the focus group was recorded to minimise this limitation.

6.6 CHAPTER SUMMARY

Study 2b presents an overview of the perceptions of site safety experts about journey management and driving-related commuting within the mining industry. The chapter identifies three key themes – workforce expectations, site policies and expectations, and enforcement. These themes describe inconsistencies in commuting policies, so enforcement is difficult or non-existent. Competing with these two factors are the expectations of the workforce. The workers want to do the right thing, but their time off is their own, showing the influence of the 'lifestyle roster' on commuting decisions.

The following chapter reports on the findings of Study 3. Following a review of relevant literature, the descriptive analysis, and the exploration of the issue with safety experts, in-depth interviews with mine workers were undertaken to explore key influences on commuting behaviours. Chapter 7 reports on the methods used for the in-depth interviews and the semi-structured interview process, as well as the findings of the interviews. The findings in Chapter 7 are then discussed using a theory-led approach to align the identified themes with the TPB framework.

Chapter 7: Exploring Individual Perceptions of Commuting Behaviour

7.1 INTRODUCTION

Chapter 7 reports on the outcomes of Study 3. Study 3 consisted of a series of in-depth interviews with mine workers at the target mine site. Using the framework presented in *Figure 2-1*, the aim of this study was to examine individual, social, situational and organisational influences on worker commuting behaviour, particularly given the results of the expert focus group which highlighted social and organisational influences as key factors for leaving site immediately after shifts.

Section 7.2 provides an overview of the study aim and objectives and how Study 3 contributes to the broader research questions. The method, including the study design, interview protocol, participants, research procedure, and adopted analysis techniques is then described (Section 7.3). The characteristics of the sample, as well as the eight key themes identified as a result of the in-depth interviews are reported in the results section (Section 7.4). This chapter then discusses how themes and concepts identified in Study 3 align with the relevant cognitive, social and organisational theories (Section 7.5). Section 7.5 also details critical beliefs which serve to further understand the most salient aspects of each of the predictors of intention and behaviour. The discussion section concludes with an overview of the study specific implications, strengths, limitations and opportunities for further research (Section 7.5), with Section 7.6 providing a chapter summary.

7.2 STUDY AIM AND RESEARCH OBJECTIVES

Previous chapters outlined the limited research that has been undertaken in respect to commuting behaviour. As such, factors which influence workers to leave the site immediately following a shift block remain unclear, despite being these workers being employed in a highly safety conscious industry. Therefore, organisational policies are developed using assumptions rather than through research-based evidence. The results of Studies 1 and 2 highlight influences from an organisational perspective and provide an overview of journey characteristics which may influence commuting decisions at the end of shifts. Study 2b highlights that this issue is not controlled by legislation or policy, but rather the control (or lack of control) comes from the expectations of the workforce in respect to their intention to leave the site immediately and their resulting commuting behaviour. The overlap of worker expectations about their commute with organisational controls suggests the need to explore more intrinsic factors associated with individual perceptions about the journey itself, the involvement of family and friends in the decision, organisational safety, risk factors, and other social pressures.

As identified in Chapter 2, there are a number of factors which influence the commuting decisions of this workforce. While there is previous research relating to the travelling workforce (see: Di Milia & Bowden, 2007; Houghton, 1993), the key influences drawn from the extant research are not specific to the context of driving home following shift blocks, nor do these studies examine the influences on worker driving decisions. Guided by the TPB and the influences of the travelling workforce framework presented earlier, Study 3 contributes to the overall research program by addressing Research Objective 3 and aims to *explore and examine the relationships between individual, social, organisational and situational influences on worker commuting behaviour*. Study 3 is exploratory in nature, seeking to understand the key influences on worker commuting decisions from an individual, social, organisational and situational perspective by specifically addressing Research Question 4:

> *What are the key influences on the travelling workforce from an individual, social, organisational and situational perspective and how do these key influences impact workers' decisions about leaving the work site to travel home immediately after a shift block?*

The outcomes of Study 3 provide support and further iteration of the key influences on the travelling workforce presented in *Figure 2-1* and *Figure 6-1*.

7.3 METHOD

The following sections describe the strategy adopted to address the research question and the overall study design, the development of the interview protocol, and the rationale for the themes discussed in the in-depth interviews, the data collection procedure, and the analytic approach.

7.3.1 Study design and general research strategy

Study 3 uses in-depth, semi-structured interviews to explore the individual differences of the workforce in the target mine site. The purpose of using semi-structured interviews is to allow some flexibility in the direction of conversation. Use of a qualitative method is supported by a mixed method approach to research methodology.

7.3.2 Developing the interview protocol

Study 3 refines the findings of Study 2b, which outline that safety personnel perceive worker expectations are a key influence on commuting behaviour. In line with the discussion in Chapter 2 and as highlighted in Section 7.2, the current study is guided by the TPB and the outcomes of Studies 1 and 2. Topics discussed during the in-depth interviews are presented in Table 7-1 and Table 7-2. Information was obtained from the group using a series of open-ended questions (see Appendix B).

Table 7-1.

Topics covered in the in-depth interview schedule

Circumstances of the commute	
• *Circumstances* • *Past behaviour* • *Distance/hours driven*	• *Thoughts about commute* • *Experience driving*
Background, life themes and history	**Company expectations and site culture**
• *Length of time in the industry* • *Occupation* • *Shift length/night or day shift* • *Licence* • *Crashes* • *Reason for the drive*	• *Commuting guidelines* • *Expectation of behaviour* • *Responsibility* • *Consequences* • *Safety on site*

Table 7-2.

Topics covered in the in-depth interview schedule (continued)

Commuting driver safety	Social expectations
• *Road environment* • *Fatigue management* • *Road familiarity* • *Risk perception*	• *Behaviour of colleagues* • *Family* • *Friends*

7.3.2.1 Background, life themes and history

The background topic was designed to understand relevant information about the participant to put the commute into context. The information sought was mostly demographic information about the participant, particularly in respect to the distance travelled and how long it takes to drive home. Information was also sought in respect of the reasons why these workers initially commenced in DIDO work as an opening discussion point.

7.3.2.2 Circumstances of the commute

The 'circumstances of the commute' topic was designed to ascertain details about the workers' usual trip home following shift block, including when they normally leave, if they leave at a set time, their general thoughts about the commute, and the time they leave to travel home. The circumstances of the commute were expected to further contribute to understanding the journey characteristics associated with the immediacy of the commuting decision.

7.3.2.3 Driver safety

The driver safety topic focused on safety during the commute. This category was designed to understand what the roads are like, individual risk perception, and organisational influence. Firstly, from a road safety perspective it is important to understand what factors about the drive the workers worry about, and how they change their behaviour in order to compensate for these factors. The second influence is associated with the organisation, specifically how organisational influence affects worker perceptions of fatigue management and how these perceptions control the journey home. The final factor associated with driver safety is how individual risk perception influences control over the journey home. This topic was developed due to the outcomes of Study 1 and Study 2, and further contributes to an understanding of individual and organisational factors, as well as journey characteristics, as key influences of commuting decisions.

7.3.2.4 Social expectations

In line with perceived norms, the discussion about social expectation was designed to explore social networks that influenced commuting behaviours. The focal social networks were family, friends, and colleagues, given the outcomes of Study 2b. The social expectations theme was developed to further understand the relative importance of social factors in respect of the immediacy of the commuting decision after shifts.

7.3.2.5 Company expectations and site culture

Company expectations and site culture are strongly linked to the findings of Study 2b and relate directly to the organisational factors in *Figure 6-2*. Study 2b highlighted limited safety practice in respect to commuting and journey management with a focus on fatigue management. The purpose of this category is to specifically understand worker perceptions of safety behaviours at the site and if these safety behaviours translate to the commute.

7.3.3 Participants

A convenience sample of participants (*N*=37) was drawn from a variety of operational and management areas. During the time on site, the researcher was only given access to the main office to comply with site induction, safety policies and operational requirements. Workers were sampled if they had meetings or training at the main office. The sample characteristics are described in the results section of this chapter.

7.3.4 Research procedure

The semi-structured in-depth interviews described in Section 7.3.2 were conducted with mine workers from the focal mine site. Each interview lasted between 20 to 45 minutes, with the shorter interviews occurring toward the saturation point of the sample. Given operational requirements, the interviews were kept as brief as possible. This study was guided by the TPB; however, it also served to further explore the possible theoretical models most appropriate for this context. The primary focus of the interviews was to explore the influences on worker decisions to leave the worksite shortly after a shift block. However, given that mine workers' commuting decisions remain relatively unexplored in the literature, the questions posed were flexible to encourage the exploration of new ideas.

7.3.4.1 Data collection and confidentiality

The audience is an important consideration when determining how to approach data collection. Given the nature of these participants, it was decided that the interview would not be recorded. The decision not to record the interview resulted from the recommendation of the Site Safety Coordinator, who advised that the workers may not wish to participate if the interview was recorded. As such, rather than recording the interview, the researcher took detailed notes. The depth of notes taken during each interview was extensive, and any unusual responses were recorded with additional notes; interesting responses were noted verbatim. These quotations were predominantly used to reinforce the findings. The interview guide provided the researcher with a record of the key ideas discussed throughout the interview and this assisted in transcription following each interview. The interviews were transcribed within a week following the interviews to reduce error. The researcher also kept detailed notes relating to the responses provided by participants and noted emerging themes following each interview, to ensure there was a record of key ideas. Other information recorded throughout the course of the interview was used to define themes of interest, such as body language and inflection.

The interviews were conducted where the interviewee's privacy was not compromised in order to maintain confidentiality. Confidentiality was particularly important considering these interviews were being conducted in a work environment. As there was a potential for the interviewee to describe information that may compromise their confidentiality, data were transcribed so as to not identify the participant. It was not viable for an additional researcher to be present at the time of the interview due to the remote location of the mine site. However, the presence of one researcher during the interviews was not considered a major limitation, given the purpose of the in-depth interviews was to understand key themes in respect to commuting behaviour rather than to perform conversational analysis.

7.3.5 Analysis

The transcribed data were organised using NVIVO 10.0. Data were analysed using thematic analysis. The approach differed from thematic network analysis which was adopted as the analysis technique within Chapter 6. As discussed in Chapter 6, there are varying thematic analysis techniques depending on the interpretive framework applied for the purpose of analysis (Braun & Clarke, 2006). The literature review presented in Chapter 2 guided this qualitative research; however, the interview protocol did not strictly address constructs within the TPB. Key topics were addressed (see Table 7-1 and Table 7-2) to determine if another theoretical framework was more appropriate to address the research question associated with this study of *what are the key influences on the travelling workforce from an individual, social, organisational and situational perspective?* The TPB framework was treated as a *guide* for the purpose of the data collection; however, following the data collection, the usefulness of the TPB to explain this behaviour became clearer. As such, the current chapter presents the key themes identified in the in-depth interviews but discusses the data using a theory-led approach, with a specific focus on TPB concepts.

7.3.5.1 *Theme development*

Data were analysed by thematic analysis and key themes were identified using a theory-led approach to outline how each theme identified related to specific constructs of the TPB (Hayes, 1997; Howitt & Cramer, 2014). The adopted approach provided the opportunity to explore and compare groups (e.g., day versus night shift), as well as examine the thoughts of particular individuals (Hayes, 1997). The results section is presented in line with the major themes identified through the in-depth interviews. The discussion section then linked these findings back to the TPB framework.

7.3.6 Ethical approval

Ethical approval was obtained from the Queensland University of Technology Human Research Ethics Committee on 26 June 2013 (approval number 1300000349).

7.4 RESULTS

The following section describes the characteristics of the sample. Key themes are then discussed. There were eight key themes which describe how these workers justify their approach to commuting home, why they leave at the time they do, and what their perception of 'safe commuting' entails.

7.4.1 Sample characteristics

The characteristics of the participants in Study 3 are presented in Table 7-3. Given the mining industry is male-dominated, 32 males and 5 females were interviewed. Of those interviewed, 81% drove more than 200 kilometres from the mine site to home, with 70% of participants driving by themselves. The most common shift block (62%) was a rotating day/night roster of seven days on and seven days off. A variety of occupations was represented within the sample. These occupations included mine operations (40%), mine maintenance (38%), and mine administration (22%).

Table 7-3.

In-depth interview sample characteristics

Characteristics		**n**	**Characteristics**	**n**
Current role:			Approximate distance travelled:	
Mine Administration	Safety professional	3	Under 200kms	9[1]
			201 – 400 kms	14[2]
	Utilities	2	401 – 600kms	9
	Security	1	601 – 800 kms	5
	Office administration	2	800kms +	1
Mine Operation	Management and Supervisors	4	Length of shift block:	
	Drill and blast specialists	3	7 days on/7 days off	23
	Engineers and advisors	4	14 days on/ 7 days off	2
	Operation and production	4	5 days on/2 days off	9
Mine Maintenance	Vehicle tradesmen	8	8 days on/6 days off	2
	Site tradesmen	7	12 days on/9 days off	1
Gender:			Shift rotation:	
Male		32	Day/Night	20
Female		5	Days only	17
Age:			Main Travel method:	
20 – 29		11	Car – driving alone	26
30 – 39		12	Car – Car pooling	6
40 – 49		10	Bus	1
50 – 59		4	Plane	4

[1]*Four participants of this group indicated they drive to the nearest airport and fly home and one participant of this group uses the bus service on offer.*
[2]*One participant of this group drives to an airport further away to secure less expensive flights.*

7.4.1.1 Day versus night shift

There is a clear difference between the commuting behaviour of mine workers following a day shift block compared to a night shift block. These differences are mainly associated with the time that the worker would be driving during the day. For example, following a night shift, the workers would be driving home during daylight hours. Comparatively, following a day shift, the worker would be driving home during the night. According to the interviews, there is a tendency for these workers to stay on site following a day shift in order to avoid night driving.

7.4.2 Key themes

There were eight key themes identified throughout the in-depth interviews: safety awareness, routine journey, attitude about the commute, attitude about work, community, perceived commuting risks, as well as family and friends' influence. These themes and sub-themes will be discussed in the following sections.

7.4.3 Theme 1: Safety awareness

Participants described a general awareness of safety and safety-related concepts. This general safety awareness aligned closely with specific safety processes and policies outlined in Chapter 5, such as fatigue management. Safety-related concepts were discussed in three ways: (1) where there is an existing risk associated with a task, how that risk would be mitigated through practical controls; (2) controlling risk through previous experience and ability; and (3) managing safety through general awareness and an application of safety knowledge.

7.4.3.1 Sub-theme 1: Practical safety control

The majority of participants expressed concern for their personal safety while driving home for a variety of reasons, such as other drivers, kangaroos, the time of day spent travelling, the long distances travelled, and fatigue. Participants justified their action by describing mitigation measures they believe counteracted the perceived risks associated with the journey home. There were two key methods, including implementing a practical safety control (see Table 7-4) and control through experience and ability (see Table 7-5). The practical solution appeared to be in response to commonly faced 'risks', such as encountering animals, falling asleep, and other drivers. For example, the use of a larger, reliable vehicle or a preference to drive at night due to a higher level of visibility of oncoming traffic can be described as practical solutions (see Table 7-4). Those participants who implement practical solutions believe that these mitigation measures control the risk to an acceptable level. An example of a mitigation measure is individuals leaving immediately after night shift and sharing the driving on the way home.

Table 7-4.

Theme 1: Safety awareness – practical safety control

Sub-theme 1.1: Practical safety control **Sub-theme content:** I am able to mitigate risks through practical measures, such as larger vehicle or by sharing the driving. I can justify leaving the site at a certain time due to practical mitigation measures that have been implemented.
Example participant responses:
"After nightshift we usually leave straight after shift. It doesn't really matter when we leave because we usually share the driving anyway. So I don't think it's that risky." (Male, aged 30, Mine Maintenance) *"I prefer to drive at night, I don't think that I get as tired and I think that I can see better at night. You don't have the sun in your eyes and you can see the trucks and cars coming toward you because of the headlights." (Male, aged 32, Mine Maintenance)* *"I drive a…[big] car, so I don't really have to worry about animals and stuff like that. I think that people really need to think about the capability of their car. They need to make sure that it's ok to drive on these types of roads, not just for it to last but to make sure they are going to be ok if they have an accident with a 'roo." (Female, aged 25, Mine Administration)* *"I leave straight after shift to get home. I usually shower, eat something and leave. I prefer driving at night, I see other vehicles better and there is less traffic. There is more wildlife out at night, but it helps to have a big car. I had a Commodore ute and I changed to a Hilux." (Male, aged 26, Mine Maintenance)* *"I prefer to drive at night, which is another reason that I leave straight after shift. There is no traffic on the road, no sun to distract me, it's not hot. I just drive with the window down to keep myself awake. I don't really worry about 'roos. I drive a [big car] with a bull bar, so I am protected if I hit a 'roo. I wouldn't like travelling in a smaller car." (Male, aged 22, Mine Maintenance)*

7.4.3.2 Control through experience and ability

A number of participants described previous experience with long distance driving as a method of controlling perceived risks associated with the journey home. This control resulted in a perceived ability to get home safely because of driving experience, ability, familiarity with the road, and knowing one's limitations (see Table 7-5). However, the data describe that relying on experience is not always mutually exclusive of implementing practical solutions. For example:

> *"I'm a very experienced driver. I've done about 342,000 kilometres in my current car and I haven't had any accidents. I am really aware of animals on the road, I have a bull bar on my car and that means that the kangaroo will come off second best, so that sort of thing doesn't worry me and those are the risks you take anyway." (Male, aged 29, Site Tradesman)*

As identified above, driving experience was described in a number of different ways. Participants stressed their ability to drive long distances in rural and remote locations, due to their experience driving. As such, the time workers leave the site to travel home is justified by their experience as a driver on country roads. A considerable number of participants described a long history of travelling significant distances on country roads, even 'practising' long journeys prior to commencing employment with the mine (see Table 7-5).

Table 7-5.

Theme 1: Safety awareness – control through experience and ability

Sub-theme 1.2: Control through experience and ability **Sub-theme content:** Ability to drive in risky situations due to experience, ability, and familiarity of the road.
Example participant response:
"I have trained myself to [drive long distances]. A group of us used to drive on the weekends to get used to driving the long distance. I built myself up to it." Male, aged 22, Mine Maintenance)
"I grew up doing these big drives so my parents really made sure that I understood the risks with driving these distances. I think that you are a safer driver if you have experience driving the road and that you are used to travelling such long distances. I think that I drive to my capabilities. I pull over when I am tired, I know my body." (Female, aged 25, Mine Administration)
"I worry about kangaroos and tourists when I travel. Tourists drive at the wrong time of day. We know where the roos are, so it's ok that we drive when we do." (Male, aged 40, Mine Maintenance)
"I am really familiar with the roads, especially on that stretch of road, I know the road like the back of my hand. I know where to keep an eye out for animals, where the blackspots are and where I won't have phone reception. I also know where the houses are along the way. I was in a storm last year and in my head I knew that there was a house that I could pull into to get out of it. I think that's important." (Female, aged 25, Mine Administration)
"I grew up in [rural Australia], so driving doesn't bother me. I'm used to it. When you grow up in rural Australia you have to get used to driving long distances." (Male, aged 29, Electrician)
"I've learnt lessons in the past about being overtired and not stopping, I had an accident. I know when I'm tired and I know what I should pull over." (Male, aged 49, Mine Operations).

The experience of driving long distances and on rural roads results in higher levels of self-efficacy in relation to the trip home. Participants stated that their experience means that they are able to manage a safe journey home, regardless of when they choose to leave. Furthermore, experience driving in rural and remote locations is something that is valued. The majority of those interviewed enjoyed driving long distances and considered it normal. Most participants grew up in the country or in rural townships.

It is believed that familiarity with the road will lead to a safer journey home. The participants stated that those unfamiliar with the road were more likely to be involved in a crash, particularly the younger and the older drivers. Such drivers are also seen as a risk to the worker commuting home from site. The perceived risk is mitigated by familiarity with the road. Awareness of risk enables the driver to be alert to risks such as kangaroos and potholes, or to avoid the risk completely, for example knowing where to pull over in a severe storm.

Finally, most participants described themselves as safe or good drivers. The statement about their skill as a driver was typically accompanied with a reference to experience-related safety awareness, as described above. Any reference to a negative outcome, for example falling asleep while driving, was used to reinforce their experience and skill as a driver and how they learnt from that mistake or oversight. Lessons are also learnt from the mistakes of others and referenced in respect to being more aware of the risks associated with the drive.

7.4.3.3 Sub-theme 2: Organisational training and policy

Individual safety awareness and safety awareness through organisational training and policy are intertwined. There are a number of examples in the data which describe experiential learning linking into concepts of organisational safety. For example:

> *"I think that I am a safe driver. I am aware of my surroundings after I came across an accident one time. At work there is a massive safety focus, I think that I am even*

safer at home as well. We get constant training, you can't get out of it." (Female, aged 35, Mine Operations)

However, despite the linked nature of these two concepts, worker journey considerations are influenced by organisational policy, from the perspective of general training, as well as from a general site safety culture perspective. Participants noted that organisational training and policies are central to working in the mining industry and on the target site. While the organisational policies were frequently referred to in the data, there was limited reference to application of the policies. Usually, the policies were considered to be a barrier to commuting at certain times.

From an organisational training perspective, the amount of safety training in the organisation results in participants justifying their driving behaviour by citing training content and the frequency of its delivery. The levels of safety on-site, while for a specific and valid purpose, typically result in workers ignoring the associated policy, which, from the perspective of some of the participants, conflicts with an individual's assessment of their personal limits. As a result, participants justified their capabilities using the awareness of risk management (see Table 7-6).

Table 7-6

Theme 1: Safety awareness – organisational training and policy

Sub-theme 1.3: Organisational training and policy **Sub-theme content:** I understand that there are guidelines and policies about safety and I am aware of them. I know what these guidelines and policies are.	
Example participant response:	
General awareness	*"There are guidelines about driving after shift, I think that you need to have an 8 hour rest before driving or you need to complete the shift and your drive within 14 ½ hours. If you have an accident and you are breaking this rule, then the insurance won't cover you, it was the same rule at [another site]. You can also get fines and there also might be punishment from the site. Fatigue management is a massive issue, so is driving after working. But I think it's about how people manage their own fatigue. People have become more aware of fatigue because of accidents. When I was a kid I never heard anything about fatigue and micro-sleeps. You hear more about that these days." (Female, aged 21, Mine Operations)* *"Being in the mining industry safety is drummed into you. We get told to make sure we manage our fatigue. We all look after each other, it's a community, we all support each other." (Female, aged 21, Mine Operations)* *"I get sick of hearing about fatigue management, I think that they drum on about it too much." (Male, aged 49, Mine Operations)*

A few participants described training and information overload in respect to safety, particularly about fatigue management, believing that organisational training in respect of risk was excessive. As a result, there is potential for complacency associated with an 'excess' of information.

While the general consensus was that there was too much organisational safety training and policy, participants supported the judgement of their fellow workers in understanding their limits and safety-related behaviours in general, relating to site safety culture. Given the considerable amount of safety information provided to these workers, they perceived a strong ability to apply their knowledge. There was also an underlying theme of a transference of safety to out of work situations, including in the home (see Table 7-7).

Table 7-7

Theme 1: Safety awareness – organisational training and policy (continued)

Sub-theme 1.3: Organisational training and policy (continued) **Sub-theme content:** I know how to apply these guidelines and I consider myself to be safety conscious.	
Example participant response:	
Applying safety knowledge	*"I'm really conscious about safety since I've been with the mine. I mow the grass at home with PPE." (Male, aged 27, Mine Operations)*
	"I think that I am a safe driver I am aware of my surroundings after I came across an accident one time. At work there is a massive safety focus, I think that I am even safer at home as well. We get constant training, you can't get out of it." (Female, aged 35, Mine Operations)
	"I'm pretty conscious about doing the right thing while I'm driving long distances like sticking to the speed limit and not texting." (Male, aged 30, Mine Operations)
	"I manage my own fatigue on the way home. I am more fatigued and dangerous if I were to have a break after nightshift. By having regular breaks on the way home, I am safe on the road and not endangering myself or others." (Female, aged 24, Mine Maintenance)

7.4.3.4 Summary: Safety awareness

Overall, the safety awareness theme describes participants' reliance on their experiences driving and working in a highly safety conscious environment. The key factor which contributes to participants' justification for leaving site at the time they do, is the perception that they have training, experience, or a practical solution to be able to mitigate any perceived risk to an acceptable level. This justification is more strongly associated with individual safety awareness rather than organisational training and policy.

7.4.4 Theme 2: Routine journey

Participants described each stage of the journey home as a routine and typically, there is little variation in steps undertaken to finalise the commute home. Routine was a theme that was identified in the majority of the interviews, typically used as a method to cope with a 'long and boring' journey home. Two sub-themes were identified as a part of routine. These sub-themes include the pre-journey routine or the preparation participants engaged in prior to getting into the car, and the routine during the actual journey. These sub-themes will be discussed below.

7.4.4.1 Sub-theme 1: Pre-journey routine

Participants described various pre-journey routines. There are two key parts of a pre-journey routine which are intertwined and highlighted in Table 7-8. Workers seem to leave work at the same time following a shift; the pre-journey routine ensures this timeline. The routine to prepare typically remains the same prior to each journey providing there are no extraneous factors (e.g., storms).

> *"I prefer to travel earlier to avoid the afternoon storms in summer." (Male, aged 42, Carpenter)*

Some routines included having a meal, shower, and packing the car before leaving the site. Other pre-journey routines included a two-hour sleep. The routine ensures that the worker leaves the site at a similar time following each shift block (see Table 7-8). However, an important distinction for the majority of the participants is variation in pre-journey routine by comparing those workers finishing night and day shifts. The pre-journey routine is contingent on the type of shift performed. The data showed that the routine of workers finishing night shifts were sometimes different from those finishing day shifts. For example, those working night shifts might drive home shortly after their shift because it is daylight and they want to get back into a day routine.

> *"When I'm on night shift I usually treat they day and night as opposite until I get home. So, I'm quite happy to drive at night until my sleeping gets back to normal. Once I finish night shift I usually just drive home. When you get home you are usually powering, and you force yourself to stay awake until night time and then go to sleep to get back into your normal rhythm." (Male, aged 49, Operator)*

Participants also describe pre-journey routines to prepare them for the actual drive, e.g., ensure there is water and coffee in the car and the music is ready to be played (see Table 7-8). However, the routine and time leaving the site are also used to manage fatigue when finishing night shifts.

Table 7-8.

Theme 2: Routine journey – pre-journey routine

Sub-theme 2.1: Pre-journey routine **Sub-theme content:** I have a set routine prior to getting in the car and leaving the site. This routine changes between night and day shift and with other extraneous factors.
Example participant response:
"I have a process that I go through before I leave site. When I am on night shift, I sleep on Tuesday until 5pm, have something to eat and then leave around 7pm that night." (Male, aged 51, Mine Operations)
"I usually leave straight away after a day shift. I have a shower and then I start driving. After nightshift I have a sleep. I get back to my room at about 7[am] and am asleep until about 11/11:30[am] then I drive straight home." (Male, aged 29, Mine Maintenance)
"There are certain things that I organise before I get on the road. I like to have a drink in the car and some gum. As soon as I finish I go back to my room and pack, fill up my water bottle and leave. It's about 40 minutes before I am on the road." (Male, aged 42, Mine Administration)
"I have a bit of a routine I go through before I drive. Usually I go to bed early the night before, don't usually have anything to drink and I pack my gear up. If I am tired I will pull up and have a sleep, I've done this on a couple of occasions when I've driven really long distances, like from Cairns." (Male, aged 39, Mine Maintenance)

7.4.4.2 Sub-theme 2: Routine during the journey

Participants described their trips home as pre-planned, learned behaviours. Each trip is planned with a petrol stop and cigarette breaks as described in Table 7-9. Participants referred to a pre-planned place to stop for a break, which would occur in the same location every time they drove that route. Given the frequency with which they travel the route, participants stated that they were safe on the remote roads; their frequency means that they understand and become familiar with the road, and know where the stops and houses are. Therefore, if there is a situation outside the normal circumstances of their travel home, they could identify solutions given their familiarity with the surrounds. For example, if there was a severe storm, they knew the next place to find shelter. Furthermore, participants argued they were safer on the roads because they were familiar with dangerous points in the road (e.g., pot holes or an upcoming safe place to pass). Once on the road, these workers push themselves to get home as soon as possible, usually by forgoing rest breaks, e.g., "*not too far to go, so I just push through*". Therefore, even if the workers had a break prior to travelling home, they may be inclined to engage in risky behaviour on the road in order to get home as soon as possible.

Table 7-9.

Theme 2: Routine journey – routine during the journey

Sub-theme 2.2: Routine during the journey **Sub-theme content:** There are set places that I stop during the journey home. I plan my journey home and have breaks at the same place during the journey.
Example participant response:
"If I don't have far to go, I just push through and get to where I am going and have a break there." (Male, aged 49, Mine Operations)
"I have a routine when I drive, I usually stop at the same truck stop. It allows me to rest and breaks up the drive." (Male, aged 42, Mine Administration)
"The drive is planned by petrol stops. Once I'd done the trip a few times I set the plan. You get to know your stops, it becomes a habit." (Male, aged 51, Mine Operations)
"I used to dread the drive at first but now it's a process. I stop regularly at the same place. It was hit and miss at first, but now I have the trip down pat. It's about getting all your ducks in a row, it's a process." (Male, aged 42, Mine Administration)

7.4.4.3 Summary: Routine journey

Overall, routine describes the process participants used to describe how they treated the drive each time they finished a shift block. It is made up of two sub-themes, the pre-journey and during the journey. Turning the journey into a routine describes a further method through which these workers justify the perceived 'safe' risk-aware approach described in the *safety awareness* theme. However, this theme also describes the habit associated with worker behaviour following a shift block. A key finding in this section is the variation in behaviour following day and night shifts.

7.4.5 Theme 3: The site has no say in what I do

There was a strong belief that the site has no control over workers after the conclusion of the shift block. The majority of participants stated that the journey home was classed as personal time rather than work time. As such, the workers believe they are responsible for their safety during the journey home and the site, therefore, has no say in what they do before or during the commute. These three themes are described in the following sections.

7.4.5.1 Sub-theme 1: It's my responsibility

The concentration on the journey home from work is associated with the distinction between 'work hours' and 'home hours'. Participants reported that they needed to be ready to work once their roster commenced, so they tried to arrive on site at least 12 – 24 hours prior to the start of their shift. It is much easier for the site to control the journey to work rather than the journey home, which is consistent with the discussion stemming from the safety experts (Chapter 5).

The limited control over departure time complements the workers' belief that if something goes wrong during the journey, it is their responsibility (see Table 7-10). However, the perceived shift of responsibility from the site to the worker underlines the belief that the site has no say in what workers do.

Table 7-10.

Theme 3: The site has no say in what I do – It's my responsibility

Sub-theme 3.1: It's my responsibility **Sub-theme content:** The site cannot dictate when I should leave or stay, it's my responsibility to determine that. It's my responsibility to make sure I am able to make it home safely.
Example participant response:
"I think that the responsibility of the trip belongs to the individual. The individual makes the choice. We can provide training, education and facilities, but it is their decision." (Male, aged 42, Mine Administration) *"I'm responsible for the drive home, I don't think anybody else should be. I don't think that the mine site is responsible, or my supervisors." (Male, aged 30, Mine Administration)* *"I am the person responsible for my safety while driving; I am the only one who can judge if I am fit to drive, it shouldn't be any different to seeing yourself as fit to work." (Male, aged 51, Mine Operations)* *"I think it's the individual's responsibility to make sure they are safe on the drive home, it's up to them. If they are tired, they should pull over and have a break. The site encourages people to stay the night, they say that over the 14 hours everything is in your own hands…I think that it is up to the individual to decide what they can and can't do, they are putting everyone in the same basket." (Male, aged 39, Mine Maintenance)*

7.4.5.2 Sub-theme 2: It's my time

The findings demonstrated a reliance on the 'lifestyle roster' as mentioned in Chapter 5. This roster means that the workers are able to have a significant amount of time away from work each year, an important reason for engaging in this type of work in the first instance. Participants stated that the key reason for engaging in long distance commuting and working in the mining industry relates to the lifestyle that results from the 'lifestyle roster' and the money earned (see Table 7-11). The lifestyle afforded to these workers is inextricably linked to the key theme relating to the mine site being unable to prescribe the time these workers choose to leave the site.

Table 7-11.

Theme 3: The site has no say in what I do – It's my time

Sub-theme 3.2: It's my time **Sub-theme content:** Working in the industry because of the 'lifestyle roster' and I want to make the most of my time off.
Example participant response:
"My friends are jealous of the job that I have because of the lifestyle. I usually ring them on the last day and tell them that I have 7 days off." (Male, aged 21, Mine Maintenance) *"I like this work because of the money and the amount of time off I get. I really like the roster." (Male, aged 49, Mine Operations)* *"The roster is good, 7 days' work and 7 days at home. But you have to remember that there is almost 2 days' travel in that. When you are home everyone wants to catch up with you. So I spend my time with friends and going to the gym." (Female, aged 21, Mine Operations)* *"It's my choice to drive home [when I do]. I don't think my employer has any say in what I do after my shift, that's my time. I choose to suffer any consequences if I had any accidents." (Male, aged 49, Mine Operations)* *"I prefer to drive at night so that it doesn't impact on my social life. If you drive during the night you don't waste time during the day. It's a trade off for a time that I wouldn't be doing anything anyway." (Male, aged 32, Mine Operations)* *"When I first started doing the drive it was an issue, so I just try not to think about it. I treat it as downtime as soon as I hop in the car, it's a break. You just have to deal with the drive the best you can, I mean its part of my work. I knew that I would have to do it, so I just get on with it. But I like to leave when I do so I can make the most of my time off. That's why I get in the car and drive straight away." (Male, aged 22, Mine Maintenance)*

7.4.5.3 Summary: The site has no say in what I do

Overall, this theme relates to the individual responsibility of the worker for the drive home and the precious nature of rostered days off. There is a strong sense of individual responsibility which results in a belief that the site has no control over what time to leave site and what should happen during the journey home, and there is a perception that staying on site to rest following shift blocks consumes too much of the limited time away from work.

7.4.6 Theme 4: Attitude about the commute

There were polarised views about the journey home which were typically associated with the degree to which the participants stated that they enjoyed driving. Some enjoyed the drive home as it gave them a chance to unwind prior to arriving home. Participants described the drive as a chance to relax or take in the scenery (see Table 7-12). Conversely, some participants described an immense dislike for the journey because of the length of time it takes, that the drive wastes their time off and that it is boring. The time workers leave site is influenced by both liking and disliking the journey. Workers who dislike the journey typically leave immediately following shift in order to *'get the drive over with'* (see Table 7-12). Comparatively, those who enjoy the journey tend to engage in the commute immediately following shifts to relax after a long week.

Table 7-12.

Theme 4: Attitude about the commute – I like/hate the drive

Theme 4.1: Attitude about the commute **Sub-theme content:** There were polarised views about the commute. The participants either like or dislike the journey home.	
Example participant response:	
I like the drive	*"I like the drive. I don't think about it any differently to when I first started doing it 3 years ago." (Male, aged 42, Mine Administration)*
	"I love driving, it's something that I have done for a long time. I love the scenery and the wildlife. I change direction sometimes where I can because you get used to the roads and it becomes pretty boring. I like to go new ways. I try to keep the drive interesting." (Male, aged 52, Mine Operations)
	"I have been working in the industry for about 2 years now. I love the drive. It's easy. I just poke along and make it up here. You get used to driving such long distances and after a while your confidence builds and you don't worry about it as much anymore." (Male, aged 45, Mine Maintenance)
I hate the drive	*"If you are not paid to drive, I can see why you would hate the drive. It's at your own expense and in your own time." (Male, aged 42, Mine Administration)*
	"It takes me about three and a half hours to drive to and from work. I hate the drive; I am really sick of driving that road. I have been doing it for the past 2.5 years and I am just over it, it's really boring, but it's part of the job. I knew that when I got into this that I would have to do the drive and I am ok with that." (Male, aged 32, Mine Operations)
	"I really hate the drive, but living close to site doesn't fit in with my lifestyle. I prefer to live in the city. I have friends where I live, I like to socialise in my week off. If I had a partner, then I might consider living closer to site, but at the moment it's not something that I want to do." (Male, aged 22, Mine Maintenance)
	"I hated the drive at first, but you get used to it. I do like working here, I think that it is worth the trip. I thought about the drive heaps when I first started … You really do get used to it." (Female, aged 26, Mine Administration)

Participants rationalised their commute by justifying its necessity; for example, hating the drive was typically associated with justification of how they reconcile their dislike to make it *'not so bad'*. There are a few factors that make up this theme, including the necessity of the trip and the alternatives on offer. Available alternatives were discussed by a large number of participants. The second sub-theme is associated with how workers manage the repetitive nature of the commute. Considering the obligatory nature of the drive, participants typically manage the commute in two different ways, by treating the drive as if it were an escape or work. These sub-themes are discussed in the following sections.

7.4.6.1 Sub-theme 1: I do what I have to

For these workers, the long journey home following work is not an option – it has to be done; some amount of driving is required (see Table 7-13 and Table 7-14). However, this sub-theme also relates to maintaining their lifestyle associated with the roster and where they live. There is a perception that a DIDO site has a better roster and provides workers with the opportunity to make the most of the time off. Therefore, the concept of there being no alternative is also related to maintaining the lifestyle that comes with working in the mining industry. For example:

> *I would prefer fly in, fly out work, but there was not an option for that when I got my job. With fly in, fly out work the rosters are really bad. You usually end up with a 14/7 roster. (Male, aged 47, Operator)*

Table 7-13.

Theme 4: Attitude about the commute: I do what I have to, it's a part of my job

Sub-theme 4.2: I do what I have to, it's a part of my job. **Sub-theme content:** I have no choice, I have to drive to work. There is no alternative, I have to get home somehow.
Example participant response:
"The job is just life, it's just what we do" (Male, aged 49, Mine Operations). *"I really like the beach so that's why I live close to the coast, I still have family and friends there and there's no place like home. I do drive a long way to spend two days off. I don't really think about the drive home, it's just something that I've got to do. Although at the start it was manageable, now I'm a bit over it." (Male, aged 27, Mine Operations)* *"I don't really worry about the drive, I just think here we go again." (Male, aged 40, Boilermaker)*

Table 7-14.

Theme 4: Attitude about the commute: I do what I have to, it's a part of my job (continued)

Sub-theme 4.2: I do what I have to, it's a part of my job (continued). **Sub-theme content:** I have no choice, I have to drive to work. There is no alternative, I have to get home somehow.
Example participant response:
"I don't have any other option. I like the flexibility of driving myself. It's down time. I wouldn't like to end up sitting next to the guy who talks the whole way to work on the bus." (Male, aged 42, Mine Administration) *"There is no flight access to the mine site…so I drive." (Male, aged 42, Mine Operations)* *"Really, it's only a long distance once a week. We all do it for the money and the lifestyle. If I was to work on the coast I would earn $50,000 less. I would consider taking a job on the Sunny Coast, I think that it would be better working Monday to Friday. I wouldn't accept it at the moment though because I am waiting to go permanent here so I can save some money and go overseas." (Male, aged 21, Mine Maintenance)* *"A lot of the crew don't like the drive, it's all they've ever done so they don't know any different. It's not really discussed with the rest of the crew. Everybody realises that it's just a part of the job and nobody likes a whinger." (Male, aged 40, Mine Maintenance)*

7.4.6.2 Sub-theme 2: Controlling the repetition

The majority of the participants described the drive home as long, repetitive, and sometimes boring. Managing the commute is about how the drive is framed in the worker's mind. For some, the drive is not considered their own time but rather part of their job. Comparatively, some considered the drive as a chance to have some down time and unwind after a long week at work (see Table 7-15). Those who considered the drive as part of their work tended not to hate the drive home. Those who considered that the drive home was wasting *'their'* time off typically disliked the drive. However, regardless of how the participants chose to treat the drive home, the time of departure did not change. In order to manage the obligatory nature of the commute, the participants described maintaining a routine in order to cope with the drive. Describing a rhythm or routine associated with coping with the drive was typically associated with those participants who disliked the commute.

Table 7-15.

Theme 4: Attitude about the commute: Controlling the repetition

Sub-theme 4.3:
Controlling the repetition
Sub-theme content:
The way I approach the drive means that I deal with it better. I treat the drive like work or I treat the drive like an escape.

Example participant response:

"I don't really think about the drive before I drive, I just like to take the shortest distance possible. I treat the drive like it's my job. I don't shut off until I go through the gate at home. I find that this is the best way to treat the drive, otherwise it would just drive me crazy and I would be over it by now." (Male, aged 49, Mine Operations)

"We travel that road 72 times a year, it's a lot. We drive the same way each time. I don't really worry about it, I know that I have to do it, it's just part of my job." (Male, aged 37, Mine Maintenance)

"I think the drive is just part of work, I just get in the car and make it happen. I don't think it's time out or a break. I don't really think about work during the drive though, that depends what has happened during the week. I will think about work if there has been a lot of problems during the week. I take pride in my work, I like to know that it's all good when I leave. But by the time I get home, all this is usually out of my mind." (Male, aged 29, Mine Maintenance)

"The road that I drive is not too bad. Roadworks are painful, it really slows you down. But I usually just have my music blaring and enjoy the drive. I am used to the drive and I don't mind it, I just take my time. The drive is kinda like my downtime, I just chill out and sing to the music. Once I leave the gate I don't think about work. I do rush to get out the gate, I just want to get out once it hits 12pm on a Friday. You get sick of it." (Male, aged 27, Mine Administration)

"I think that it is important to have some flexibility in the drive, which is why I carpool. That way I can have a beer on the way home to unwind. The drive home is an opportunity to unwind after work." (Male, aged 36, Mine Maintenance)

"I always get away from work on time so I don't have to rush to get home. I don't mind the drive, it's time out for me. I especially like getting to go home after a bad week, that's when I am really hanging to leave and will leave as soon as I can." (Male, aged 21, Mine Operations)

"I drive the same way each time. There is about half an hour of dirt, but it's a shorter distance so that's why I go that way. I like driving, I listen to music and relax on the way home. I think that I get more tired driving shorter distances, so the distance doesn't bother me." (Male, aged 30, Mine Operations)

7.4.6.3 Summary: Attitude about the commute

Overall, there are two parts to this theme – the obligatory nature of the commute and its repetitive nature. There is a perception that there are limited or no alternatives available, so workers described the commute as just something they do to remain employed and maintain their current lifestyle. To motivate them for the journey, some treat the drive as work and others treat the drive as downtime after a busy seven days at work.

7.4.7 Theme 5: Attitude about work

Attitudes about work and the site in general influence the intention to leave work at a certain time. Mine workers spend half the year on site and are usually eager to leave the site at the end of the shift block. There were two sub-themes associated with participants' attitudes about work. Firstly, some described work in a positive manner, such as *"I like my job"*. Alternatively, the description about work was less positive and the commute was seen as a way to escape the worksite. These two themes are discussed in the following two sections.

7.4.7.1 Sub-theme 1: I like my job

Positive associations with the job are usually linked to the perception of higher wages and better conditions when compared with coastal jobs or jobs on other sites. If there is a positive attitude toward the workplace, the commute is typically considered to be part of the job (see Table 7-16). Positive associations or liking one's job results in the workers accepting the commute as necessary and not complaining about the travel.

Table 7-16.

Theme 5: Attitude about work – I like my job

Sub-theme 5.1: I like my job **Sub-theme content:** I like my job, so the commute does not bother me.
Example participant response:
"I like this job. The main reason I stay in this job is because of the money and because there is nothing available on the coast. I wouldn't live closer to the site." (Female, aged 21, Mine Maintenance)
"The distance that I travel doesn't bother me. The company I work for is good … I am supplied with a company vehicle." (Male, aged 51, Mine Operations)
"The mood changes on the seventh day. Everyone is happy. They are all on the radio excited about the fact that they get to go home. Not everyone wants to get out of the place, some people like it. Everybody just wants to get home in one piece." (Female, aged 26, Mine Operations)

7.4.7.2 Sub-theme 2: I just want to get out of this place

The clear distinction between 'my time' and the 'site's time' stems from the amount of controls in place on the site in respect of other health and safety precautions. Participants stated that once the shift ends, the other reason they want to leave as soon as possible is because of the level of control on the site. The participants said that they leave site when they do because they are *'sick of it', 'just want to get out of the place'* and get back to *'civilisation'* (see Table 7-17). Additionally, there is also a desire to get home as soon as possible to see their families. This desire to get home is despite their family's insistence and encouragement for them to take their time and get home 'whenever'.

Table 7-17.

Theme 5: Attitude about work – I just want to get out of this place

Sub-theme 5.2: Attitude about work – I just want to get out of this place. **Sub-theme content:** I just get sick of being on site, so when it is time to go home I just want to leave as soon as possible.	
Example participant response:	
I just want to get out of the place	*"There is so much control on site that it just makes you want to get out of the place." (Male, aged 42, Mine Maintenance)* *"I usually leave site as soon as this shift ends. I am not ever in any rush, but I do want to get out of the place. At the end of a 7 day shift I'm usually a bit sick of the place so I am happy once I've passed the security gate. If I had to stay on site after a shift I would not be happy. If they forced me to take a break after the shift, I would sleep in a swag outside the security gate just for the principle. There is no better feeling than seeing the security gate in your rear vision mirror." (Male, aged 49, Mine Operations)* *"When I am leaving site to go home I am usually pretty eager to get home. You get sick of being here. It's also good to get home to see the kids. I don't rush home, I don't try to get home fast. I usually get in the car and leave work as soon as I have finished work." (Male, aged 39, Mine Maintenance)* *"You also get sick of the place and you just want to leave." (Male, aged 21, Mine Maintenance)* *"You get sick of the place once you've been on site for a little while, so after shift you usually just want to get out of the place." (Male, aged 30, Mine Maintenance)*

7.4.7.3 Summary: Attitude about work

Attitude about work influences commuting decisions, especially when the worker is *'sick of the site'*. Participants who feel there is too much control on site described a need to leave site as soon as possible. Those who like their job acknowledge the travel requirement and generally accept it.

7.4.8 Theme 6: Community

There is a sense of community within each crew/workgroup. This community relates to how workers support their colleagues and this support influences their commuting decisions (see Table 7-18). They all seek to *'help each other out where possible'*, including when it comes to the commute home. However, when this support occurs, crews are then pressured to leave at the same time as their colleagues, especially in carpooling situations. As previously mentioned, carpooling is usually adopted within workgroups between those who work closely with each other every day. Obviously, car-pooling takes advantage of multiple drivers having the perception that leaving immediately following a shift is acceptable, but it also results in the group leaving site immediately following shift so the other members of the group are not inconvenienced. Therefore, some workers reported that they did not engage in carpooling because of the lack of flexibility. On the other hand, some participants described engaging in carpooling due to the perceived social benefits. By having others in the car, the trip is a little easier as there are people to talk to and share the driving with.

Given the close community, there is also a sense of 'follow the leader'. It appears that there is a perception that the act of leaving immediately following shift blocks is a behaviour that is readily adopted in the industry in general and on site. Therefore, workers justify the behaviour as in line with what their colleagues, supervisors and others in the industry do. The justification of behaviour that is in line with colleagues and supervisors supports further exploration from the perspective of perceived norms (Lapinski & Rimal, 2005).

Table 7-18.

Theme 6: Community

Theme: Community **Theme content:** The guys I work with look out for me, we help each other out. I don't like carpooling because you have to leave when the others in the car want to leave or I like carpooling because I share the driving and socialise on the way home. Workmates are a part of the mining lifestyle; i.e., they form a close knit community.	
Example participant response:	
Help each other out	*"The other guys I car pool with are on the opposite shift to me. When I am on day shift, they are on night shift. We take turns to drive. I drive my car every third week. Whoever is on night shift sleeps on the way home and the one/two on day shift drive." (Male, aged 40, Mine Maintenance)* *"I car pool from [town] to [site]. We have 5 people in the car. We organise to be on the same flights, but even if I don't manage to get on the flight with the others, there is always a way to get a lift to site. The car that we drive to site stays at [the] airport." (Female, aged 21, Mine Operations)* *"We all look after each other, it's a community, we all support each other. That's why I car pool. It's easier and cheaper, we work together." (Female, aged 21, Mine Operations)*
Convenience/ flexibility	*"I think that you have an added responsibility if you car pool. You have to worry about someone else in the car. You have to pull over for them to have a smoke. You have to change your route because you have to drop someone home and you have to listen to someone else's music. I really don't like car pooling." (Male, aged 47, Mine Operations)* *"I usually travel by myself. The time that I leave to travel home varies, so car pooling is not really convenient. It's not so much about the trip home with other people that bothers me, it's the trip to work. It means that I have to leave when they want to leave and that is not really convenient for me." (Male, aged 29, Mine Maintenance)*
Social aspect	*"I like carpooling; it makes the trip easier. It means that I have other people to talk to and it doesn't get boring." (Male, aged 49, Mine Operations)* *"Whoever isn't driving on the way home has a few drinks to pass the time. It's a bit of an outlet. You live with these blokes, so you have to make the most of the time off." (Male, aged 40, Mine Maintenance)* *"I think that it is important to have some flexibility in the drive, which is why I carpool. That way I can have a beer with my mates on the way home to unwind. The drive home is an opportunity to unwind after work." (Male, aged 36, Mine Maintenance)*
It's what everyone else does	*"Not everyone wants to get out of the place, some people like it. Everybody just wants to get home in one piece. I just can't wait to see my husband. Some want to get out. Some always whinge about work, I've seen so many changes. 90% of the people here are family people, just trying to earn a dollar." (Female, aged 26, Mine Operations)* *"Going home is a good thing you get excited to see everyone, it makes the drive easier when you know that you have some time off. Everyone leaves straight after work, it's what we do. Everyone just wants to get home as soon as possible to make the most of the time off. Nobody wants to spend more time here than they have to. The supervisors leave within the hour of us leaving." (Male, aged 22, Mine Maintenance)*

7.4.8.1 Summary: Community

The community aspect described by participants centres predominantly around carpooling. Some enjoy carpooling as they are able to share the driving and socialise with the others in the car. Alternatively, those who do not like carpooling describe it as inflexible and inconvenient. Overall, the participants stated that carpooling helps out their colleagues, which is consistent with a community mentality.

From the perspective of co-workers and supervisors, the key influence here is following what others do and what generally happens in the industry. The perception is that leaving work immediately following a shift is common practice within the industry. As such, these workers model their behaviour on the perception of what others do.

7.4.9 Theme 7: Perceived commuting risks

The participants described perceived risks associated with the commute home in two different ways. The first type of risk identified in the in-depth interview data was the risk identified through *'organisational training and policy'* as described in Theme 1 or as a direct result of work. The second type of risk identified was associated with the drive. These two perceived risks will be discussed in the following two sections.

7.4.9.1 Sub-theme 1: Work-related commuting risks

Work-related commuting risks were identified by participants because of their ability to risk assess situations as a result of their training (see Table 7-19). There were a number of perceived risks associated with the commute home that were related directly to work, such as leaving immediately after the last shift, and fatigue. As described in Theme 1, these risks were readily identified but participants described mitigation measures in order to justify their behaviour. For example, some participants described leaving immediately after work as a risk due to travelling during the night. This risk was typically ignored due to the type of car the participant drove, i.e., a large four-wheel drive. Alternatively, if a fatigue-related risk was identified, participants sometimes described pulling the vehicle over to sleep or leaving work the morning after the end of the shift block.

Table 7-19.

Theme 7: Perceived commuting risks: work-related commuting risks

Sub-theme 7.1: Work-related commuting risks **Sub-theme content:** Perceived risks identified that are associated with working seven days straight.	
Example participant response:	
Leaving straight after work	*"I don't think that driving straight after work is risky because it's not very far to Yeppoon. If I was driving to Brisbane, then I would stay the night." (Male, aged 21, Mine Maintenance)*
	"I don't take risks by driving straight away after work. I used to drive straight away, but now I am happy to wait. I think that it comes with maturity. You begin to realise that you are not getting great gains by leaving earlier, overtaking and speeding home." (Male, aged 42, Mine Administration)
Fatigue	*"The biggest consequence of fatigue is having an accident and I think that it's a big thing to all of us. I won't risk my life to get home. My family encourages me to make sure I pull over if I feel tired, they are always concerned. They are the same when I drive other long distances, they want me to text them when I get there." (Female, aged 21, Mine Operations)*
	"The supervisors monitor the guys for fatigue. They have criteria that they follow based on physical signs, such as attention to the task. But most importantly, they know their guys and can tell when they are tired." (Male, aged 42, Mine Administration)

7.4.9.2 Subtheme 2: Driving-related commuting risks

There were commonly identifiable risks associated with the actual drive home after shift. These risks were often identified as factors to keep in mind when leaving at a certain time of the day (e.g., kangaroos at night). These risks were described as factors that were frequently encountered during the journey home and, therefore, were considered by participants when embarking on their journey home (see Table 7-20). These risks included storms, other drivers, vehicle maintenance, and the road itself. However, as with work-related risks, participants described methods to diminish the perceived level of risk by implementing mitigating strategies.

Table 7-20.

Theme 7: Perceived commuting risks: Driving-related risks

Sub-theme 7.2: Driving related risks **Sub-theme content:** Perceived situational risks associated with the actual commute home.	
Example participant response:	
Kangaroos	*I try not to drive at night time. I try to leave at a time so I'm not driving at night. I have hit two kangaroos in the past, so I try to leave early to avoid kangaroos. I always plan to leave at a certain time so I don't run late, and so I'm not driving at night." (Male, aged 27, Mine Operations)*
	I avoid night driving because I am worried about animals, my car is not suitable." (Female, aged 21, Mine Administration)
	I know where the roos are, so it's ok that I drive when I do." (Male, aged 40, Mine Maintenance)
Storms	*"I worry about the trip when we have lots of rain. I drive for about an hour and a half on a dirt road." (Male, aged 21, Mine Maintenance)*
	"I worry about weather and flooding and knowing the right roads to take if there are roads blocked." (Female, aged 21, Mine Administration)
Other drivers	*"I worry about others on the road. There are a lot of people who take risks like not resting after shift. They are a risk to others on the road. Once you have seen an accident, that puts things into perspective." (Male, aged 51, Mine Operations)*
	"You get these younger guys in their V8 supercars who are a bit dangerous. They have lead feet. Usually in the 20 – 26 year old bracket." (Male, aged 40, Mine Maintenance)
	"I think that the biggest problem on the roads are the other idiots. They are the ones that cause the accidents. They are the ones you don't know where they are going. We drive the same roads all the time so we know those roads like the back of our hands." (Male, aged 49, Mine Operations)
Vehicle maintenance	*"There are a number of people who drive cheaper cars to work. A number of those vehicles I wouldn't consider travelling in, they are bombs and the owners are basically just running the car into the ground." (Male, aged 42, Mine Administration)*
	"Some people car pool, and that's different. I would put them in a different category, they are trying to do the right thing, although there are a lot that drive and car pool in really crappy cars and bounce down the road getting no sleep. That really doesn't make any difference by sharing the drive, 'cause you wouldn't be able to sleep anyway. That sort of shit is just stupid." (Male, aged 29, Mine Maintenance)
The road itself	*"I usually travel the same way to go to and from work. I sometimes take a different way, via the Capricorn Highway, but I like to avoid that road because there are heaps of trucks that travel that way and that means that the traffic is always pretty shit." (Male, aged 29, Mine Maintenance)*
	"Because I know the roads so well I am happy to drive at night. I avoid the Bruce Highway because it's so much busier and there are so many blackspots along that road. The road that I drive is faster anyway, I have been driving that way from the start. They have also done so upgrades to the road that I drive on over the last 12 months so it makes it a lot safer." (Female, aged 25, Mine Administration)

7.4.9.3 Summary: Perceived commuting risks

Perceived commuting risks are extrinsically linked to Theme 1, safety awareness. As described in Theme 1, these participants have a strong ability to identify risk due to the risk assessment processes learnt during training. These risk assessment tools are transferred to analysing risk in their day-to-day life. As such, when discussing their journey home, there was a strong focus on the types of risks that they may face during their journey, and as highlighted by Theme 1, methods by which these workers mitigate the risk to a level they are comfortable with.

7.4.10 Theme 8: Understanding the commute

Social influences were frequently mentioned throughout the interviews. These social influences included family, friends and colleagues. The theme of *understanding the commute* is associated with social influences playing a part in encouraging or discouraging the commute occurring immediately following a shift block. In line with the previous themes, there was a justification of the risk-taking behaviour associated with the commute following shift. Participants mentioned the behaviours of other workers to justify their own behaviours, or justified the time they left the site based around carpooling and the inflexibility associated with others being in the car. Additionally, family were also a key influence on worker commuting behaviour following shifts. This influence is manifested in two key ways: either the worker perceived that there was pressure to get home as soon as possible in order to spend time with their family during their time off, or the family encouraged the worker to take their time getting home following the end of shift. These social influences are discussed further in the following sections.

7.4.10.1 Sub-theme 1: Pressure to get home

There were two key distinctions associated with the pressure to get home sub-theme (see Table 7-21). Firstly, the worker places pressure on themselves to get home at a reasonable time to spend time with significant others. As a result of the perceived pressure, the worker seeks to leave site as soon as possible following the end of their shift. There is also workers' perception that significant others want the worker home within a particular timeframe. This pressure is more implicit. The pressure perceived by the worker is typically associated with a sense of 'missing out' on family life or social interactions while being away on site. While there is also an explicit pressure associated with family or friends expressing a desire for the worker to ensure they are home by a certain time, this pressure seems to occur infrequently and is often associated with a specific event (e.g., child's birthday or friend's party). Regardless of the nature of the pressure (explicit or implicit), this social factor appears to strongly influence the time these workers leave site following both day and night shift.

Table 7-21.

Theme 8: Understanding the commute: Pressure to get home

Sub-theme 8.1: Pressure to get home **Sub-theme content:** Workers place pressure on themselves or perceive pressure from family and friends to get home as soon as possible.	
Example participant response:	
Family or friend pressure	*"They rush to get home to see their kids or they're excited to get home because they have something planned with their friends and are not focused on the drive." (Female, aged 21, Mine Administration)*
	"I have school age children and I like to have some time with them while I'm home, so I like to get home as quickly as possible." (Male, aged 36, Mine Operations)
	"I think that there is always pressure to get home from family and yourself. I want to get home, but it's stupid to leave that night, straight after work." (Male, aged 47, Mine Operations)
	"I think that there are pressures to get home because of family and to have some downtime." (Male, aged 42, Mine Operations)
	"I do really want to get home to see my family though, after 7 days being on site, that's pretty much the reason why people want to get out of here as soon as possible." (Male, aged 32, Mine Operations)

7.4.10.2 Sub-theme 2: Encouragement to take time

There are workers with family and friends who encourage them to take time. This encouragement is usually expressed as an understanding of the risks associated with the drive and is usually associated with the worker describing that friends or family members understand that the drive is one component of their work, or that they worry about the drive (see Table 7-22).

Table 7-22.

Theme 8: Understanding the commute: Encouragement to take time

Sub-theme 8.2: Encouragement to take time **Sub-theme content:** Family and friends encourage the workers to take their time during the journey home.	
Example participant response:	
They understand what I do	*"My dad used to work in the mines, so he understands." (Male, aged 21, Mine Maintenance)*
	"I have two children, a daughter and a son. They don't know much about the drive that I do after a shift, what they don't know won't hurt them. So I don't tell them anything. My son understands though, he used to work with me, he learnt a lot from me." (Male, aged 49, ,Mine Operations)
	"My wife understands what I do and knows that I don't take risks." (Male, aged 42, Mine Administration)
Worry about the drive	*"My family encourages me to make sure I pull over if I feel tired, they are always concerned. They are the same when I drive other long distances, they want me to text them when I get there. My friends are also concerned about the drive." (Female, aged 21, Mine Operations).*
	"The travelling worries my wife, but that's more because of the road and others on the road. My kids trust my judgement, so it doesn't worry them at all. My wife doesn't push me to get home, she is always telling me to stay safe and be careful. My wife doesn't want to know about things that happen on the trip home, she just wants me home safe." (Male, aged 40, Mine Maintenance)

7.4.10.3 Summary: Understanding the commute

Social influence acts in two ways, either encouraging the worker to take their time on the journey home, or the worker perceives that there is pressure to get home as soon as possible. An important consideration is that encouragement to take time seems to refer to the journey itself rather than the time that the worker leaves the site. As such, encouragement to take time, with perceived pressure to leave immediately, may occur in parallel.

7.5 DISCUSSION

Chapter 7 presents the findings of in-depth interviews (Study 3) with 37 mine workers from the focal mine site. Study 3 aimed to examine the interrelations between individual, social, and organisational influences on worker commuting behaviour in order to address Research Objective 3. The following section discusses the findings using a theory-led approach. These findings also informed the development of the questionnaire developed for Study 4. The practical implications, strengths, limitations and future research opportunities arising from this study are discussed.

The in-depth interviews support four key influences presented in *Figure 2-1* which can be drawn from the eight themes identified. These key influences extend those influences discussed in Chapter 2 and further refine the factors presented in *Figure 4-4* and *Figure 6-2*. In line with the TPB and based on the results of the in-depth interviews, a notable iteration of the influences of the travelling workforce framework is the separation of individual and social factors (see *Figure 7-1*).

Figure 7-1 is an extension of the key influences on the travelling workforce identified throughout this program of research. This figure summarises the findings following the in-depth interviews which confirm the inclusion of these concepts in the following study and support the findings drawn throughout the previous chapters (see *Figure 2-1*, *Figure 4-4* and *Figure 6-1*). In Section 2.3, *Figure 2-1* presented three individual factors, lifestyle, housing and community, and site isolation, as potential influences for further examination with the research program. These individual influences were not revealed in the in-depth interviews as relating to the decision to leave site immediately following a shift block. As such, while these three individual influences are informative for ongoing discussion in the research program, there is no support for these influences informing the immediacy of the commuting decision. The following sections will not specifically discuss individual characteristics of drivers, as these will be addressed through the analysis of demographic variables in Chapters 9, 10 and 11. *Figure 7-1* depicts the thematic focus of Chapters 9, 10 and 11.

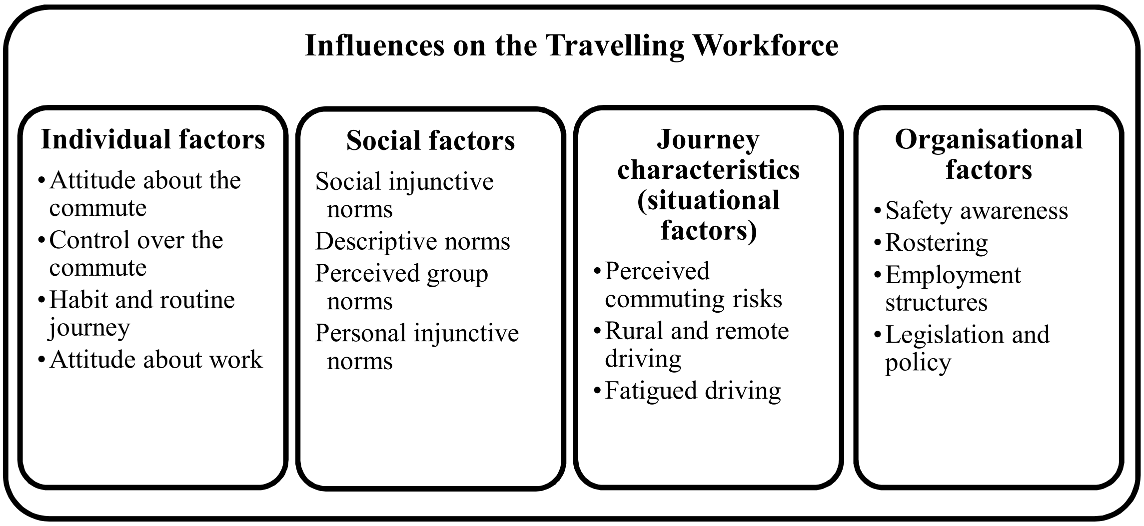


Figure 7-1: **Identified influences on the travelling workforce following in-depth interviews**

From the in-depth interviews, individual, social, situational and organisational factors were able to be identified and will be discussed in the following sections. This discussion highlights how each theme relates to key influences described in the current research, and how these themes are informed by the TPB and associated frameworks presented in Chapter 2. Following the data collection in Study 3, the application of the TPB is supported as an appropriate model to further explore the behavioural intentions of driving-related commuting behaviours. However, as discussed in Chapter 2, there are limitations in explaining this behaviour using only the TPB framework. These limitations support an augmentation of the framework to consider other factors, while maintaining parsimony.

7.5.1 Individual factors

Individual factors were identified under three themes resulting from the in-depth interviews. Theme 2 which described routine and planned behaviour identified how the commute is planned for, which aligns with the habitual or routine nature of the journey. Theme 3 described the individual control and responsibility associated with leaving immediately following a shift block, which is associated with control over the commute. Individual attitudes about the commute were identified in Theme

4. Overall, these attitudes were associated with the necessity of the commute and managing the repetitive nature of the commute. Finally, Theme 5 described individual attitudes about work and how these attitudes impact on the commuting decision. The following sections discuss individual factors as described in *Figure 7-1* and how these concepts align with TPB constructs.

7.5.1.1 Attitudes about the commute

There were three themes identified that contribute to understanding workers' attitudes about commuting. Attitude about the commute was associated with the necessity of commuting and framing the drive in a specific way in their mind in order to cope with its repetitive nature (Theme 4). Additionally, Theme 4 was associated with the boring and repetitive nature of the drive and how these workers *'do what they have to'* in order to maintain their lifestyle. In order to motivate themselves to engage in the drive, some described the drive as work, while others described it as downtime after a busy week at work. Finally, Theme 5 reveals the attitude toward work itself and the contribution of this attitude to the commute. Participants who feel there is too much control on site described a need to leave the site as soon as possible. Those who liked their job acknowledged the travel requirement and generally accepted it.

From the perspective of the TPB, attitudes are a key antecedent of intention to perform the target behaviour. Attitudinal responses can be readily identified within Theme 3 in respect to workers' attitudes toward not leaving the site immediately following a shift block. There is a sense of entitlement in respect of the time off which is something these workers were not willing to alter. Theme 4 is directly related to attitudes about the commute. Theoretically, these attitudes can be categorised as instrumental and affective in line with that posited by the TPB. The positive and negative associations with engaging in the commute are identifiable as affective (or experiential), or the underlying feelings about performing the target behaviour (Ajzen & Fishbein, 2000). Comparatively, the obligatory nature of the commute can be identified as instrumental, or the perception of what will happen if one engages in the target behaviour (Ajzen & Fishbein, 2000). Further discussion of these concepts is presented in Chapter 8 in order to operationalise the attitudinal construct in line with the TPB. Briefly, the operationalisation of the attitudinal construct focuses on the necessity of the commute, attitudes about work, safety consciousness of the workers, and the influence of significant others in line with the findings of Themes 3, 4 and 5.

7.5.1.2 Control over the commute

Individual control over the commute can be identified as the perceived control the site has over the individual worker in respect to commuting (Theme 3). From a TPB perspective, this concept can be described as PBC, or the perceived amount of control an individual has over performing a behaviour (Ajzen, 2002b). Theme 3 describes the perception that the worker is primarily responsible for the commute given it is out of work hours. Theme 5 is associated with the level of control the site has over the worker in respect of their day-to-day work. There is a perception of a significant amount of control on the site in general; however, there is no mention of the control being associated with the commuting decision. While respondents identified that there is a desire for workers to stay on site to rest in certain circumstances following a shift block, they do not consider it an obligation. Additionally, there is a perception that, once the shift is over, the site has no control in time that is considered to be ‘personal’. Both themes contribute to the discussion about PBC.

Chapter 5 data revealed that there are no site rules which prohibit workers from leaving site immediately following a shift. This limitation was confirmed in the in-depth interviews. The workers considered that they controlled the commute given their experience in assessing risk during their work on-site. Their experience in risk assessments aside, participants described that the worker has primary responsibility for themselves at the end of a shift block, regardless of the time they leave the site. In order to control the perceived risks associated with the journey, these workers typically justified their decision in terms of risk mitigation. For example, acknowledging that at certain times of the day, a driver is more likely to encounter kangaroos on the road, workers describe that they have purchased large vehicles to counteract the risk. There is a perception that the journey home is risky; however, the workers do not perceive any impediment to leaving the site after a shift block at any time they wish, due to the perception that safety during the journey home is solely their responsibility. Further discussion of the operationalisation of PBC is presented in Chapter 8. The operationalisation of the control construct focuses on the perceived allocation of responsibility between the site and the individual, as well as individual perceptions of the extent of control the site has over the worker leaving immediately after shift.

7.5.1.3 Habit and routine behaviour

Habit and routine behaviour in relation to the commute home was identified in Theme 2 through two distinct components, pre-journey routine and routine during the journey itself. Habit is addressed separately considering the extensive information that was provided during the in-depth interviews, which is in line with the TIB and IBM presented in Chapter 2.

Commencing a journey home is based on the time an individual typically leaves the mine site. The reliance on routine could potentially be positive for the actual journey (i.e., creating familiarity with the road); however, given their departure time is so routinised and habitual, this places these workers at risk during their journey home. As such, the in-depth interviews support the position that commuting decisions are based on habit and routine. There is a clear reliance on routine as the reason behind the journey occurring at the time that it does; this is particularly relevant for the workers to justify safe commuting behaviour: the more routinised the behaviour, the higher level of perceived safety associated with the journey. Given this finding habit should augment the TPB to further explain this behaviour.

7.5.1.4 Attitude about work

Attitude about work comprises two distinct facets. Firstly, this attitude stems from the reasons why these workers continue to work in the industry and the lifestyle associated with the roster. Secondly, this concept deals with the isolation of working on a mine site and how these workers 'just want to get out of the place'. Because the attitudinal response associated with work focuses on the work environment rather than the commute specifically, it is not directly canvassed in further analysis within this research program beyond a discussion point or to inform the operationalisation of TPB constructs, particularly in respect to lifestyle, rostering, and site-related influences (e.g., sick of being on site).

7.5.2 Social factors

Social factors were identified as influencing commuting behaviour. *Figure 7-1* presents individual factors (e.g., attitudes, habits, and control) separate from normative factors, given the emphasis on social factors identified in Study 3. These normative factors are associated with four key reference groups, co-workers, supervisors, friends and family. Reference groups were identified and confirmed through the in-depth interviews. The rationale for the use of the key reference groups is described in Table 7-23. Each reference group can be associated with an identified theme.

Table 7-23.

Identifying key reference groups and related themes

Reference group	Rationale	Related themes
Co-workers	Co-workers were identified as a key group with reference to the site being like a community.	Theme 6
Supervisor/Manager	Supervisors were discussed within the in-depth interviews either engaging in the same commuting behaviour or as a control of the workers' commuting behaviour.	Theme 3
Family	Family was identified as a key reference group due to the reliance on the opinion of family about when the worker should commute home, and the perceived pressures from family about getting home as soon as possible.	Theme 8
Friends (other than co-workers)	Friends were identified as a key reference group due to their involvement in social events during workers' time off. Friend involvement is typically associated with lifestyle.	Theme 8

Social factors, as contemplated by the TPB, are associated with subjective norms which are the influence that reference groups have on decisions, intentions, and resulting behaviours. The internalisation of this influence results in individuals assessing behaviour in line with what they think the reference group considers as appropriate, desirable, and morally correct (Triandis, 1980). As conceived by the social norms approach, there is a clear distinction between descriptive and injunctive norms (Lapinski & Rimal, 2005). This approach informs the subjective norms construct of the TPB, to a limited extent, of the perceived social pressure to engage (or otherwise) in the behaviour (Ajzen, 1991). The social norms approach, as described in Chapter 2, extends this to include a 'follow the leader' type behaviour (descriptive norms) and the perceived approval of the reference groups to engage in the behaviour (injunctive norms). This approval and behaviour was evident throughout the in-depth interviews, particularly in Themes 6 and 8.

Descriptive norms are associated with the actual behaviour of others on the site or industry more generally. Descriptive norms describe how an individual perceives that the industry currently operates. More specifically, descriptive norms define typical or normal practice. This definition assists individuals to make assessments about effective and appropriate action in respect of the behaviour (J. R. Smith & Louis, 2008; White et al., 2009). From the perspective of commuting home from site after shifts, assessment of descriptive norms provides the individual with the ability to assess what others in the industry would do, in order to make appropriate decisions about commuting immediately following the shift block (or otherwise).

Descriptive norms are an important consideration in the current research because of the follow the leader behaviour that is evident in Theme 6. Descriptive norms are references to the behaviour undertaken by most others in an individual's reference group, with no social sanctions should the individual not conform with the majority (Lapinski & Rimal, 2005). There is reference throughout the in-depth interviews to '*that's what everyone else does*' or '*everyone on site leaves immediately after the shift, including the supervisors*'. Supervisors are only mentioned as barriers to leaving immediately (i.e., they are perceived as the rule enforcers). However, there is a perception that supervisors also leave shortly after the conclusion of the shift, which is consistent with the perception of the individual that leaving immediately after a shift is typically what occurs in the industry. Theme 8 highlights injunctive norms, particularly in reference to support of friends and family. This theme highlights that there is a perception that the worker ought to travel home as soon as possible to spend time with their family. Comparatively, some workers perceived that they ought to take their time as their friends and family acknowledge and understand the risks associated with the commute.

Co-workers and supervisors were typically involved in carpooling, following what others do and justifying their behaviour in line with what was perceived to be usual behaviour. The justification of behaviour is in line with perceived group norms and descriptive norms. Perceived group norms explain what the individual thinks that others do at the site. Perceived group norms are descriptive norms as well, given they refer to the beliefs of what is actually done by most others at the site (Lapinski & Rimal, 2005), with no specific social sanctions associated with performance of the behaviour. There was discussion within the in-depth interviews that it was common for all workers, including supervisors, to leave site immediately after a shift. Carpooling influenced workers to leave site at a specific time, with some of the participants describing carpooling as inflexible. However, this view was polarised, and some participants described carpooling as a safer way to travel home, given the ability to share the driving or allocate the driving to a colleague who has had a chance to sleep.

Injunctive norms are associated with beliefs about what ought to be done, or perceptions of approval or thoughts of what one ought to do or others would do in the same situation (Cialdini et al., 1990). From a social norm perspective, social injunctive norms are associated with perceived social pressures from significant others to engage in or perform the behaviour (White et al., 2009). In the case of commuting, social injunctive norms are more associated with friends' and family approval (or otherwise) of the behaviour. Discussion about family and friends is typically associated with social activities during down time/time off. As such, there were two specific associations with family and friends and the commute home: perceived pressure to get home, and encouragement to take time. Social injunctive norms motivate action through rewards and punishments for engaging (or otherwise) in the behaviour. For example, the influence imposed by family and friends is typically associated with encouraging the worker to take their time to get home, or pressuring them to get home as soon as possible in order to spend more time socialising. The encouragement to take time is typically associated with the journey itself, which potentially results in competing messages of 'take your time' and 'hurry up and get home'. Given that there is suggestion that workers are a close community, it is likely that this community-type behaviour is emulated across commuting behaviours.

Comparatively, personal injunctive norms are associated with the morality of the behaviour, meaning is it moral to engage in the behaviour (or otherwise). There was a great deal of discussion within the in-depth interviews about the rules associated with commuting after work and if the site had any control over what happens outside the gate. Personal injunctive norms are similar to social injunctive norms as the construct is about 'what ought to be done', as well as considering what is important to the individual. Therefore, social sanctions are associated with the behaviour and are thus operationalised as 'what ought to be done' (Lapinski & Rimal, 2005)

7.5.3 Critical beliefs

The thematic analysis using a theory-led approach highlights the alignment of this research with the TPB. As discussed in Chapter 2 and highlighted in Section 2.9.1, underpinning each construct within the TPB is a salient belief. Salient beliefs underpin all factors described in *Figure 7-1*, including individual factors, social factors, journey characteristics and organisational factors. Salient beliefs are not specifically highlighted as a factor in *Figure 7-1*. The following discussion underlines the interrelated nature of salient beliefs in this phenomenon. The themes that underpin the salient beliefs discussed are associated with the attitudinal, normative or control constructs discussed in Section 2.9.1. TPB procedure calls for the elicitation of salient beliefs through a formalised belief elicitation process. However, Chapter 2 describes the lack of research in the area of commuting behaviour with the mining industry. Therefore, while a prescriptive approach is more commonly adopted, the research question and methodology required a less structured and more exploratory approach. The primary reason for adopting an exploratory approach was to ensure a deep exploration of the issue rather than concentration on belief structures pre-determined by a theoretical framework, which was for guidance purposes at that stage of the research effort. Despite common practice being to question participants using specifically worded questions, there are examples of research whereby semi-structured interviews were adopted with the expectation that these open-ended questions would result in participants mentioning the beliefs and opinions that were most salient or important to them (e.g., Kasprzyk et al., 1998). The critical beliefs that were examined were drawn directly from the in-depth interviews. The rationale and related themes are presented in the following sections. Given organisational constraints, there was no opportunity to further test or assess the critical beliefs drawn from the in-depth interviews.

Behavioural beliefs - advantages and disadvantages

The thematic analysis confirmed that the advantages and disadvantages of leaving site immediately following a shift block were associated with lifestyle and social factors. The findings which are aligned with advantages and disadvantages are described in Table 7-25 and Table 7-25. This description outlines the advantages and disadvantages, the rationale for associating the finding with these behavioural beliefs, and the related theme uncovered through the thematic analysis. By leaving the site immediately, the worker is able to make the most of time off and spend more time with their family or friends. As with the barriers, disadvantages were associated with the risks of leaving immediately. The disadvantages examine the risks associated with the commute, particularly in respect to fatigued and rural and remote driving. Workers acknowledge that there is some level of risk which they accept, despite them being safety aware and holding the perception that these risks are appropriately mitigated.

Table 7-24.

Summary of behavioural beliefs (advantages) from in-depth interviews

Behavioural beliefs		Rationale	Related theme/s
Advantages	a) Make the most of the time off	Workers perceive that leaving immediately following shifts allows them to spend more time off.	Theme 3 Theme 8
	b) Get to see family sooner	Leaving immediately means that the worker is able to see their family sooner.	Theme 8
	c) Get home as soon as possible	Leaving immediately after shift means that the worker will be able to get home sooner.	Theme 8
	d) Get off site as soon as possible	Leaving immediately after shift means that the worker will be able to get off site as soon as possible.	Theme 5

Table 7-25.

Summary of behavioural beliefs (disadvantages) from in-depth interviews

Disadvantages	a) Puts others road users at risk	Acknowledgement that leaving immediately is a risky behaviour which may impact others.	Theme 1 Theme 7
	b) Puts me at risk	Leaving immediately following a shift is risky for an individual.	Theme 1 Theme 7
	c) Doesn't comply with site rules	Leaving immediately following a shift is not in line with the expectations of the site and there may be repercussions.	Theme 1 Theme 3
	d) May be involved in a crash	May be involved in a crash due to the time of day driving, fatigue or other factors.	Theme 1 Theme 7
	e) Breaks the road rules	Self-reported evidence that the workers are advised that they will break the road rules if they leave immediately and are fatigued.	Chapter 6
	f) Won't be covered by insurance	Self-reported evidence that the workers are advised that they will not be covered by insurance if they leave immediately, are fatigued and have a crash.	Chapter 6
	g) May be involved in a near-miss	May be involved in a near miss due to the time of day driving, fatigue or other factors.	Theme 1 Theme 7
	h) Taking a risk	Driving immediately following a shift block is seen to be risky.	Theme 1 Theme 7

Normative beliefs – approval and disapproval

Approval and disapproval associated with normative beliefs was associated with the four key reference groups revealed during in-depth interviews (see Table 7-26). Beliefs associated with reference groups were associated with approval or disapproval, as contemplated by the TPB. Co-workers were typically associated with providing approval for driving home immediately following shift. While it is acknowledged that it is risky to leave site immediately following shift, typically co-workers believed in the ability of their colleagues to appropriately assess the risk associated with the commute and make a sensible decision. Alternatively, there was also the perception that everyone in the industry leaves site immediately following shift. There was a belief that supervisors and managers disapproved of leaving the site immediately following shift due to the fatigue and journey management policies.

Supervisors and managers' disapproval was typically referenced when participants stated that journey safety was their responsibility. Comparatively, family and friends' disapproval was typically associated with identified risks associated with the journey home. As such, participants justified accepting or ignoring the risk in the context of their risk mitigation strategies.

Table 7-26.

Summary of normative beliefs from in-depth interviews

Normative beliefs		Rationale	Related theme/s
Who approves?	a) Co-workers	Co-workers are part of a community that exists on site. Individual decisions are influenced by colleagues. Co-workers trust the decisions made by their colleagues.	Theme 6 Theme 8
Who disapproves?	a) Supervisor/ Manager	Supervisors are aligned with the site and are seen to disapprove of workers leaving immediately following shifts.	Theme 3 Theme 6
	b) Family	While family want the worker to get home as soon as possible, there is also an encouragement to take their time.	Theme 8
	c) Friends (other than co-workers)	While friends want the worker to get home as soon as possible, there is also an encouragement to take their time.	Theme 8

Control beliefs - facilitators and barriers

As can be seen in Table 7-27 and Table 7-28, control beliefs centre on risk mitigation, compliance with site rules, and family concerns. Barriers are typically associated with Themes 1 and 7, which concern risky situations and factors (see Table 7-28). Facilitators were typically associated with social factors and routine, rather than risky situations or factors (Table 7-27). Table 7-27 and Table 7-28 provide an overview of each facilitator and barrier, the rationale for its inclusion, and the related theme.

Table 7-27.

Summary of control beliefs (facilitators) from in-depth interviews

Control beliefs		Rationale	Related theme
Facilitators	a) Doing what others do	Engaging in the behaviour due to the behaviour of others.	Theme 6
	b) Following a routine	The pre-planned nature of the trip can act as a facilitator, to encourage the worker to leave the mine site earlier than they should, rather than assessing the situation at the conclusion of each shift block.	Theme 2
	c) Family want me home	Wanting to leave site and get home as soon as possible because of family responsibilities and needs.	Theme 8
	d) Experienced driver	Any perceived risks are mitigated given experience as a long-distance and country driver thus facilitating the journey to commence.	Theme 7
	e) Car is built for country roads	Any perceived risks are mitigated given the car will ensure safety, thus facilitating the journey to commence.	Theme 1 and Theme 7
	f) Carpooling	Carpooling results in the ability to manage the driving risk and is therefore identified as a facilitator to leaving immediately following a shift.	Theme 1 and Theme 6
	g) Needing to be somewhere	Self-reported evidence that children's parties, sporting matches and other social events encourage workers to leave immediately.	Chapter 6
	h) Sick of being on site	Sick of being on site due to the long shift blocks which encourages workers to leave as soon as work has finished.	Theme 5
	i) To get the drive over with	Leaving straight after shift because of an extreme dislike of the commute.	Theme 4

Table 7-28.

Summary of control beliefs (barriers) from in-depth interviews

Control beliefs		Rationale	Related theme
Barriers	a) Family concerns	Family have concerns about the worker travelling home immediately following shift, preventing the worker from leaving immediately.	Theme 8
	b) Complying with site rules	Workers concerned about site guidelines about commuting home following shift which prevents the worker from leaving immediately.	Theme 1
	c) Avoiding dawn/dusk driving	Workers concerned about driving at times of the day which are perceived to be high risk, resulting in the worker being unlikely to leave immediately after shift.	Theme 7
	d) Avoiding night driving	Workers concerned about driving at times of the day which are perceived to be high risk, resulting in the worker being unlikely to leave immediately after shift.	Theme 7
	e) Feeling tired	Workers concerned about travelling immediately following shift if they are tired.	Theme 1 and Theme 7
	f) Seeing a crash occur	Workers less inclined to travel immediately following shifts if they are aware of a crash or near miss as a result of the driver travelling immediately following a shift.	Theme 1 and Theme 7
	g) Being in an crash	Workers less inclined to travel immediately following shifts if they are aware of a crash or near miss as a result of the driver travelling immediately following a shift.	Theme 1 and Theme 7
	h) Training in fatigue management	Training in fatigue management means that the worker is less likely to travel home immediately after a shift.	Theme 1 and Theme 7
	i) Wanting to get home in one piece	The worker perceives that they may be involved in a crash if they leave site immediately following shift.	Theme 1 and Theme7
	j) Not getting home tired	Self-reported evidence that these workers manage the change in day and night shift by forcing their body back to a normal rhythm.	Chapter 6

7.5.4 Journey characteristics

The following section discusses journey characteristics as described in *Figure 7-1*. These factors are contemplated by environmental constraints or situational factors as contemplated by the RAA, TIB and IBM (see Section 2.9.4). While there were mixed views about the commute, a key theme was associated with the perceived risk of the commute. Participants described leaving immediately following shift blocks as risky; however, the risk was accompanied with a risk mitigating measure to counter the likelihood or consequence of an adverse outcome. Participants stated that they were able to leave immediately following a shift because of measures that had been put in place to counteract the level of perceived risk. Theme 7 highlights perceived commuting risks. Risks fall into two categories, work-related and driving-related risks. The work-related risks were associated with leaving straight after work and fatigue.

From an environmental or situational perspective, the primary consideration of the worker is the time of day spent driving. Participants considered the distance to be travelled based on time of day and shift type. For example, it seemed more likely that workers were more inclined to leave site immediately following a shift block after finishing night shift than day shift. This finding is associated with the night shift workers being able to drive home during daylight hours. However, there are a number of logistical factors that impact on decision to leave site immediately following a shift block. These logistical decisions were typically associated with involving others in the decision (e.g., carpooling). There were a number of participants who described an aversion to carpooling or using the company-provided bus due to the inflexible nature of these options.

Driving-related risks were associated with things that were encountered during the journey, for example kangaroos, storms, other drivers, poor vehicle maintenance and the road itself. Some risks were associated more frequently with night driving (e.g., kangaroos). There are also situations whereby workers accept the risk associated with the commute or alter their routinised behaviour due to a change in condition or situation. These circumstances change the time that workers leave site. This change may be associated with inclement weather or a need to attend a birthday party. Where identified, environmental constraints, or external factors, are examined by contemplating the influences as facilitators or barriers to achieve parsimony.

7.5.5 Organisational factors

The following section discusses organisational factors as described in *Figure 7-1*. Organisational factors are an important consideration of commuting behaviour. Organisational factors identified are associated with employment structures, rostering, as well as legislation and policy. This study also identified safety awareness as an important organisational factor. These factors are discussed from a thematic perspective in the following sections.

7.5.5.1 Employment structures and rostering

Employment structures and rostering contribute to the variation in decisions associated with commuting immediately following a shift. Organisational structure also contributes to the flexibility associated with the commute. For example, those in professional roles have the ability to leave early on the last day of shift in order to factor their commute into the final day's work. These professional workers seemed less concerned about the journey given the flexibility of their roster in this respect.

7.5.5.2 Legislation and policy

The in-depth interviews supported the limitations identified in legislation and organisational policy regarding commuting. There is no control on worker commuting decisions following a shift block. According to the participants, it is the individual responsibility of the worker to ensure they arrive home safely. However, extending beyond the legislation and policy discussion in Chapter 5, there is a clear reliance on site safety policies and the use of risk assessments to identify and mitigate the risks associated with the commute, as highlighted by Theme 1 and Theme 3. As such, while there is no direct control of legislation and policy over commuting, there is transference of safety-related behaviours from on-site to off-site behaviours.

7.5.5.3 Safety awareness

Participants described organisational policies associated with safety on-site and their compliance with awareness of those safety requirements. While there is still an awareness of the risks associated with commuting and commuting immediately following a shift block, the safety awareness theme describes the justification associated with the commute and the justification of behaviour. There is also evidence of risk assessments being performed in line with on-site requirements. These workers consider that they have control over the commute given their experience in assessing and responding to risk. However, there is a clear distinction between site-related safety practices and the safety practices associated with the journey home. While the risks are assessed in the same way, the individual has greater control around the decision to engage in commuting behaviour. There is a clear inextricable link between safety awareness on-site and safety awareness in respect to the journey home; there is a clear transfer of safety-related concepts on the approach adopted to determining the safety aspects of the journey. The association between site and journey safety awareness demonstrates some support for the question of the relationship between these two concepts. This relationship is examined further in the survey chapter.

7.5.6 Implications

The in-depth interviews demonstrated support for the TPB to be applied in this context, augmented by additional factors, given the influence social, individual, organisational and situational factors have on worker intentions and behaviour. The TPB framework provides a structured way to examine the relationships between the key influences of a travelling workforce associated with leaving site immediately following shift. However, there are clear limitations in the original model. The themes presented following the analysis of the in-depth interviews demonstrate that routine, risk perception and mitigation, as well as perceived social norms, play an important role in employees leaving site immediately following a shift block. Additionally, when considering commuting safety, the in-depth interviews demonstrate that employees place substantial weight on: (1) experience driving long distances, (2) familiarity with the road, and (3) their understanding of associated commuting risks and mitigating these risks. However, the TPB is limited in consideration of these factors. As such, based on the outcomes of the in-depth interviews, the applicability of the TPB to this context, the identifiable shortcomings of the TPB framework, and additions to the TPB framework are included in the quantitative questionnaire for the purposes of Study 4.

Overall, the in-depth interviews highlighted the safety awareness of the workers and the influence of significant others. The key element of the findings parallels with the TPB framework, particularly in respect to the attitude about the commute itself, the reliance on co-workers in the site community, and the social influences on committing to the drive, and finally the control around the time that the workers leave the site and the assertion that the drive home is outside site control.

The application of the risk assessment process to the journey home is evident in participants' responses and is clearly associated with the processes used on site. However, there appears to be a significant reliance placed on the mitigating strategies implemented in order to perceive control over the commute. For example, a common risk mitigation strategy for night driving is buying a larger car with a bull-bar. Practically, this strategy does not change the likelihood of being involved in a collision with an animal and potentially does not even change the consequence. These workers justify leaving work using these types of strategies.

Routine is also cited by the participants as a positive risk management tool. However, placing a reliance on familiarity with the journey could also result in complacency and potential loss of concentration. The association of routinised behaviour with risk minimisation provides further understanding of the influences on worker commuting decisions. Industry experts can use this understanding to implement more strategic approaches to address this off-site behaviour.

7.5.7 Strengths, limitations, and future research

The study explores the perception of 37 workers from various occupations at the focal mine site. This study is the first to explore the influences associated with the decision to leave site immediately following a shift block. While this research focuses on the mining industry, there are clear parallels with other industries, particularly those involving professional driving and shift work. Given the limited information available on this topic, in-depth interviews were a necessary step in the exploration of this topic.

A key limitation of in-depth interviews is the generalisability of the data and the reliability of the sample. The present sample was derived through a convenience sampling method to comply with safety and induction policies. As the interviews were not recorded, a potential limitation may be associated with the researcher failing to observe subtle changes in body language due to focusing on writing participants' responses. The results of the in-depth interviews were used to support the application of a theoretical model and to develop the questions to be used in the questionnaire in Study 4 in order to support the overall results of the research program. While the focus on the perceptions of workers from one mine site may be considered a limitation, there are benefits in adopting this approach. This research draws on the opinions of workers at all levels of the organisation; research such as the current program would usually focus on operational staff only. The benefit of examining the perceptions of those at all levels of the organisation is that it gives a clear understanding of the variation of behaviour between those in different levels of the organisation.

Participants were willing to admit to leaving the site immediately following a shift block, because it is the perception that leaving the site immediately following a shift is the individual worker's decision to make: they are responsible for their safety during the journey home. Therefore, it is unlikely that there was a social desirability bias involved in the responses in this study.

7.6 CHAPTER SUMMARY

The findings demonstrate that these participants sought to minimise risks created by individual, social, situational and organisational factors by planning their commute and routinising their behaviour. While participants acknowledged the risks associated with their travel, they also perceived that repetition of their travel behaviours minimises these risks to a level which is acceptable to them. In the case of commuting home, the benefits outweigh the risks. In order to maintain an acceptable level of risk, workers' typical routine changes in response to various situational factors (e.g., flooding, interactions with wildlife, boredom/monotony associated with the trip, or type of shift performed).

A large component of this chapter has discussed workers using risk assessments in order to gauge the risk associated with the commute home from work. Risk assessments, while logical in structure, are organisationally derived. The mining industry, being safety focused, makes safety training around risk assessment a core element. In order to justify behaviour, these workers cited a staged approach to considering the potential risk and then explained the measures in place to mitigate the severity of the outcome. Theme 1 describes 'safety awareness' from an individual and organisational perspective, and demonstrates that participants justified leaving site immediately after shift due to their training, experience or a practical solution they feel appropriate. This ordered, structured thought process is taught through risk identification and assessment processes and is applied to this outside-work scenario.

The findings showed that the time workers leave the worksite is not contingent on an assessment of situational factors such as fatigue levels, length of completed shift or time of day, as contemplated by organisational guidelines. However, describing the habit associated with the commuting decision was also associated with a risk awareness and assessment to justify why habitual behaviours were appropriate in this instance.

The next chapter describes the method for the quantitative survey (Study 4). Based on the outcomes of the in-depth interviews, Chapter 8 describes the rationale for the survey items and constructs used to further examine the relationships between individual, social, organisational and situational factors identified. The following chapter is the foundation for the quantitative analysis undertaken in Chapters 9, 10, and 11.

Chapter 8: Quantitative Survey Method

8.1 INTRODUCTION

Chapter 8 describes the method for Study 4, the quantitative survey. The chapter provides an overview and rationale for the survey items and constructs which are tested in the following three chapters (Chapters 9, 10, and 11). Overall, the aim of Study 4 was to operationalise and statistically explore the findings of the in-depth interviews to determine the most salient and statistically significant influences and the impact of those influences on the immediacy of the commuting decision.

This method chapter presents an overview of the focus and alignment of the chapters relating to Study 4 (Section 8.1). Section 8.3 describes the study design and explains the purpose of adopting a two survey approach. The following section presents the structure and development of the survey and details the composition rationale for each measurement item (Section 8.4). Section 8.5 describes the method for recruiting participants. Section 8.6 calculates the minimum sample size required for the research, with Section 8.7 providing a chapter summary.

8.2 STUDY AIM AND RESEARCH OBJECTIVES

Study 4 presents and explores relationships as a result of previous studies within this research program. As presented in *Figure 7-1*, the following three chapters focus on examining individual, social, organisational and situational influences on driving-related commuting decisions based on Research Objective 3 and Research Objective 4 (see Section 1.5).

8.3 STUDY DESIGN AND GENERAL RESEARCH STRATEGY

Two cross-sectional, pen and paper survey were developed based on the findings of Study 1, Study 2 and Study 3. Participants completed the surveys during work hours. The results are presented in Chapter 9, Chapter 10, and Chapter 11. Broadly, the findings of the descriptive study (Chapter 4) contributed to the development of items relating to situational factors, the focus group (Chapter 6) contributed to the development of items to examine organisational factors, and the in-depth interviews (Chapter 7) contributed to the development of items to examine individual and social factors. The two surveys developed assessed behaviour following day and night shifts. The rationale for the development of two surveys is discussed in the following section. As highlighted in Chapter 7, following data collection, the usefulness of the TPB to explain this behaviour became clearer. As such, the questionnaires were developed in line with standardised TPB questions (Ajzen, 1991, 2002a; Fishbein, 2003). The questionnaires contained quantitative items, using a 7-point Likert scale. The Site Safety Manager recommended that the survey remain as brief as possible given the nature of the target population and due to time restrictions for operational requirements.

The TPB prescribes a follow-up survey to measure planned behaviour following the initial survey (Ajzen, 2002a); however, this follow-up survey was not undertaken for a number of reasons. Operational requirements resulted in limited access to the respondents. On a daily basis, the workers on the target mine site are transported to work areas which are located significant distances from the main site office. Furthermore, these workers have limited or no access to email during the day. Overall, the researcher was allowed a small amount of time with the respondents to facilitate this research. Hence it was impractical to undertake a follow-up survey.

8.3.1 Day versus night shift

There is support, both anecdotally and resulting from the findings of Studies 2 and 3, for a large variation in behaviour between commuting following a day shift versus following a night shift. While self-reported evidence suggests this phenomenon exists, the in-depth interviews highlight this variation is due to avoiding animals on the road, having a preference to drive at a certain time of the day, and to some extent, workplace restrictions on commuting following shift. The in-depth interviews showed that generally workers drive immediately following a night shift but will stay the night following the conclusion of a day shift. This difference is mainly due to the perception that it is safe to drive following a night shift because the commute occurs during daylight hours. As such, two surveys were developed to capture the variation in behaviour following these two shift types. The measures in each survey were identical with the exception of the shift qualifier. For example, *"in the last month, I have typically driven home immediately after finishing a night shift block"* compared to *"in the last month, I have typically driven home immediately after finishing a day shift block"*. To easily distinguish between the day and night survey, the day survey was printed on yellow paper and the night survey was printed on blue paper. For ease of discussion, henceforth measurement items are presented referencing both day and night shift blocks (e.g., day/night) and referred as *'the day survey'* or *'the night survey'* and the results will be described as outcomes following *day shifts* or *night shifts*. A complete copy of the day and night survey can be found at Appendix C and D.

8.4 INSTRUMENT DEVELOPMENT AND STRUCTURE

Construct selection and rationale was based on a mixture of theory and analysis of previous studies within this program of research and operationalises each construct presented in Study 3 (see Section 7.5). Measurement items were adapted from previous literature. The questionnaire comprised three sections. The first section was designed to understand attitudes and perceptions about driving home immediately following a shift block and the journey home. The second section queried employee perceptions about safety practices in the organisation relating to general safety and commuting safety. The final section sought general demographic information and information about employee journeys following the shift block.

The measures used in the survey were adapted from existing scales to fit within the context of driving home from mine sites following day and night shift blocks. The constructs presented and discussed result from previous research using the TPB with adjustments to the context of driving home immediately following a shift block, as recommended by previous TPB literature (Ajzen, 1991, 2002b; Fishbein, 2003).

8.4.1 Theory of Planned Behaviour constructs

It is important to assess each construct in line with target behaviour (Ajzen, 1991). The behaviour must be defined in order to appropriately measure other factors within the model. The workers on the focal mine site are able to rest or sleep after a shift before driving home, catch a bus if they live locally, or engage in carpooling. Therefore, workers on the focal site do not have to leave the site immediately following a shift. The primary risks, however, are associated with fatigue, driving in rural and remote areas and driving during dawn and dusk (see Section 2.5). As such, the current research defines the target behaviour as driving home immediately after finishing a shift block. In line with the recommendations of Ajzen (1991) and Fishbein (2003), the behaviour was precisely defined in terms of target, action, context and time (TACT). The target behaviour was limited to driving home *immediately* after finishing a rostered day or night shift block, with participants asked to recall or apply their behaviour to a typical month. Recalling behaviour from a typical month was to ensure the recency of the behaviour and intentions reported by respondents. Measures were adapted from previous TPB research to align with the target behaviour and context (Ajzen, 1991, 2002b; Fishbein, 2003).

Participants were provided verbally with the definition of the term 'immediately' prior to commencing the survey, and the definition was also presented on the cover page of the survey in bold font to highlight the importance of the information. The definition presented to the participants advised:

> *In this case, the term "immediately", includes time for you to pack your car, have a shower, have something to eat and leave the site following your day/night shift block.*

To ensure understanding of the target behaviour, Section C of the questionnaire asked participants to advise 'if you have a break after a day/night shift block, before you drive home, typically how long (hours/mins) is it?'

Past behaviour

Past behaviour was measured using a 7-point scale anchored by *'never'* and *'very often'*. Adapted from Ajzen (2002a), past behaviour was measured using, "In the last month, I have typically driven home immediately after finishing a day/night shift block".

Behavioural intention

Intention to commute home immediately following a day/night shift block was measured using two items to assess intention to engage in the behaviour, as well as one item to assess individual willingness to engage in the behaviour. Intention is used as the dependent variable in most analyses. These measures were, "I intend to drive home immediately after finishing my day/night shift block", "It is likely that I will drive home immediately after finishing my day/night shift block" and "I am willing to drive home immediately after finishing my day/night shift block". Intentions and willingness were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

8.4.1.1 Measurement items for social and individual factors

The following section discusses the measurement items for individual and social factors referenced in *Figure 7-1*. These factors are operationalised through the TPB constructs – attitude toward the behaviour, subjective norms and PBC.

Attitude toward the behaviour

A composite measure of attitudes toward driving home immediately after a shift block combined both affective and instrumental attitudinal responses. As outlined in Chapter 2, the interchangeable use of affect and attitude to denote evaluation makes the operationalisation of attitude unclear given the variation of definitions. Study 3 examined both affective and instrumental responses associated with the behaviour of leaving immediately following shift blocks (see Section 7.5.1.1). These responses straddled the practicalities of being involved in remote work, as well as the emotional aspects. Attitudinal responses were measured from both instrumental and affective perspectives. Both affective and instrumental attitudes were measured using a 7-point semantic differential scale. Participants were presented with the following statement, “For me, driving home immediately after a day/night shift block in a typical month would be” followed by positive/negative, unnecessary/necessary, worthless/beneficial, unwise/wise, and breaking the rules/complying with the rules. The scale anchors were derived from the findings of Study 3, with a focus on the necessity of the commute, attitudes about work, safety consciousness of the workers, and the influence of significant others.

Subjective norms

In addition to being a key construct of the TPB, the inclusion of subjective norms was due to the influence of family and friends outlined in Study 3 (see Section 7.5.2), as well the self-reported evidence expressed in Study 2b (see Section 6.4.3.3). The support (or lack thereof) to leave immediately following shifts of significant others was measured given the identification of such polarising themes identified in Study 3. Two items were used to assess subjective norms. These measures were: “Most people who are important to me would support me if I drove home immediately after finishing my day/night shift block” and “The people in my life whose opinions I value would approve of me driving home immediately after finishing a day/night shift block”. Participants were required to respond on a 7-point Likert scale ranging from 1 (very unlikely) to 7 (very likely).

Perceived behavioural control

PBC in respect to commuting after shift is associated with who is responsible for ensuring the commute is engaged in safely, through two key factors. Individual choice is associated with leaving the site at the desired time, since there is a perception that there are no specific organisational controls that prevent the worker engaging in the commute immediately after shift (see Sections 6.4.3 and 7.5.1.2). A composite measure of PBC assessed both the extent to which respondents had control over leaving site immediately after a shift block, and the perceived ease of performing the behaviour. Considering there are site expectations associated with the commute, this construct seeks to assess if workers perceive that the decision is theirs to make, and that their ability to make the decision aligns with their abilities to perform the behaviour. These measures were operationalised controllability and self-efficacy components of PBC. *Controllability* was measured with two items: “Driving home immediately after finishing my day/night shift block is within my control” and “Driving home immediately after finishing my day/night shift block is up to me”, using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). *Self-efficacy* was measured using one item: “It would be easy for me to drive home after finishing my day/night shift block” on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

8.4.1.2 Measurement items for behavioural, normative and control beliefs

Participants were required to respond to statements that were developed based on salient beliefs identified in Study 3. These salient beliefs underpin the constructs identified by the TPB as key influences on intention and behaviour, further contributing to understanding the importance of individual, social and organisational influences. The rationale for the inclusion of each of these beliefs was presented in Chapter 7 (see Section 7.5.3). The following sections discuss how these salient beliefs were measured for the purpose of the current research.

Behavioural beliefs

Behavioural beliefs, or advantages and disadvantages, assessed individual beliefs of engaging in the target behaviour resulting from outcomes identified and discussed in Study 3 (see Section 7.5.3). Participants were presented with the statement: “During a typical month, how likely is it that driving home immediately after finishing a day/night shift block will result in the following”, and were required to respond to a number of advantages and disadvantages on a 7-point Likert scale anchored by 1 (very unlikely) to 7 (very likely). These beliefs included putting others at risk, putting me at risk, making the most of my time off, seeing my family as soon as possible, getting home as soon as possible, getting off site as soon as possible, non-compliance with site rules, breaking the road rules, uninsured, involved in a crash, involved in a near miss, and taking a risk.

Normative beliefs

Normative beliefs were assessed using family, friends, co-workers and supervisors as relevant reference groups. Participants were required to respond to the following statement, "During a typical month, how likely is it that the following individuals or groups of people would approve of you driving home immediately after finishing a typical day/night shift block". The identified reference groups were drawn from the in-depth interviews. Reponses were sought using a 7-point Likert scale anchored by 1 (very unlikely) to 7 (very likely). TPB research often provides participants with a "not applicable" (n/a) option when measuring normative beliefs. This option allows respondents to indicate if a reference group is not relevant. For example, a reference group of husband or wife is not applicable to a respondent who is not married, and if the respondent is married, family would capture an instance where partner is applicable. It was determined that the reference groups devised for the survey would be relevant to all participants, therefore the 'not applicable' option was not provided for ease of analysis.

Control beliefs

Control beliefs, or facilitators and barriers, were assessed using a 7-point Likert scale anchored by 1 (very unlikely) to 7 (very likely). Participants answered this question in response to the most salient beliefs highlighted in Study 3. Control beliefs were presented in two sections. The first section posed the statement: "How likely is it that the following factors would encourage you to drive home immediately after finishing a day/night shift block in a typical month". Participants were required to respond to the identified facilitators of carpooling, following what others do, needing to be somewhere, routine, my family want me home, experienced distance driver, car made for country roads, sick of being on site and to get the drive over with. Participants were also required to respond to the following statement about identified barriers: "How likely is it that the following factors would prevent you from driving home immediately after finishing a day/night shift block in a typical month". The barriers assessed included listening to family concerns, workplace policies, avoid driving at dawn/dusk, avoiding night driving, feeling tired, seeing an accident, being involved in an accident, fatigue management, get home in 'one piece' and not get home tired.

8.4.2 Measurement items for additions to the Theory of Planned Behaviour

Based on the in-depth interviews, there were a few constructs which are not considered within the TPB but which were discussed as influences on commuting behaviour. These constructs are associated with the link between previous behaviour and intention and the specificity of the normative factors discussed during the in-depth interviews beyond that contemplated by subjective norms. These additional constructs are discussed in the following sections.

Habit

Habitual behaviour was measured using a modified version of Verplanken and Orbell's (2003) self-report habit index. Routine and habitual behaviour was identified throughout the in-depth interviews (see 7.5.1.3). Operationalising this construct was aligned with the pre-journey routine given the focus of the research, and contributed to an understanding of the individual influences of the commuting behaviour of interest (see *Figure 7-1*). Participants were presented with the following statement: "Driving home immediately after finishing a day/night shift block is something", and asked to respond to four actions. Eight items from the self-report habit index were deleted for reasons of parsimony and content validity (e.g., *"that's typically me"* and *"that makes me feel weird if I do not do it"*). The remaining actions were, *"I do without thinking", "I do automatically", "I have been doing it for a long time"* and *"Is part of my end of shift routine*". These items were measured on a 7-point Likert scale anchored by 1 (strongly disagree) to 7 (strongly agree).

Social injunctive norms

Social injunctive norms are about perceptions of approval or thoughts of what one ought to do. These perceptions are based on what others would do in the same situation (Lapinski & Rimal, 2005). These norms are associated with perceived social pressures from significant others to engage in or perform the behaviour. Social injunctive norms motivate action through rewards and punishments for engaging (or otherwise) in the behaviour, providing further understanding about how social influences affect the immediacy of the commuting decision. Given that there is a suggestion that the people are engaged in a close community, it is likely that this community type behaviour is emulated across how the workers engage in commuting (see Section 7.5.2). Participants were required to respond to two items: "How many of the people who are important to you would approve of driving home immediately after a day/night shift block" and "Most people who are important to me think that driving home immediately after a day/night shift block is something one ought to do". These items were measured on a 7-point Likert scale (1, None to 7, All).

Personal injunctive norms

Personal injunctive norms are associated with the morality of the behaviour. There was a great deal of discussion within the in-depth interviews about the rules associated with commuting after work and if the site has any control over what happens outside the gate. While personal injunctive norms are still about what ought to be done, these norms also refer to those morals that are important to the individual (Lapinski & Rimal, 2005), and as with social injunctive norms operationalised as what ought to be done (see Section 7.5.2), contribute to understanding the social influences on the immediacy of the commuting decision. Personal injunctive norms were measured using two statements: "I feel that driving home immediately after a day/night shift is something I ought to do", and "Driving home immediately after a day/night shift block would go against my principles". These were assessed on a 7-point Likert scale (1, strongly disagree to 7, strongly agree).

Descriptive norms

Descriptive norms describe an individual's perception of the prevalence of the behaviour in the industry (Lapinski & Rimal, 2005; White et al., 2009). From the perspective of commuting home from site after shifts, an assessment of descriptive norms describes the assessment of what others in the industry would do prior to finalising a commuting decision (see Section 7.5.2). Operationalisation of descriptive norms determines the perceived behaviours occurring more widely within the industry, and further refines the social influences detailed in *Figure 7-1*. A measure of descriptive norms was obtained using 1 item on a 7-point Likert scale (1, None to 7, All). The item was: "In the industry, how many people do you think drive home immediately after a day/night shift block".

Perceived group norms

Perceived group norms are an explanation of what the individual perceives are the behaviours of their colleagues. This would be classed as a descriptive norm as well, given it refers to the beliefs of what is actually done by most others at the site (Lapinski & Rimal, 2005). There was discussion within the in-depth interviews that supervisors and other workers engage in this behaviour all the time (see Section 7.5.2), supporting the inclusion of this construct for further analysis. Participants were required to provide their perceptions of those reference groups which have the opportunity to engage in the behaviour themselves (e.g., supervisors/managers and co-workers), and the extent to which these reference groups agree with leaving the site immediately following a shift block.

Perceived group norms were measured using two items on a 7-point Likert scale *(*1 *Strongly disagree* to 7 *Strongly agree* and *"1 None to 7 all*;). These items were: "During a typical month, how much would the following individuals or groups of people agree that driving home immediately after a day/night shift block is a good thing to do" and "During a typical month, how many of the following individuals or groups of people would drive home immediately after a day/night shift block". These perceptions were measured against supervisors/managers and co-workers, the reference groups drawn from the in-depth interviews presented in Study 3, further supporting the examination of social influences.

8.4.3 Measurement items for situational factors

These constructs provided further contextual information to the study. Each construct was included as it was identified as an important contributor to the commuting decision-making process from the literature review, or on the basis of the outcome of previous studies within the research program. The purpose of the additional situational (environmental) constructs was to provide context to the driving-related commuting decision in line with the RAA, TIB and IBM frameworks (see Section 2.9.4) in order to contextualise the relationships identified in the TPB (see Section 7.5.4).

The situational factors, or journey characteristics, identified in Studies 1 and 3 were used to identify those participants who had the intention to leave site immediately following a shift block, and the risk taking behaviour in which they engage during the journey (see *Figure 7-1*). Once the employees are on their way home, they report that they have measures in place which assist in maintaining a safe approach to their commute. For example, as mentioned earlier, the perception is that frequently travelling the same stretch of road makes the journey home safer. Drawing on Study 1 and the perceived driving risks identified during the in-depth interviews in Study 3, journey characteristics were measured to assess the risks being taken during the journey home. These risks concentrated on fatigue-related risks and rural and remote driving. Four items were used to measure fatigue-related journey characteristics, as well as the frequency of rural and remote situational factors.

The items for this section of the questionnaire were adapted from a Driver Behaviour Questionnaire (DBQ) and were used to assess propensity to engage in risky behaviours (Freeman, Wishart, Davey, Rowland, & Williams, 2009). DBQ questionnaires assess the frequency of committing a violation or error, and how often the respondent engages in the behaviour. This research focused on the assessment of violations associated with organisational journey management policies, as well as risks identified in Study 1 and Study 3. Some of the acts presented to the respondent were derived from the industry and organisational journey management policies detailed in Study 2. For each group of situational factors, respondents were presented with the following statement: "During your journey home, how often do you".

Fatigue-related items assessed how often participants drove while being tired. Participants were asked to respond to the frequency in which they perform a safe or unsafe act during the journey home following a shift block, measured on a 7-point scale (1, never to 7, every time), including: "drive for longer than 2 hours", "drive home without stopping", "lose concentration" and "stop for a nap". Rural and remote items also were considered. Participants were asked to respond to: "drive in unfamiliar areas or settings", "drive on unsealed roads", "encounter wild animals or livestock on the road" and "hit livestock or animals", using the same statement presented above. There were also general situational factors considered using the same approach. These items included: "Drive even though you suspect you may be over the legal blood alcohol limit", "Disregard the speed limit on a highway", and "See an accident or the aftermath of an accident".

8.4.4 Measurement items for organisational factors

As outlined in Chapter 2, literature discussing safety in a workplace typically refers to two concepts: (1) safety culture; and (2) safety climate. Employees are influenced by numerous factors beyond their own perceptions of safety. These influences include factors from the organisation, its processes, and other workers; however, these external factors are difficult to measure. As such, this research considers the internal psychological factors or perceptions about organisational safety practices. As workers spend a considerable portion of their week in a work environment, the commuting focus offers an opportunity and a framework to investigate the overlap between driving and work safety behaviour, as well as the impact of colleagues and the organisation on the decisions of these workers.

The organisational influences described in Study 3 relate primarily to demographic information about employment structures and rostering. However, as highlighted in the literature review and in discussing the findings of Studies 2a and 3, safe behaviour is also associated with the overall safety perceived on-site (see *Figure 7-1*). Further, it is posited that this site safety behaviour extends into the behaviour exhibited by the worker in respect to their commuting intention and behaviour.

Table 8-1.

Safety climate, safety motivation, safety compliance, and safety participation measurement items

Construct	Measurement item and reference
General safety climate	1. Management places a strong emphasis on workplace health and safety
	2. Safety is given a high priority by management
	3. Management considers safety to be important
General safety motivation	1. I feel that it is worthwhile to put in effort to improve my personal safety onsite
	2. I feel that it is important to maintain safety at all times
	3. I believe that it is important to reduce the risk of accidents and incidents in the workplace
General safety compliance	1. I use the correct safety procedures for carrying out my job
	2. I use all the necessary safety equipment to do my job
	3. I ensure the highest levels of safety when I carry out my job
General safety participation	1. I promote safety within the organisation
	2. I put in extra effort to improve the safety of the workplace
	3. I voluntarily carry out tasks or activities that help to improve workplace safety

Safety climate is measured in respect to general site and journey (task-specific) practices in the current research. Constructs used to operationalise site safety culture were adapted from the condensed safety climate scale of Neal and Griffin (2006), including safety climate, safety motivation, safety compliance, and safety participation (see Table 8-1). All items were measured on a 7-point Likert scale anchored by 1 (strongly disagree) to 7 (strongly agree).

Safety while commuting was measured using the safety climate, safety motivation, and safety participation constructs proposed by Neal and Griffin (2006), adapted to measure safe journey practices. While safety climate measures assess site-related safety, these measures do not consider off-site safety such as commuting safety. Given the outcomes of the in-depth interviews associated with the distinction between safety awareness relating to site safety and commuting safety, the safety journey practices needed to be measured. *Safe journey practices* include journey safety climate, journey safety motivation, and journey safety participation. Safety compliance was not included to measure safety journey practices, given the operationalisation of this construct and its association with safety equipment (e.g., personal protective equipment) and documented safety procedures. The primary reason for the exclusion of this construct is associated with the finding in Section 6.4.3 – that journey policies are unclear and unenforceable. A secondary reason for the exclusion of this construct is associated with the operationalisation of the construct not being contextually appropriate for commuting safety. As such, it is unlikely that there are explicit, documented safety procedures or additional safety equipment required to drive a personal vehicle home after a shift block. Therefore, it was futile to assess compliance with unwritten and unclear requirements. However, given that higher-level policies exist, the respondents were asked about management's commitment to those policies, their motivation to ensure a safe journey home, and their willingness to participate in a journey management approach. As with the safety climate measures, constructs used to operationalise safe journey practices were adapted from the condensed safety climate scale of Neal and Griffin (2006) (see Table 8-2). All items were measured on a 7-point Likert scale anchored by 1 (strongly disagree) to 7 (strongly agree).

Table 8-2.

Journey safety climate, journey safety motivation, and journey safety participation measurement items

Construct	Measurement item and reference
Journey safety climate	1. Management places a strong emphasis on journey management 2. Journey home policies are given high priority by management 3. Management considers journey home policies to be important
Journey safety motivation	1. I feel that it is worthwhile to put in effort to improve my personal safety in respect to my journey home 2. I feel that it is important to maintain safety while driving home at all times 3. I believe that it is important to reduce the risk of accidents and incidents on the road when driving home from work
Journey safety participation	1. Within the organisation, I promote the journey management policies associated with the journey home from work 2. I put in extra effort to improve the safety of my journey home from work

8.4.5 Demographics

Demographic factors were highlighted in Studies 1, 2, and 3 as having a relationship with crashes. Some of these factors even revealed a propensity for engaging in risky behaviours. While there are no specific hypotheses presented, exploration of these background factors is important. General information regarding participants' gender, age, and marital status was sought. This information was used to provide an overview of the sample characteristics. Information was also sought regarding residential location in order to ascertain the distance travelled following a shift block. Specific information concerning occupational characteristics and journey characteristics was also sought, for example, information relating to the employment of participants at the mine was requested. This information was associated with the nature of the engagement, such as permanent, contractor, or other. The type of roster participants typically engaged in was also queried. Roster type is associated with the length of time spent on-site and at home.

8.5 PARTICIPANTS

Participants were recruited via convenience sampling from the same Queensland mine site as the previous studies. Participants were requested to respond to one version of the survey only. The survey was distributed to mine workers during scheduled safety training sessions. These training sessions form part of the annual compliance and competency for mine workers, and general safety induction which covered all aspects of safety across the mine site. All employees were required to attend this general safety induction session which was held from July to late September 2014. The survey ran for this entire period to capture the entire site in the sampling frame. Groups consisted of 10 – 25 workers and they were randomly allocated to the night or day survey group, unless they only ever performed one shift type. Random allocation was achieved by allocating every second group to complete the night shift survey and was deemed the most suitable approach given that the majority of these workers alternate between shifts types every shift block. If a worker only performed one shift type, then their response was sought in respect to that shift type.

8.5.1 Data collection and confidentiality

The survey did not require participants to identify themselves or the crew to which they belong. Data were coded in such a way to maintain confidentiality of participants. At the time of completing the survey, there were no managers or representatives of the mine site in the training room. The completed survey was handed back to the research team or an independent person directly upon completion. Finally, participants were reminded that responses were confidential and only aggregate data following analysis would be provided to their employer.

8.5.2 Qualitative pilot

The survey underwent a number of revisions to ensure that the survey was appropriate for the target group. These revisions involved Site Safety Supervisors and managers, as well as site training officers. The purpose of these reviews was to ensure that the questions contained in the survey were applicable and that the language and structure of the survey were appropriate for the target group. The final stage of this assessment process involved a qualitative pilot. This pilot involved six participants (two female and four male) and involved verbal feedback to the researcher following completion of the survey. Given the location of the pilot participants, this feedback was provided verbally over the telephone. The main criticism related to the length of the original survey. Based on the feedback, the original survey was shortened and the inclusion of some measures was reconsidered. For parsimony, measures perceived repetitive by those involved in the qualitative pilot were reviewed for necessity. Social injunctive norms were distilled from three measures to two measures. Two measures were intended to measure descriptive norms. Upon review, it was determined that both measures were capturing the perceived number of people who drive home immediately following a shift, and as a result, one item was removed. There were a large number of items that were intended to measure perceived group norms. These items were reviewed and duplication was removed, resulting in two items being used to measure perceived group norms.

8.5.3 Analyses

All data were analysed using IBM SPSS Version 22.0. A variety of statistical analyses were used to address research questions posed in Chapters 9, 10, and 11. Analyses undertaken are described in each chapter prior to the presentation of the results.

8.5.4 Ethical clearance

Ethical approval was obtained from the Queensland University of Technology Human Research Ethics Committee on 13 June 2014 (approval number 1400000399).

8.6 STATISTICAL POWER AND SAMPLE SIZE

An appropriate sample size is required to be determined for regression analyses. Tabachnick and Fidell (2007) recommend a rule of thumb be measured based on the intended number of predictors. For multiple regression, the required sample size is calculated by $N \geq 50 + 8m$ (where m is the number of predictors) in order to test for an effect size of .05 and 80% power (Tabachnick & Fidell, 2007). For the current research, in order to ensure an adequate statistical power for the day and night survey, the minimum sample size required for each sample was $N = 106$ in order to measure the relationship between behavioural predictors and intention.

8.7 CHAPTER SUMMARY

Chapter 8 has described the research program objectives associated with the quantitative survey (Study 4). This chapter has provided an overview of the survey items and constructs which relate to Study 4, with a brief rationale for the composition of the measures. The chapter then concluded by describing participant selection and data collection relevant to Study 4.

The next chapter examines the organisational and situational influences on driving-related commuting behaviour. A series of study specific research questions are assessed to determine the usefulness of further consideration of specific organisational and situational influences. The chapter also reports the descriptive statistics associated with Study 4.

Chapter 9: Examination of Organisational and Situational Influences on Commuting Behaviour

9.1 INTRODUCTION

Chapter 9 reports on the organisational and situational outcomes of surveys distributed to DIDO employees on the target mine site. The chapter is the first of three chapters to report the findings of Study 4. The aim of Study 4 was to operationalise and statistically explore the findings of the in-depth interviews to determine the most salient and statistically significant influences and the impact of those influences on the immediacy of the commuting decision. The study contributes to the overall research program by addressing two key elements (organisational and situational) of Research Objective 3 which is to *explore and examine the relationships of individual, social, organisational and situational influences on worker commuting behaviour and how these key influences impact workers' decisions about driving home immediately following a shift block.*

The first substantive section of Chapter 9 details the focus of the chapter and how Study 4a relates to the overall research questions (Section 9.2). The method used to analyse the organisational factors and journey circumstances is described in Section 9.3. Section 9.4 reports the overall sample characteristics which are relevant to Chapter 9, as well as Chapters 10 and 11. Data reduction methods for Study 4a are described in Section 9.5. The results section is separated into two parts: organisational factors and journey characteristics (Section 9.6). Section 9.7 discusses the key findings, the theoretical and practical implications, strengths and limitations, as well as directions for future research effort, while Section 9.8 summarises the chapter.

9.2 STUDY AIM AND RESEARCH OBJECTIVES

Study 4a refines the findings of the in-depth interviews presented in Chapter 7 by operationalising the key influences, as well as examining and exploring statistically the relationships identified in previous studies within this research program, to determine the most salient and significant influences and the impact of those influences on the immediacy of the commuting decision (see *Figure 9-1*).

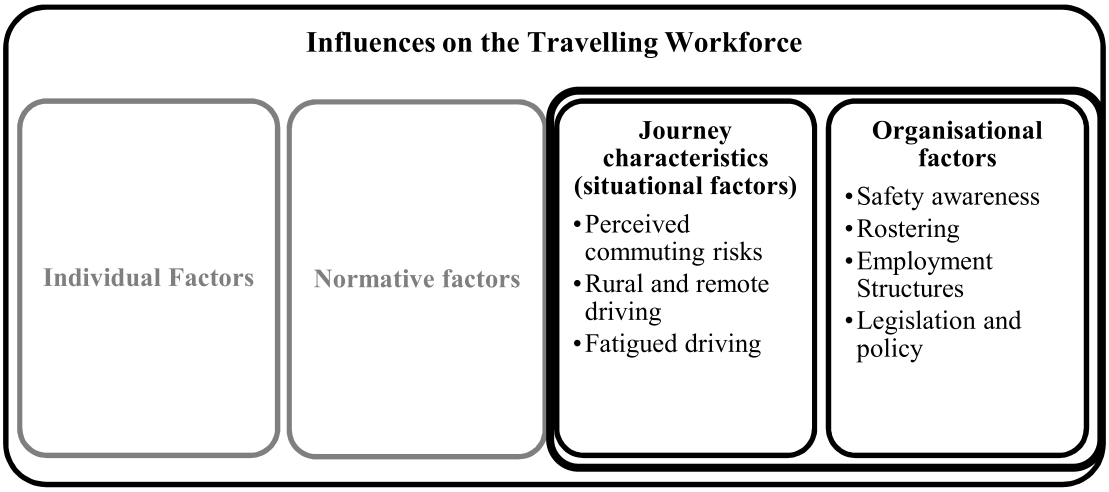


Figure 9-1: **Influences examined in Chapter 9**

This chapter will focus on analysing and discussing organisational perspectives and journey characteristics (situational factors), particularly given that in-depth interviews and the expert focus group supported further consideration of these two factors. The influences presented in *Figure 9-1* align with those presented in *Figure 7-1* which were identified iteratively throughout the previous three studies. The objectives of this research are achieved by addressing Research Questions 4 and 5.

> *Research Question 4 [RQ4]: What are the key influences on the travelling workforce from an individual, social, organisational and situational perspective and how do these key influences impact workers' decisions about leaving the work site to travel home immediately after a shift block?*
>
> *Research Question 5 [RQ5]: What are the interrelations and relationships of the key influences on the travelling workforce from an individual, social, organisational and situational perspective and how do these key influences impact workers' decisions about leaving the work site to travel home immediately after a shift block?*

In order to address the above research questions and support the further exploration of key influences on commuting behaviour in line with Research Objective 3, a series of study specific questions are presented. Rather than responding to hypotheses, these study specific research questions focus and further refine factors identified through the review of relevant literature, as well as the outcomes of previous studies in this program of research, for further consideration in the following chapter. These study specific questions are aligned thematically to the influences of the travelling workforce presented in *Figure 7-1*. As such, in addition to focusing on preliminary descriptive analyses, this chapter will present and discuss key influences associated with organisational and situational factors. The most salient organisational and situational influences arising from Study 4a are further examined, in addition to the traditional TPB constructs in the following chapter, to explain the immediacy of the commuting behaviour following shifts. The following sections will describe the study specific research questions of interest and the rationale behind these questions.

9.2.1.1 Organisational factors

There was support in Studies 2 and 3 of a difference between immediacy of driving home when workers finish day shifts compared to workers finishing night shifts. It was also proposed that there is a difference between permanent and contracted employees in respect of their decisions:

> *Study Question 9.1: Does a significant difference exist between intention to leave immediately following day and night shifts between permanent and contracted employees?*

Extending on the difference between employment types, there was support in Study 3 that there are slight differences across occupation. For example, there is a difference between the time supervisors and workers leave the site. Hence it is important to identify the at-risk cohorts:

> *Study Question 9.2: Who are those groups most likely to leave work immediately following day and night shifts?*

A key theme in Studies 2a and 2b was that workforce expectations are the key consideration in respect commuting behaviour. The in-depth interviews supported a strong risk assessment process associated with the journey home from work following day and night shifts. From an organisational perspective, safety policies associated with commuting behaviours are not enforced for the journey home, resulting in organisational policies which are quite malleable. While the commuting expectations of the workforce are more commonly associated with maintaining a certain 'lifestyle', safety-related factors and risks associated with the commute home are clearly contemplated by these workers without reference to organisational policies (see Study 3). This finding reveals safety knowledge which is potentially indicative of a positive safety climate on site (Neal et al., 2000). It is important to understand if this positive safety climate (identified in the research program) applies to the journey:

Study Question 9.3: Are worksite safety practices and culture transferred to workers' decisions and off-site commuting behaviour?

Considering that the general safety climate of the site provides further insight into the safety practices adopted by individuals, it is important to understand the link between safety practices on the worksite and worker commuting behaviour, hence the following question:

Study Question 9.4: Does organisational safety climate influence worker decisions to leave work immediately after a shift block?

9.2.1.2 Journey characteristics (situational factors)

The characteristics of the journey (situational factors) were highlighted in Study 3 primarily as the perceived commuting risks associated with the drive home immediately after shift (e.g., fatigue). Furthermore, Study 3 highlighted a difference in perceived commuting risks associated with driving in remote areas (i.e., time of day, and animals on the road). Identifying these two primary factors as perceived risks in Study 3 confirms the complex nature of the decision making process associated with leaving immediately following a shift block. These factors were also identified in the literature review and Study 1.

> *Study Question 9.5: What are the risky journey and driving circumstances which are frequently encountered while commuting home from work, and is there a difference in encountering these risks leaving after day and night shifts?*

There was evidence in the in-depth interviews that behaviour is associated with the distance to be travelled, which can be classified as a situational factor. For example, workers seem more dismissive of risks associated with the commute if they have a shorter distance to drive, hence this question:

> *Study Question 9.6: Is there a relationship between intentions to leave immediately following shifts and distance travelled?*

9.3 METHOD – ANALYSING ORGANISATIONAL INFLUENCES AND JOURNEY CHARACTERISTICS

Chapter 9 describes the preparation of the data for analysis and performs analyses associated with organisational factors and journey characteristics. Analyses performed are described throughout this section.

9.3.1 Study design and procedure

A questionnaire was developed for the purpose of Study 4. This chapter explores the organisational and situational influences on workers' intentions to drive home immediately following shift blocks.

9.3.1.1 Measures

Items used to measure situational and organisational influences were detailed in Chapter 8 (see Section 8.4.3 and Section 8.4.4, respectively). As described in Chapter 8, the dependent variable, intention, was measured by assessing the likelihood of driving home immediately following a shift in the last month, and while the intention measure is more applicable to Chapters 10 and 11, it was considered when assessing organisational and situational factors.

9.3.1.2 Participants

Participants were recruited via convenience sampling. The method used to recruit these participants and information about data collection and confidentially is detailed in Section 8.5. An overview of the profile of the participants is reported later in this chapter. The participant profile is relevant to Studies 4a, 4b, and 4c.

9.3.1.3 Analyses

All data were analysed using IBM SPSS Version 22.0. Descriptive analyses were performed to understand the sample, particularly in respect to distance and time travelled, rest break following shift, and employment type. The descriptors of interest were identified in the literature review earlier in this thesis (see Section 2.5). As such, the literature review shaped which demographic variables were analysed. One-way analysis of variance and independent *t*-tests were performed to compare group differences on continuous dependent variables.

Group differences were examined between day and night shift, occupation and employment type, fatigue-related variables and rural and remote factors. These factors were considered against intention to drive home immediately following a shift block and to assess the difference between day and night shifts. The dependent variable, behavioural intention, was developed using the recommended approach of the TPB. Where required, post-hoc analyses using Tukey's HSD were performed (Tabachnick & Fidell, 2007). The results are presented in the following sections.

Bivariate correlations using Pearson's Product-Moment Correlation test were performed (Tabachnick & Fidell, 2007). These bivariate correlations were used to examine the relationships between the safety climate constructs with intention and past behaviour, and to determine which safety climate constructs report a statistically significant relationship with behavioural intention.

9.3.1.4 Missing data

Data were screened to ensure that responses had been entered correctly and to review missing values. The outcome and treatment of missing data were consistently applied in Studies 4a, 4b, and 4c. Furthermore, responses of each item were reviewed to ensure compliance with the assumptions of multivariate analysis techniques. From the day responses, n=5 responses were removed due to large amounts of missing data and from the night survey $n=8$ responses were removed for the same reason. Demographic data were the largest source of missing data with assessment of a reasonable travelling distance (30.6%), break after shift before driving home (11.5%), and break during journey (9.5%) represented the variables with the largest amount of missing data. The remainder of the dataset was missing between zero and five per cent. Missing data were deleted pairwise in order to minimise the impact of deletion (Tabachnick & Fidell, 2007).

9.4 SAMPLE CHARACTERISTICS

All employees who attended the safety training sessions were invited to participate in the survey. Of the 492 surveys distributed, 461 responses were received, resulting in a high response rate of 93.7%. Overall, 19 night and 12 day surveys were not answered. The lack of response was because the worker either did not complete the survey, chose not to participate or there were limited responses on the form, making the survey unusable. A survey response was deemed unusable if one section of the key construct items was not complete. Following data cleaning, the sample sizes were N = 222 for the night survey and N = 239 for the day survey. The sample sizes are therefore suitable for the proposed analyses based on the requirements detailed in Section 8.6.

Participants responding to the night shift survey comprised 48% of respondents (n=222) and those responding to the day shift survey made up 52% of respondents (n=239). As would be expected, males made up the majority of the respondents (n=404, 89%) (see Table 9-1), with an average age of 40 (n=446, M=39.7, SD=11.1) (see Table 9-1). Of all the participants, 60% indicated that they were married (see Table 9-1).

Table 9-1.

Gender of participants by shift type

		Day shift		Night shift	
(*N* = 461)	**Participants**	**Freq.**	**%**	**Freq.**	**%**
Gender	Male	209	87.4	195	87.8
	Female	25	10.5	23	10.4
	Unknown	5	2.1	4	1.8
Age in years	17 – 24	25	10.5	8	3.6
	25 – 34	64	26.8	67	30.2
	35 – 44	75	31.4	57	25.7
	45 – 54	52	21.8	48	21.6
	55 – 64	19	7.9	25	11.3
	Over 65	3	1.3	3	1.4
	Unknown	1	0.4	14	6.3
Marital status	Single	52	21.8	31	14.0
	Married	137	57.3	139	62.6
	Divorced	6	2.5	3	1.4
	Separated	9	3.8	4	1.8
	De-facto	34	14.3	38	17.1
	Unknown	1	0.4	7	3.2

9.4.1 Occupational descriptors

Table 9-2 reports that the sample primarily comprises approximately three-quarters permanent workers, with a quarter on contract-based employment agreements (see Table 9-2). This finding is consistent with the Australian Bureau of Statistics (2011) data which describes that approximately 26% of the mining workforce is contract-based.

Table 9-2.

Employment type by shift type

		Day shift		Night shift	
(N = 461)	**Participants**	**Freq.**	**%**	**Freq.**	**%**
Employment type	Permanent	154	64.4	157	70.7
	Contractor	70	29.3	49	22.1
	Unknown	15	6.3	16	7.2

Consistent with the categories outlined in Study 3, occupation was categorised as mine administration, mine operation and mine maintenance. Mine operation occupations, such as operators, drill specialists and blast specialists, represented the majority of respondents (n=316, 69%) (see Table 9-3). The sample showed an average industry experience of ten years (n=457, M= 10.1, SD=8.2).

Table 9-3.

Occupation by shift type

		Day shift		Night shift	
(N = 461)	**Participants**	**Freq.**	**%**	**Freq.**	**%**
Occupation					
Mine administration	Safety professional	3	1.3	0	0.0
	Utilities	18	7.5	15	6.8
	Security	4	1.7	2	0.9
	Office administration	20	8.4	0	0.0
Mine operation	Management and supervisors	30	12.6	12	5.4
	Drill and blast specialists	12	5.0	3	1.4
	Engineers & advisors	25	10.5	1	0.5
	Operation and production	79	33.1	154	69.4
Mine maintenance	Vehicle tradesmen	26	10.9	19	8.6
	Site tradesmen	16	6.7	5	2.3
	Unknown	6	2.5	11	5.0

Reported shift length is consistent with previous research at an average of 12-hours (n=446, M=12.1, SD=1.2) (Di Milia, 2006), and a large majority of these 12-hour shifts are performed for 7 days in a row (see Table 9-4).

Table 9-4.

Length of shift block by shift type

		Day shift		Night shift	
(N = 461)	**Participants**	**Freq.**	**%**	**Freq.**	**%**
Length of shift block	7 days on/7 days off	138	57.7	211	95.0
	14 days on/ 7 days off	14	5.9	9	4.1
	5 days on/2 days off	50	20.9	0	0.0
	8 days on/6 days off	8	3.3	0	0.0
	12 days on/9 days off	1	0.4	0	0.0
	Other	28	11.7	1	0.5
	Unknown	0	0.0	1	0.5

9.4.2 Description of drivers

Australian licensing operates on a points system, called demerit points. For certain infringements, a driver may be issued with a fine and lose points as a penalty. Once the driver loses 12 demerit points during a three year period, they have the potential to lose their licence. *Figure 9-2* reports that the majority of those on-site had not lost any demerit points within the past three years (53.5% of participants). Furthermore, only a small percentage of workers reported losing more than twelve points.

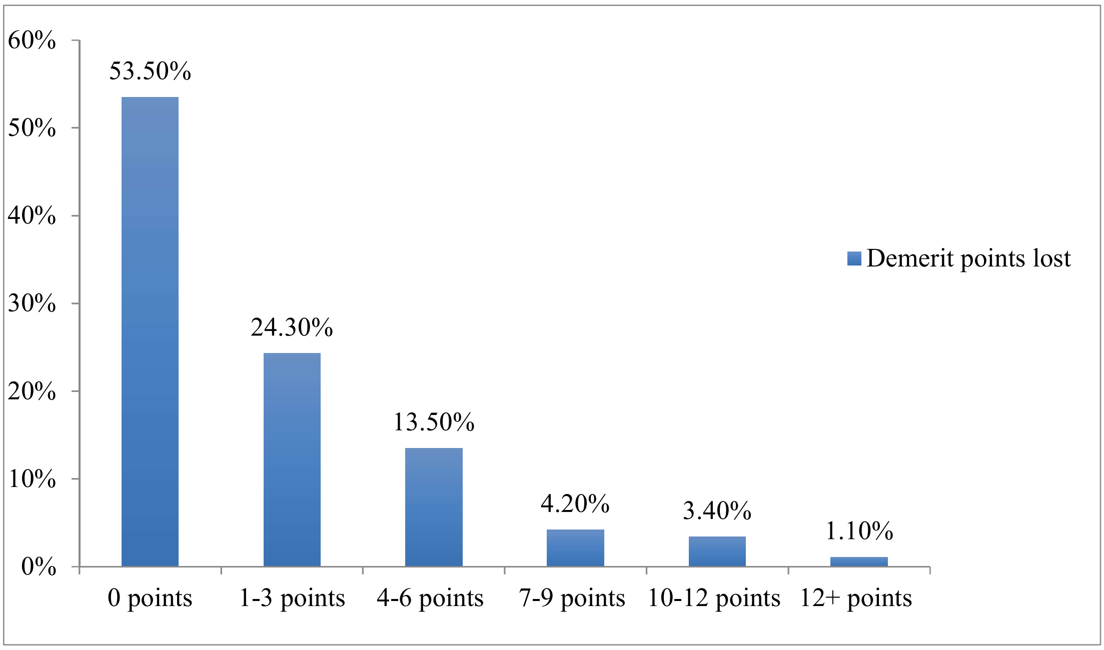


Figure 9-2: **Number of demerit points lost within the last three years**

Independent *t*-tests were conducted to assess the difference between two risky driving behaviours examined in the survey ('over legal blood alcohol content (BAC)' and 'disregard speed') following day and night shifts. Assessment of Levene's test for equality of variance reports a violation of assumption of equal variance between groups for both of these risky driving behaviours (Tabachnick & Fidell, 2007). As such, equal variances were not assumed for either group across both risky driving behaviours. Table 9-5 demonstrates that, when considering the risky driving behaviour of driving with *suspicion of being over the legal BAC*, there was no statistically significant difference in scores for workers finishing day or night shifts. Furthermore, there was no statistically significant difference between day and night shifts and disregarding the speed limit (see Table 9-5).

Table 9-5.

Results of t-tests and descriptive statistics for risky driving behaviours by shift type

Outcome	**Group**								
	Day shift			**Night shift**			**95% CI for Mean Difference**	**t**	**df**
Risky driving behaviour	**M**	**SD**	**n**	**M**	**SD**	**n**			
Drive even though you suspect you may be over the legal blood alcohol content	1.23	.73	237	1.33	.74	221	-.03, .24	1.55	453
Disregard speed	2.46	1.47	235	2.25	1.18	220	-.46, .04	-1.68	443

****p<.001, ** p < .02, * p < .05*
Equal variance not assumed

9.4.3 Journey characteristics and residential location of participants

Respondents drive an average of 437 kilometres (*SD* = 315kms) or approximately 4.5 hours when travelling home from work (see Table 9-6).

Table 9-6.

Distance travelled by shift type

		Day shift		Night shift	
(n=461)	**Participants**	**Freq.**	**%**	**Freq.**	**%**
Distance travelled home	Under 150kms	81	33.9	36	16.2
	151kms - 300kms	18	7.5	26	11.7
	301kms - 450kms	30	12.6	44	19.8
	451kms – 600kms	43	18.0	54	24.3
	601kms – 750kms	28	11.7	36	16.2
	751kms – 900kms	24	10.0	9	4.1
	Over 900kms	14	5.9	5	2.3
	Unknown	1	0.4	12	5.4

The main travel method on-site is driving a car (see Table 9-7) which aligns with the description of the site as primarily DIDO. Participants also engage in air travel as a form of commuting. It is important to recognise that in order to FIFO, these workers still drive up to 150 kilometres to the closest airport, approximately a 1.5-hour drive.

Table 9-7.

Main travel method by shift type

		Day shift		Night shift	
(n=461)	**Participants**	**Freq.**	**%**	**Freq.**	**%**
Main travel method	Driving a car	168	70.3	153	68.9
	As a passenger	15	6.3	29	13.1
	Flying	50	20.9	24	10.8
	On a bus	2	2	10	4.5
	Other	0	0.8	1	0.5
	Unknown	4	1.7	5	2.3

Rural and remote driving is an identifiable risk. As such, the remoteness of the sample is an important consideration due to the roads on which these workers travel. Based on respondent residential postcodes, the sample was categorised to determine potential for driving in remote locations using the ARIA remoteness classification[18]. This classification allows quantitative comparisons between city and country (ABS, 2003; Census Paper No.03/01, p. 1). *Figure 9-3* reports that these workers predominately reside in Inner Regional Australia (day shift: 38.5%, night shift: 44.6%).

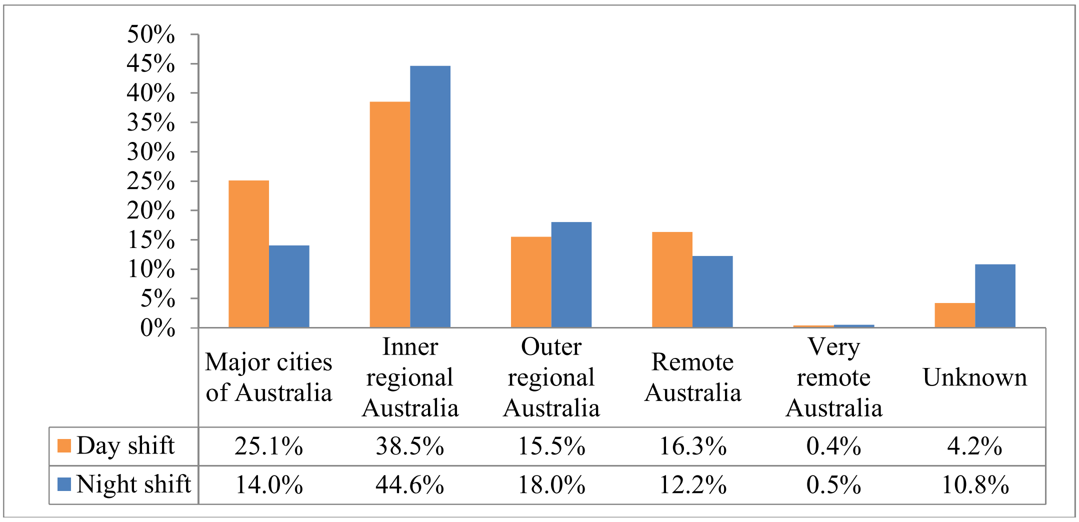
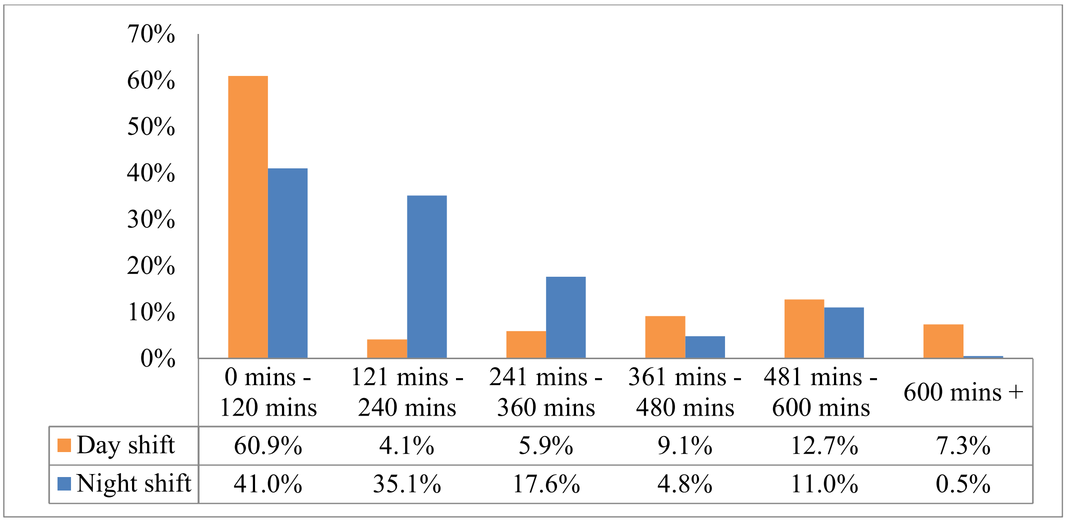


Figure 9-3: **Residential location of workers by ARIA region**

Study 2a describes organisational policies which seek to restrict travel immediately following shifts. As previously discussed, these policies seek to ensure that shifts and the commute are completed within a 14-hour period. Despite the long distances travelled to their residence, 41% of respondents admit to leaving site within two hours of the end of their night shift and 60.9% of respondents admit to leaving site within two hours of the end of their day shift (see *Figure 9-4*). Therefore, on average, these workers are driving 2.5 hours longer than the organisational policy allows immediately following a shift.

[18] Section 0 describes the ARIA classification



	0 mins - 120 mins	121 mins - 240 mins	241 mins - 360 mins	361 mins - 480 mins	481 mins - 600 mins	600 mins +
Day shift	60.9%	4.1%	5.9%	9.1%	12.7%	7.3%
Night shift	41.0%	35.1%	17.6%	4.8%	11.0%	0.5%

Figure 9-4: **Break following shift (mins) by shift type**

Finally, the average number of rest breaks during the journey home is two, with 32% of respondents reporting that they do not have a break at all (*n*=461). If a break occurs, it lasts an average of 34 minutes (*n*=315). The average time spent engaging in a rest break is 37 minutes (*SD* = 74 mins) for the day shift sample and 30 minutes (*SD* = 38 mins) for the night shift sample.

An independent samples *t*-test was performed to assess if distance travelled influenced the likelihood of workers engaging in a break during the journey following both day and night shifts. The average distance travelled following a day shift where the worker engaged in a break was 512 kilometres (*SD* = 272.78) and 319 kilometres (464.15 kilometres) without a break. Following night shifts, workers travelled an average of 279 kilometres (*SD* = 263.05) without a break and 484 kilometres (*SD* = 209.34) with a break during the journey. The results indicated that longer distances travelling resulted in workers being more likely to engage in a break during the journey following both day (t (133.10) = 3.63, p = .000, d = .54) and night shift blocks (t (63.73) = 4.91, p = .000, d = .92).

9.5 PRELIMINARY RESULTS: ORGANISATIONAL AND JOURNEY SAFETY CLIMATE

The purpose of this section is to explain the steps undertaken to prepare the data for analysis. This section reports on the internal consistency of the measures used to examine organisational and journey safety climate, as well as the method adopted to create composite scores for use in further analyses.

9.5.1 Assessing organisational and task-related safety climate constructs and measurement items

The literature review discusses general safety climate as the higher-level safety aspiration of an organisation. *Journey safety climate* is, therefore, a subset of general safety climate. The measures used for these constructs have been used in previous research (Neal & Griffin, 2006) and align with safety climate literature (Zohar, 1980). Given these measures are used in previous research, Cronbach's α was used to confirm reliability for each construct. A Cronbach's α of at least 0.7 for each construct is considered to be adequately reliable (Tabachnick & Fidell, 2007). The results of reliability (see Table 9-8) demonstrated constructs presented have satisfactory values, ranging from .44 to .96 across the day and night survey, indicating acceptable levels of internal consistency. As can be seen in Table 9-8, *journey safety participation* and *journey safety motivation* did not meet the accepted level of .7. *Journey safety participation* and *journey safety motivation* are important contributors to understanding *journey safety climate*. Given the operationalisation of *journey safety compliance* was not contextually appropriate (see Section 8.4.4), *journey safety climate* measures willingness to engage in journey safety rather than compliance with specific rules. As such, understanding safety participation is important. For theoretical reasons, *journey safety participation* will be included in further analysis; however, the results should be treated cautiously.

There are two TPB constructs presented in Table 9-8. These constructs are used in Chapter 9 analysis; however, some descriptive analyses using these constructs are presented in this chapter. Therefore, reliability measures are presented in this section to prepare for analyses in Chapters 9, 10, and 11. The internal consistency of *past behaviour* was unable to be assessed due to the reliance on a single item to measure this construct.

Table 9-8:

Mean, standard deviation and Cronbach's α for safety climate constructs split by shift type

Construct	No. of items	Range	Day shift Mean	SD	Cronbach's α	Night shift Mean	SD	Cronbach's α
Past behaviour	1	1 – 7			n/a			n/a
Intention	3	1 - 7	5.33	1.90	.95	4.82	1.99	.96
General safety climate	3	1 – 7	6.29	.79	.91	5.74	1.25	.91
General safety motivation	3	1 – 7	6.48	.59	.84	6.23	.87	.83
General safety compliance	3	1 – 7	6.35	.71	.89	6.21	.89	.93
General safety participation	3	1 – 7	6.13	.78	.76	5.92	.91	.78
Journey safety climate	3	1 – 7	5.27	1.36	.90	4.89	1.37	.86
Journey safety motivation	3	1 – 7	6.21	.69	.64	5.93	.98	.79
Journey safety participation	2	1 – 7	5.61	1.08	.44	5.37	1.00	.60

9.5.1.1 Organisational and journey safety climate composite scores and descriptive statistics

Composite scores were calculated by summing the total observations for a respondent (by construct) and dividing by the number of items (Field, 2013). For all constructs, this technique provided a mean score with a low of 1 and a high of 7. To account for missing data, mean scores were calculated providing no more than one item was missing from the scale. If more than one item was missing, it was decided that the case did not have sufficient information to calculate a valid score and was recorded as missing data for that case. The constructs developed following this technique were in line with those constructs identified in the previous section (see Section 9.5.1) that achieved sufficient levels of internal reliability.

Following the creation of the composites, further descriptive analyses and visual inspections revealed the constructs of *general safety motivation* and *general safety compliance* for the night sample and *general safety climate and general safety compliance* for the day sample demonstrated high levels of kurtosis and were negatively skewed beyond the generally accepted rule of thumb of -1.5 to +1.5

(Tabachnick & Fidell, 2007) (see Table 9-9). It was expected that there would be a grouping at the positive end of the scale for these measures due to the findings of Chapter 7, social desirability bias and the thought that generally, “I am safe at work”. In line with the recommendations in Tabachnick and Fidell (2007), log transformations were applied to the three safety climate constructs that exhibited skewness and/or kurtosis. Prior to analysis, these constructs were reverse scored, composites were created, and then the log of these composites was calculated using the LG_{10} function in SPSS. Analyses were performed on both the log-transformed data and untransformed data. The outcome revealed a similar pattern and result. As such, to ensure interpretability, the original data were used and reported.

Table 9-9.

Safety climate composites skewness and kurtosis

	Day shift		Night shift	
Construct	**Skewness**	**Kurtosis**	**Skewness**	**Kurtosis**
General safety climate	-1.82	6.30	-1.42	1.98
General safety motivation	-1.29	2.52	-2.46	10.20
General safety compliance	-1.80	6.35	-2.49	10.41
General safety participation	-.86	.49	-1.42	3.89
Journey safety climate	-.92	.80	-.57	-.24
Journey safety motivation	-.74	.24	-1.34	2.75
Journey safety participation	-.67	.15	-.56	1.13

9.6 RESULTS

The results from the survey are presented as they relate to the research questions presented at the beginning of this chapter. Firstly, an analysis of organisational factors which affect driving home immediately following day or night shifts is presented. Finally, the results of the analysis of the situational factors, which effect driving home immediately following day or night shifts, are reported.

9.6.1 Organisational factors

This section provides an analysis of organisational factors such as employment type, time workers leave site, and intentions to leave site immediately based on occupation. These analyses were performed using independent samples *t*-test and one-way analysis of variance.

9.6.1.1 Time leaving site following day and night shifts

As highlighted in Section 6.4.3.3, self-reported evidence suggests that workers are more likely to leave site immediately following night shifts when compared with day shifts. To test the proposition that there is a statistically significant difference in intention to leave site immediately following a day (M = 5.33, SD = 1.89) and night (M = 4.82, SD = 1.99) shift block, an independent samples *t*-test was performed. The results reported a statistically significant difference in the mean intention scores for workers finishing a night and day shift (t (458) = 2.81, p = .005, two-tailed). Therefore, the sample reports a statistically significantly higher intention to leave immediately following day shifts. However, the magnitude of the differences in the means (mean difference = .51, 95% *CI*: .15 to .87) was very small (*Cohen's d* = 0.26; r = 0.13). Workers were slightly more inclined to drive home immediately following day shifts when compared to behaviour following night shifts.

A closer examination of the number of workers leaving within two hours of the end of a shift block reveals that a large proportion of workers leave site shortly after day shift (see Table 9-10). Leaving within two hours of the end of a shift block and driving an average of 437 kilometres (five hours) home equates to 17 hours of wakefulness without accommodating for the time it takes the worker to get ready for work or for their journey. According to *QGN16* (see Section 5.5.2.1), after 16 hours of wakefulness, adequate controls should be implemented to mitigate against an adverse outcome while operating a vehicle. Comparatively, the time that those finishing night shift leave site is gradual, but is typically between the end of shift and six hours after the shift. These findings demonstrate the limitations in the alignment of fatigue guidance material, organisational policy and practised reality.

Table 9-10.

Number of workers after day and night shifts by length of break categories

		Shift type	
		Day shift	**Night shift**
Length of break after shift (categories)	0 mins – 120 mins	134	77
	121 mins – 240 mins	9	66
	241 mins – 360 mins	13	33
	361 mins – 480 mins	20	9
	481 mins – 600 mins	28	2
	600 + mins	16	1
	Total	220	188

9.6.1.2 Intentions of contractors versus permanent employees

An independent samples *t*-test was conducted to compare the difference between permanent and contractor employees' intention to leave site split by shift type. Table 9-11 reports no statistically significant difference between intentions of permanent and contract workers across either shift type.

Table 9-11.

Results of t-tests and descriptive statistics of intention to leave site by shift type

Outcome	**Group**								
	Permanent			**Contractor**			**95% CI for Mean Difference**		
Shift type	***M***	***SD***	***n***	***M***	***SD***	***n***		***t***	***df***
Intentions (day shift)	5.42	1.84	154	5.04	2.04	69	-.16, .93	1.41	221
Intentions (night shift)	4.83	2.04	157	4.81	1.90	49	-.63, .67	.06	204

****p<.001, ** p < .02, * p < .05*

9.6.1.3 Self-reported behaviour of workers following day and night shifts

A visual inspection of self-reported data representing workers leaving site in the hours following the end of shift demonstrates a considerable variation in trends of leaving the site between day shift and night shift (see *Figure 9-5*). As depicted, time leaving the site appears to be relatively consistent between contractor and permanent employees. However, there is a noticeable difference between the behaviour of workers finishing day and night shifts, particularly two hours after the shift ends. Also, a higher proportion of contracted employees leave within two hours of the end of the shifts, when compared to permanent employees (see *Figure 9-5*). The difference between the percentage of permanent and contracted employees leaving site between two and four hours following day and night shifts is noteworthy. The graph depicts that workers following night shifts gradually leave site during the course of the day. In comparison, workers finishing day shifts tend to leave immediately or wait until the following day.

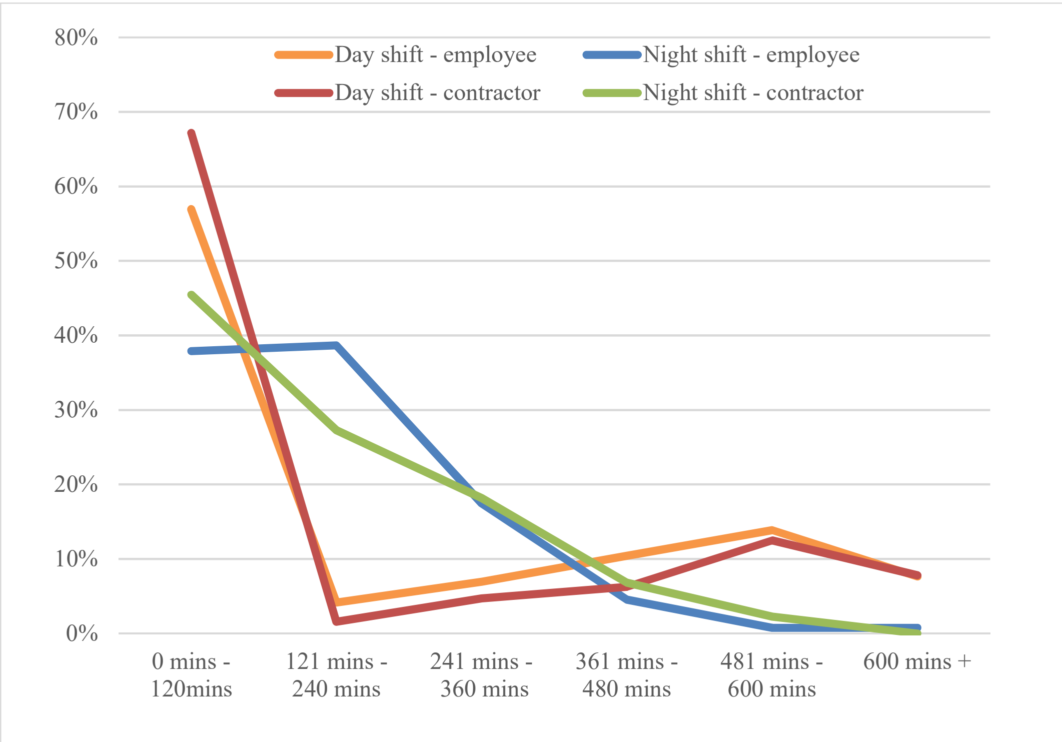


Figure 9-5: **Percentage of permanent and contracting employees leaving site in the hours following the end of shift**

9.6.1.4 Intention to leave site immediately by occupation

A one-way between-groups analysis of variance was conducted to explore the impact of occupation type on intention to leave the site immediately after day and night shifts. The occupational groupings were determined in Chapter 7 following the in-depth interviews (mine administration, mine operation, and mine maintenance). The results demonstrate that there was no statistically significant difference in intention between occupation grouping, following day or night shifts.

9.6.2 Organisational and journey safety climate

In order to assess the transference of site-related safety climate to journey-related, off-site commuting related behaviour, bivariate correlations examined the relationship of on- and off-site safety practices using a task-related measure of journey safety. This section reports on the outcome of these analyses. These correlations assessed the relationship between general safety and journey safety climate with intention and past behaviour.

9.6.2.1 Bivariate correlations assessing site and journey safety climate

Pearson's product-moment correlations were used to assess the relationship between (1) *general safety climate*, (2) *general safety motivation*, (3) *general safety compliance*, (4) *general safety participation*, (5) *journey safety climate*, (6) *journey safety motivation*, (7) *journey safety participation*, (8) *intention*, and (9) *past behaviour*. As reported in Section 9.5.1.1, descriptive analyses demonstrated high levels of skewness and kurtosis for some safety climate constructs.

Table 9-12 reports strong positive correlations between both general safety climate constructs and journey safety climate (task-specific) constructs for the day and night sample. The results show strong positive relationships between *general safety motivation, general safety compliance*, and *general safety participation* for the day and night samples.

Table 9-12.

Pearson's product moment correlation of safety climate constructs

Variable	1	2	3	4	5	6	7	8	9
1. Past Behaviour	1	.75** *n*=218	-.03 *n*=218	-.06 *n*=218	-.03 *n*=218	-.06 *n*=218	-.05 *n*=215	-.02 *n*=218	-.20** *n*=218
2. Intention	.78** *n*=237	1	-.01 *n*=222	-.04 *n*=222	-.01 *n*=222	-.05 *n*=222	-.01 *n*=222	-.05 *n*=222	-.21** *n*=222
3. General safety climate	.10 *n*=238	.12 *n*=238	1	.51** *n*=222	.57** *n*=222	.62** *n*=222	.57** *n*=222	.37** *n*=222	.33** *n*=222
4. General safety motivation	.10 *n*=238	.14* *n*=238	.69** *n*=239	1	.86** *n*=222	.83** *n*=222	.32** *n*=222	.48** *n*=222	.37** *n*=222
5. General safety compliance	.12 *n*=238	.11 *n*=238	.68** *n*=239	.81** *n*=239	1	.82** *n*=222	.33** *n*=222	.41** *n*=222	.36** *n*=222
6. General safety participation	.14* *n*=238	.19** *n*=238	.64** *n*=239	.78** *n*=238	.79** *n*=239	1	.44** *n*=222	.46** *n*=222	.40** *n*=222
7. Journey safety climate	.01 *n*=237	-.03 *n*=237	.51** *n*=238	.36** *n*=238	.34** *n*=238	.39** *n*=238	1	.49** *n*=222	.51** *n*=222
8. Journey safety motivation	.04 *n*=237	.02 *n*=237	.41** *n*=238	.58** *n*=238	.48** *n*=238	.45** *n*=238	.41** *n*=238	1	.65** *n*=222
9. Journey safety participation	.16* *n*=237	.13* *n*=237	.35** *n*=238	.45** *n*=238	.42** *n*=238	.51** *n*=238	.62** *n*=238	.61** *n*=238	

***Correlation is significant at .01 (2-tailed)*
**Correlation is significant at .05 (2-tailed)*
Light grey shaded cells represent correlations for the night survey and white cells represent correlations for the day survey

There was also a strong positive relationship between *general safety climate* and *journey safety climate* for both the day shift and the night shift samples. For the day and night samples, the positive relationship with *journey safety climate* was more pronounced in respect to management *general safety climate* than *journey safety participation* or *motivation*.

General safety participation and *general safety motivation* held weak positive relationships with *intention* for the day shift sample only. For all other safety climate (both task-specific and general) constructs, the relationship between past behaviour, intention, and the safety climate constructs was not statistically significant when considering both day and night shift samples, except for both measures, *general safety participation* for the day sample, and *journey safety participation* for both the day and the night samples. However, there was a weak, negative relationship between *intention*, *behaviour,* and *journey safety climate* following night shifts, indicating that journey participation is considered by the worker, in some way, following a night shift. While the findings associated with *journey safety participation* are statistically significant, these results should be treated with caution given the reliability of the measure. This finding demonstrates that, despite the positive relationships between *general safety climate* and *journey safety climate* constructs, there is limited or no support for relationships between *safety climate* and *safety motivation* with *intention* to drive home immediately following day or night shifts. However, there is support for further examination of the *safety participation* measures, particularly the task-specific measure of safety participation.

9.6.3 Journey characteristics

This section provides an analysis of the journey characteristics, such as rural and remote driving, fatigue-related considerations, and distances travelled. These analyses are performed using independent samples *t*-test and one-way analysis of variance.

9.6.3.1 Rural and remote driving

In order to determine significant differences between day and night groups on rural and remote factors, a series of *t*-tests were conducted. The results presented in Table 9-13 demonstrate that there was no statistically significant difference between workers finishing day or night shifts, and the frequency of encountering rural and remote risks such as driving on *unfamiliar or unsealed roads* and *encountering or hitting an animal*. Following both day and night shifts, workers encounter animals on the road during their journey about 50% of the time. It is rare for these workers to drive on unfamiliar roads during the journey home, but they sometimes drive on unsealed roads.

Table 9-13.

Results of t-tests and descriptive statistics for rural and remote-related considerations by shift type

Outcome	Group						95% CI for Mean Difference	*t*	*df*
	Day			Night					
	M	*SD*	*n*	*M*	*SD*	*n*			
Unfamiliar roads	1.91	.95	237	1.95	1.98	220	-.15, .25	.46	455
Unsealed roads	2.68	1.84	238	2.91	2.00	220	-.12, .59	1.30	456
Encounter animals	4.66	1.72	237	4.52	1.66	221	-.45, .17	-.87	456
Hit animal	2.11	1.11	238	2.16	1.11	219	-.16, .25	.48	455

****p<.001, **p < .02, *p < .05*

9.6.3.2 Fatigue-related considerations

A series of independent samples t-tests were performed to explore the differences between those workers finishing day shift and those workers finishing night shift in respect to managing fatigue. Table 9-14 reports a statistically significant difference (albeit small) in the mean scores for driving home without stopping and stopping for a nap during the journey (Cohen's *d* = -.41; r = 0.20 and Cohen's *d* = 0.32; r = 0.16, respectively). Therefore, workers finishing day shifts were associated with a statistically significant higher likelihood of driving home without stopping. Furthermore, workers finishing night shifts were more likely to stop for a nap during the journey home.

Table 9-14.

Results of t-tests and descriptive statistics of fatigue-related considerations by shift type

Outcome	Group						95% CI for Mean Difference	*t*	*df*
	Day shift			Night shift					
	M	*SD*	*n*	*M*	*SD*	*n*			
Drive while tired	2.43	1.13	238	2.60	1.30	219	-.05, .40	1.53	455
Drive longer than 2 hours	2.85	1.94	237	2.94	1.92	221	-.26, .45	.52	456
Drive home without stopping	3.29	2.43	238	2.41	1.88	220	-1.28, -.48	-4.32*	456
Lose concentration	2.18	1.14	237	2.15	0.97	220	-.22, .17	-.27	455
Stop for a nap	2.32	1.55	238	2.80	1.52	220	.21, .77	3.41*	456
Drive under time pressure	2.11	1.20	237	1.93	1.02	221	-.38, .03	-1.71	456

****p<.001, **p < .02, *p < .05*

9.6.3.3 Distance travelled and intentions

A one-way between-groups analysis of variance was conducted to explore the influence of intention to drive home immediately following day and night shifts based on the distance travelled home. Participants were divided into seven groups (see Table 9-15). These groups were based on Åkerstedt et al. (2005) who reported increased number of near misses after 83 minutes of travel following night shifts (approximately 150 kilometres), and also considering the closest township to the target site is approximately 150 kilometres away.

There was no statistically significant difference between the intention and distance travelled groups following night shifts. In respect to *day shifts*, there was a statistically significant difference at $p<.05$ level in intention for the seven groups: F (6, 230) = 6.06, p =.000, ω^2 = .11. Post hoc comparisons using the Tukey HSD test indicated that the mean score for Group 1 (M = 6.14, SD = 1.50) was significantly different from Group 6 (M = 4.57, SD = 2.09) and Group 7 (M = 3.86, SD = 2.23) at the Bonferroni-adjusted alpha level of .007. Examination of the mean scores demonstrated that the mean difference between Group 1 and Group 5 was approaching significance at the adjusted alpha level.

Table 9-15.

Mean and SD of intention to leave immediately based on distance travelled by shift type

Outcome	**Group**					
	Day			**Night**		
	M	***SD***	***n***	***M***	***SD***	***n***
Group 1: 0 – 150 kms	6.14	1.50	80	4.97	1.90	36
Group 2: 151 – 300 kms	5.87	1.25	18	5.28	1.80	26
Group 3: 301 – 450 kms	5.13	1.96	30	4.42	2.19	44
Group 4: 451 – 600 kms	5.06	1.89	43	4.88	2.02	54
Group 5: 601 – 750 kms	4.74	1.97	28	4.86	1.97	36
Group 6: 751 – 900 kms	4.57	2.09	24	3.67	1.87	9
Group 7: 901 + kms	3.86	2.23	14	5.33	2.56	5

9.7 DISCUSSION

This study aimed to explore the journey characteristics and organisational factors which influence workers' decisions to leave site immediately after shift blocks. This study addressed a series of study specific questions which were used to address overall Research Question 4 and Research Question 5.

9.7.1 Demographics

The sample covered all occupations on site, providing an understanding of the behaviour across all types of occupations within the mining industry. There are limited studies which have the opportunity to sample across all levels of the organisation; therefore, considering site coverage, it is argued that this sample is generally representative of the industry. This position is supported by the alignment of the sample with demographic variables observed more widely in the industry. Demographically, there are a high proportion of males on site, which is consistent with the industry in general. The average age of 40 years is higher than expected. This result illustrates that, in this instance, positing that risk taking behaviour is associated with the stereotypical behaviour of young males (aged 18 – 27 years) is misguided. There are also a high number of married workers on this site. Finally, the composition of permanent and contracting employees is consistent with the figures reported by the ABS (2011).

Participants described driving an average of 437 kilometres (*SD* = 315kms) or approximately 4.5 hours to get home. The distance reported in the current study is 200 kilometres greater than the distances reported in previous research efforts which examine shift workers in the Bowen Basin (Di Milia, 2006). The difference seen here may be associated with the section of road the previous research targeted and the location of the mine site in the current research. However, a large proportion of mine sites are in the Bowen Basin, and therefore face similar challenges in respect to the distances required for workers to travel home. The results demonstrate that a large proportion of the workforce on-site reside in inner regional Australia (i.e., larger townships). The distances that these workers are travelling are considerable; however, the findings reveal that these workers do not travel on unfamiliar roads often. This finding may be associated with the industry experience of the sample and the number of times they have driven these roads for commuting purposes. Study 3 reports that workers perceive that they are safer with greater industry and driving experience. As such, industry experience is examined further in Study 4b.

While there are a number of FIFO workers in the sample, it is important to acknowledge the risks associated with the commute to the airport from site. The research of Åkerstedt et al. (2005) reported that night shift workers, in particular, are 9 times more likely to be involved in a crash after driving for 83 minutes or longer. This time is approximately the length of time that it takes for a worker to travel to the closest airport from the mine site. As such, those engaging primarily in FIFO work were surveyed and their responses analysed as the focal mine site is approximately 150 kilometres from the closest major centre and airport, which requires workers to travel for longer than 83 minutes, a demonstrable risk factor according to previous research (Åkerstedt et al., 2005).

9.7.2 Organisational factors

Organisational factors assessed in this study were associated with length of roster, type of shift, and organisational policies. The lifestyle roster was described as an important influencer for leaving immediately following a shift block in the in-depth interviews. From the perspective of rostering, the majority of the sample is made up of permanent employees working a 7 days on, 7 days off roster. This rostering is consistent with industry practice (see Section 2.2.1). There are only certain circumstances in which workers are employed on alternative rosters. For example, administrative staff work Monday to Friday only, and services personnel, such as chefs, work 14 days on, 7 days off.

Study 2a described that organisational policies seek to restrict travel immediately following shifts by limiting work and commute time to 14 hours. If a worker is engaged to perform a 12-hour day, these restrictions limit the worker to a two hour commuting period. However, an allowance of two hours for commuting does not allow for the time that it takes to get ready for work in the morning, the time to get back to site, and leave the site. Despite these restrictions, the majority of workers on site reside an average of 4.5 hours from site. For a worker to drive home immediately following a shift, this travel results in breaking the organisational policy which restricts these workers to a 14 hour day. The ignorance of this organisational policy could be explained by the finding in the in-depth interviews which describes time after work as 'my time'.

Taking the average journey and shift length into account very rapidly meets the total wakefulness minimum of 16 hours set by *QGN16* (see Section 5.5.2.1). This time spent awake does not include time to get ready for work before the shift, getting ready to leave the site or other miscellaneous factors. Therefore, it is reasonable to consider that drivers could be awake for up to 20 hours on the last day of shift. Research has demonstrated that 17 hours of wakefulness results in driving performance that is equivalent to a blood alcohol concentration of 0.05%, with each additional hour contributing a 0.004% rise (Dawson & Reid, 1997). Despite the obvious risks, it does not seem that there are targeted journey management plans in place for these workers, even with this requirement being detailed in *QGN16*. The focus group in Study 2b provides some insight to the misalignment between policy and practice. While site expectations and policies are set, there is competition with individual expectations – particularly in respect to the expectation of *'it's my time'*. While these workers are aware of the site expectations, enforcing this policy is difficult. Furthermore, the policy requirements seem almost unachievable, given the ease in which these workers achieve the minimum requirements to qualify for a tailored journey management plan.

9.7.2.1 Variation between night and day shift

There is a significant amount of anecdotal evidence that suggests that there is a variation in the commuting behaviour of mine workers following day and night shift blocks. This proposition was explored through Study Question 9.1 which questioned if there is *a difference between journey behaviour when travelling home following a night or day shift?* The results of the in-depth interviews in Chapter 7 supported the proposition that workers are more inclined to leave site immediately following night shift when compared to day shift. However, the results of Study 4 revealed that the variation in behaviour is not that simple.

The data shows that most workers leave within two hours of the end of the shift and there is a distinct difference between workers following day and night shifts. While there was a significant difference between behavioural intentions following a night and day shift block, the difference was very small and the results were not as expected. The results demonstrated a stronger intention to leave immediately following day shifts when compared to intentions to leave following night shifts. However, regardless of the shift type, there was a tendency to leave site immediately. There were a high number of workers leaving site within two hours of finishing their shift, which is a common pattern of behaviour across both shift types. However, this behaviour is particularly prevalent following day shifts.

According to a visual assessment of the data, following a day shift workers tend to leave straight after shift. Those workers who stay on site following night shifts tend to leave periodically during the day, much sooner than the 10-hour break proposed by organisational policy. Contrary to self-reported evidence of the expert focus group, a higher proportion of workers tend to leave immediately following day shifts when compared to night shifts. However, following day shifts, workers tend to stay overnight if they do not leave immediately. As such, overall a larger proportion leave site within a few hours following night shifts, which is consistent with anecdotal evidence. Further examination of these data confirms the self-reported evidence of the expert focus group in Chapter 6. There is a clear need for guidelines or interventions to be put in place for driving following night shifts given that that a larger proportion of the workforce leave more rapidly at the end of this shift.

9.7.2.2 *Difference between contractors and permanent employees*

The second part of Study Question 9.1 questions the difference between contractors and permanent employees. While the trend in time leaving the site between the two groups following day shifts is relatively the same, a higher proportion of contracted employees leave within two hours of the end of the shifts. Anecdotal evidence posits that the key reason contractors leave immediately following shift is associated with the limited availability of on-site accommodation. On the focal site, each employee has access to accommodation even after the end of the shift block; therefore, contractors leaving immediately following shifts could not be attributed to accommodation problems. While there are a lower number of permanent employees leaving site within the first two hours after the end of night shift, there is an 11 percentage point difference between permanent and contracting employees leaving site between two and four hours following night shift blocks, indicating permanent employees still leave shortly following night shift. Statistical comparison and visual inspection of *Figure 9-5*, which presents the percentage of permanent and contracting employees leaving site in the hours following the end of shift, indicates that there is little difference between the behaviour of permanent and contracting employees on this site.

9.7.2.3 *At-risk cohorts*

Study Question 9.2 seeks to understand those groups that are most likely to leave immediately following shifts. There was no statistically significant difference between any of the occupation groupings presented. A key consideration here is the variation between white and blue collar workers in respect to the time that they leave the site. More specifically, the in-depth interviews revealed a perception that supervisors leave shortly following shifts. The limited buy-in by workers in supervisory roles has the potential to contribute to the safety behaviour of the workers, given the link between safety culture and management commitment frequently described in safety climate literature (Neal & Griffin, 2006). While there was no statistically significant difference between occupation or contractors and permanent employees, an at-risk cohort which should be considered when identifying opportunities for interventions are those workers finishing night shift. The in-depth interviews and the graphical representation of the time leaving site demonstrate that there is a trend for these workers to leave site without engaging in a sufficient rest break following their shift. According to the outcomes of the in-depth interviews, the variation between behaviour following night and day shift blocks can be explained by the time that the worker is engaging in the commuting (i.e., during the day). However, despite the daylight driving, research demonstrates that those engaging in night shift work are already at increased risk of a fatigued-related incident (Baulk et al., 2009).

9.7.3 Organisational safety climate versus journey safety climate

There was no statistically significant relationship between behaviour, intention, and the safety climate constructs except for journey safety participation. The results demonstrated that general and journey safety participation had significant relationships between the safety climate variables and intention for the day sample. For the night sample, there was a statistically significant negative relationship between journey safety participation and intention. Therefore, this sample demonstrates limited support between safety climate and intention to leave site immediately following a shift block, given only one element of safety climate held a relationship with intention and past behaviour (Study Question 9.4). Given the only significant relationship identified across both the day and night samples was with *journey safety participation*, and in order to maintain a parsimonious model, the ability for *journey safety participation* to predict *intention* will be further examined in the next chapter in line with the TPB framework as the key influence relating to organisational factors, as depicted in *Figure 9-1*.

While there was limited support for the safety climate influencing leaving site immediately following day or night shift, there was support for the transference of safe work behaviours to commuting-related safety perceptions (Study Question 8.3). The transference of knowledge, skills, attitudes, and behaviours was evident during the in-depth interviews and was supported through the operationalisation and analysis of journey safety climate and general safety climate. The results demonstrate that there is a relationship between safety commitment, motivation and participation, between on-site and off-site safety. Overall, given the positive relationship between site safety climate and journey safety climate, a strong site safety climate strengthens safety motivation and participation in respect to journey safety. As described in the in-depth interviews, participants typically justified their commuting behaviours by discussing risk mitigation strategies associated with commuting. Therefore, the finding of relationship between site-related safety climate and task-specific safety climate is not surprising.

9.7.4 Journey characteristics (situational factors)

Driving risks are associated with two factors. The first driving risk relates to situational risks that occur during the commute which potentially occur without the driver being able to react (e.g., kangaroos, flooding, or other drivers). The second type of risk is associated with the risk identified by the driver and accepted prior to commencing the commute (e.g., the distance travelled, travelling during the evening, travelling on an unsealed road or travelling after a long shift or shift block). The difference between these two types of risks is important, due to the risk assessing processes these workers engage in prior to their commute, as highlighted in the in-depth interviews. For those risks that are accepted prior to engaging in the behaviour, there is an opportunity to use targeted interventions for behaviour change.

9.7.4.1 Driving risks

Study Question 9.5 seeks to further refine the understanding of those risky circumstances encountered while commuting, and if there is a difference between driving home following day and night shifts. Some commuting-related driving risks were identified through the in-depth interviews and these risks were categorised as rural and remote related risks or fatigue-related risks. There was no statistically significant difference between those driving immediately following day shifts and night shifts for those situational risks associated with rural and remote driving (e.g., encountering or hitting animals). A significant situational risk faced by these workers during their commute home is encountering animals, with the mean score describing that animals are encountered during the commute over 50% of the time. Surprisingly, there was no significant difference between encountering animals following day or night shifts. Previous research has described a difference in collisions occurring during night driving (Rowden et al., 2008); however, previous research did not examine if there was a higher prevalence of encountering animals during certain parts of the day. The difference here could be due to the visibility associated with night and day time driving, resulting in the driver not being aware of the animal until the last minute.

The distances that these workers are travelling are considerable. Analysis of the risk-related questions describes that these workers 'sometimes' travel longer than two hours without stopping for a break and 'sometimes' drive home without stopping. The average distance travelled and average time spent travelling are consistent with workers not taking significant rest breaks during the commute, with the standard deviation indicating that workers following day shifts are more likely to engage in longer rest breaks than workers following night shifts. While the results indicated that workers were more likely to engage in a rest break during the journey when driving longer distances, these breaks, according to the in-depth interviews, are typically associated with a 10- to 15-minute stop to fill up with petrol or use the toilet. Furthermore, this result is more pronounced following night shifts when compared with day shifts, which could be associated with the worker feeling tired due to a compounding sleep debt. There is, however, a statistically significant difference between those finishing day and night shift blocks in respect to driving home without stopping. The data show that workers are less likely to stop following night shift. Following night shift, the workers are driving during the day and have the opportunity to make the most of the day; comparatively, following day shifts, family and friends are sleeping while the worker is driving home, so there is less reason to rush home. However, there is significant evidence in previous research to suggest that driving following night shifts is risky, given sleep debt and irregularity of the circadian rhythm (Philip et al., 2005). Finally, workers are slightly more likely to stop for a nap following night shifts. According to the mean response, stopping for a nap falls between 'rarely' and 'sometimes'. There is a statistically significant difference between stopping for a nap following night shift and day shift; this difference indicates that workers are more likely to stop for a nap following night shifts. Overall, while those workers finishing night shift are more inclined to drive home without stopping, they are also more inclined to stop for a nap during the journey.

From the perspective of the DBQ questionnaire, there is no evidence that these workers are risk takers from the perspective of driving-related offences, with over half of the participants reporting that they have not lost any demerit points; however, loss of demerit points is not necessarily synonymous with not engaging in risky behaviour. The in-depth interviews describe drinking 'roadies' during the journey home. While the data do not support workers driving while being over the legal blood alcohol content, during the in-depth interviews some participants described taking turns at driving to accommodate the 'roady'. According to the data, speeding is engaged in 'sometimes' and there is no difference in behaviour following day or night shifts.

9.7.4.2 Intention to leave immediately and distance travelled

There was no statistically significant difference between workers' intention to leave site immediately following night shift and overall distance to be travelled. However, examination of the mean intention across 150 kilometre categories demonstrated that there was a gradual decrease in mean intention to leave immediately as distance to be travelled increased. This was the same following day shifts; however, there was a statistically significant difference between the 0 – 150 kilometre and 751 – 900 kilometre categories. This difference indicated that those travelling more kilometres held a lower intention to leave immediately following day shift blocks, suggesting that there is some consideration applied to distance travelled when workers are commuting a large distance (Study Question 8.6). This is examined further in Study 4b in line with the TPB framework.

9.7.5 Implications

There are clear practical implications in respect to the findings of Study 4a. The results demonstrate that these workers leave progressively during the day following the end of night shift blocks with limited rest or sleep and drive an average of 4.5 hours home. This result has clear implications for current policy and practice. As discussed in Studies 2a and 2b, the focus of these policies toward a one-size fit all approach has clear limitations. In practice, these limitations are identifiable by analysing the times workers leave following the shift block and the behavioural differences following night and day shift blocks.

There have been a large number of changes in the industry to ensure employees, regardless of their employment status, are provided with accommodation following the end of the shift block. While there was no statistically significant difference between permanent and contracting employees, there is evidence that suggests a higher percentage of contracting employees leave immediately following shift, supporting the suggestion that the industry treats contracting employees differently to permanent employees. The variation between contracting employees and permanent employees leaving site immediately following shifts may be due to the extra benefits afforded to permanent employees; however, this assumption is purely speculative. Further examination of these differences may offer some insight into the safety behaviour of the industry in general.

The distances travelled by these workers are also a practical implication. There is strong argument for other transportation means to be offered by the mine site, such as carpooling, using buses or FIFO. There is a company-provided bus that transports some workers from the target site to some towns close by. However, the in-depth interviews indicated that some workers perceive limitations with these alternatives. When engaging in carpooling, a worker feels pressure to leave the site at a predetermined time. This limitation also applies to using the company-provided bus. While the bus provides positive risk mitigation outcomes, these outcomes are not as readily realised by those carpooling. For example, if two workers carpool to drive 900 kilometres immediately after night shift, the mitigation strategy may have a limited impact on the likelihood of a negative outcome.

In respect to FIFO, there are clear limitations in respect to flying into central locations unless alternative transportation is offered to workers to facilitate their departure and to ensure safe passage to their place of residence. The distances from the airport to home are sometimes substantial: in the case of some of these workers up to a two-hour journey from a major centre such as Brisbane. With an increase in the possibility of a near miss or crash after 83 minutes of travel following night shifts, further consideration of travel before and after the group transport must be considered. Buses offer more flexibility than FIFO; however, there are practical limitations in the number of locations to which buses can travel to ensure viability.

The key reason for the separation of safety climate into a general safety concept and a task specific safety concept is that it enables examination of the relationship between the site-related safety concept and the non-site related safety concept. The separation of general and task specific safety demonstrates the influence of safety motivation and participation at work has on safety away from work.

9.7.6 Strengths, limitations, and future research

The limitation of a survey methodology is associated with respondents' ability to understand and adequately respond to the survey instrument and the inability for the researcher to probe the respondent for further information. The survey instrument was designed to test the outcomes of the in-depth interviews; therefore, the survey design aligned with the previous findings in the program of research. Relevant components of the survey instrument were adapted from previous instruments developed for the purpose of measuring safety culture and situational risk factors relating to road safety.

The data were collected by respondents self-reporting about intention and past behaviour. Given the data collection was organised through the respondents' employing organisation, it is possible that there may be social desirability bias associated with the data (Nederhof, 1985). However, the respondents were informed of the confidentiality of their responses prior to the completion of the survey, and that results provided back to the employing organisation would be at an aggregated level. The outcome of the survey was consistent with the outcome of the in-depth interviews and the focus group, indicating limited influence of social desirability bias. In order to maintain confidentiality of the workers, it was not possible to directly compare responses to times workers were actually leaving the site. Future research could conduct an observation study to assess the times workers leave site following shift and compare these data to the self-reported behavioural data.

9.8 CHAPTER SUMMARY

Chapter 9 has presented the first part of Study 4, focusing on analysing organisational factors and journey circumstances which influence worker intentions and behaviour to leave site immediately following shift blocks. The chapter provided an overview of, and justification for, the measures used in the quantitative component of the research program. Chapter 9 then provided an overview of the sample, particularly in relation to the occupational descriptors, as well as descriptors associated with the workers as drivers and journey characteristics, such as time and distance travelled. The organisational and journey safety climate concepts were analysed by assessing the correlation between each construct. This chapter discussed two key safety climate components associated with task-specific (journey) and site specific (general) safety climate. Using this analysis, further examination of journey safety participation and the ability for this construct to predict intention is considered in the following chapter, which will examine individual and social influences on commuting behaviour through the application of the well-known TPB. A series of hypotheses associated with traditional TPB constructs will be tested using multiple regression analysis. Additional normative and safety climate constructs are also tested, using multiple regression analysis.

Chapter 10: Examination of Individual and Social Influences on Commuting Behaviour – Applying the TPB

10.1 INTRODUCTION

Chapter 10 examines the individual and social outcomes of the survey of DIDO workers on the target mine site. The chapter reports on Study 4b, representing the second of three chapters which report the findings of Study 4. The aim of this study was to operationalise and explore the outcomes of the in-depth interviews using the TPB as the foundation of a theory-led approach to guide analysis. The study contributes to the overall research program by addressing Research Objective 3 to *explore and examine the interrelations between individual, social, organisational and situational influences on worker commuting behaviour and how these key influences impact workers' decisions about leaving the work site to travel home immediately after a shift block.* Chapter 10 also addresses Research Objective 4 to *identify opportunities for interventions regarding driving home from site immediately following a shift block.*

Section 10.2 provides an overview of how Study 4b contributes to the overall research objectives through the consideration of individual, social, situational and organisational social factors. This section also details a series of hypotheses based on the outcomes of the in-depth interviews. The methodological approach and analyses used to test the presented hypotheses are then discussed (Section 10.3). The data reduction approach is presented in Section 10.4. The results of the analysis of the theoretical model, an extension of the TPB, are reported in Section 10.5. Section 10.6 is a discussion of the key findings, the theoretical and practical implications, strengths and limitations, as well as direction for future research, with Section 10.7 summarising the chapter.

10.2 STUDY AIM AND RESEARCH OBJECTIVES

Study 4b focuses on individual and social factors related to the immediacy of driving decisions at shift end (see *Figure 10-1*). Given the findings relating to safety climate in Chapter 9, this chapter also examines the influence of journey safety participation and journey characteristics. Study 4b refines the findings of the in-depth interviews presented in Chapter 7 by statistically exploring the relationships between individual, social, situational and organisational factors identified throughout the previous chapters to determine the most salient and significant influences, and the impact of those influences on the immediacy of the commuting decision. The research objectives of this chapter are achieved by addressing overall Research Question 4 and Research Question 5, namely:

> *Research question 4 [RQ4]: What are the key influences on the travelling workforce from an individual, social, organisational and situational perspective and how do these key influences impact workers' decisions about leaving the work site to travel home immediately after a shift block?*
>
> *Research question 5 [RQ5]: What are the interrelations and relationships of the key influences on the travelling workforce from an individual, social, organisational and situational perspective and how do these key influences impact workers' decisions about leaving the work site to travel home immediately after a shift block?*

In order to address the above research questions, a number of hypotheses are presented. The hypotheses were based on a review of TPB literature, as well as the iteration of *Figure 10-1* formed from the findings of previous studies within the research program. The influences presented in *Figure 10-1* have been distilled into theoretical constructs as a result of Study 1 through to Study 3, as well as through the examination of organisational factors and journey characteristics in Chapter 9. The following sections present the hypotheses and the rationale.

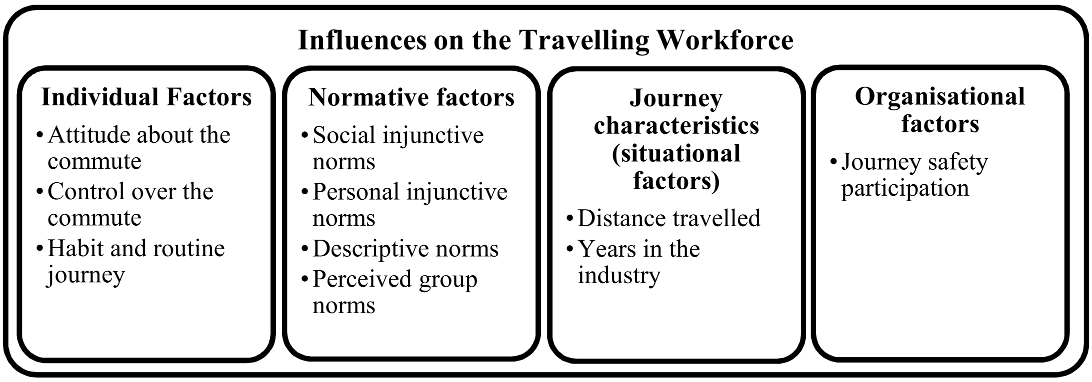


Figure 10-1: **Influences examined in Chapter 10**

10.2.1.1 Individual factors

Chapter 2 highlighted the TPB as theoretical frameworks which can assist in the explanation of driving home immediately following a shift block. Ajzen (1991) posits that intention is a key factor in determining an individual's behaviour. Studies 2 and 3 highlighted the importance of considering individual factors in order to understand why some workers leave the site immediately after their shift to drive home.

Extending beyond the TPB, the in-depth interviews (Chapter 7) described the time workers leave site and their pre- and during-journey routine as habitual in nature. The addition of habits into the TPB is likely to explain further variance in intention to leave the site immediately following a shift block, in turn further explaining individual behaviour in this context.

10.2.1.2 Social factors

Social (normative) factors were identified as a key influence of behavioural intention throughout Study 3, which are also identified in the TPB framework. The TPB contemplates subjective norms as the key normative influence. However, as highlighted in Chapter 7, there is evidence of other social factors, particularly associated with *follow the leader* type behaviour (*descriptive norms*) and the morality associated with the behaviour (*injunctive norms*).

10.2.2 Attitudes toward behavioural intentions

As highlighted by previous research, attitudes are significant predictors of behavioural intention. There are numerous examples demonstrating attitude as a strong, positive predictor of behavioural intention, for example the occupational health and safety of farmers (Colémont & Van den Broucke, 2008), road crossing intentions of adolescents (Evans & Norman, 2003), and driver speeding intentions (Warner & Åberg, 2006). Study 3 demonstrated that workers tended to accept the drive as necessary and the sooner they leave site, the sooner they are able to get home to see their family or have some time out. As such, generally these workers held positive attitudes about driving home immediately after shift. Likewise, if the attitude about driving home immediately following the shift was negative, individuals were less inclined to engage in that behaviour. Accordingly, it is hypothesised:

H1a. Attitude will positively influence behavioural intentions to leave site immediately following a shift block.

10.2.3 Subjective norms and behavioural intentions

Subjective norms are often highlighted as the least likely to predict variance in behavioural intentions (White et al., 2009). Study 3 demonstrated that the performance of the behaviour is somewhat associated with social factors highlighting a link to people who are important to the individual. Given that the commute is associated with social factors like getting home to see family and friends, it is anticipated that these groups will also influence the behaviour. Therefore, it is hypothesised, if these social groups approve of driving home immediately following a shift block, then the behavioural intention is likely to be high, accordingly:

H1b. Subjective norms will positively influence behavioural intentions to leave site immediately following a shift block.

10.2.4 Perceived behavioural control and behavioural intentions

PBC is the perceived level of control an individual has over the performance of the behaviour, including self-efficacy and ability to perform (Ajzen, 2002b; Albarracín, Johnson, & Zanna, 2005). The in-depth interviews demonstrated that workers believe the time they leave the worksite is their choice and they accept any consequences associated with their decision. As such, it is expected that there is a strong positive relationship between PBC and behavioural intentions:

> *H1c. PBC will positively influence behavioural intentions to drive home from site immediately following a shift block.*

10.2.5 Perceived group norms and behavioural intentions

The in-depth interviews provided justification for the inclusion of the perceived group norms associated with supervisors and co-workers[19]. Both perceived group norms will influence the behavioural intentions of workers from a 'leading by example' mentality (see Section 7.5.2). As such, it is hypothesised that there is a strong positive relationship between supervisor-perceived group norms and behavioural intentions such that if it is perceived that co-workers or supervisors are likely to drive home immediately following a shift block, individuals will also demonstrate a high behavioural intention to drive home immediately following a shift block.

> *H2. Perceived group norms, (a) co-workers and (b) supervisors, will positively influence behavioural intentions to drive home immediately following a shift block.*

10.2.6 Descriptive norms and behavioural intentions

A key theme identified in Chapter 7 (see Section 7.4.8) is the propensity for workers to follow what their colleagues do. This mimicking behaviour could be described as being associated with a perceived approval to leave site immediately following shifts. Extending this perception, there is a belief that this is generally

[19] For ease of reference, perceived group norms detail the group (e.g. *perceived supervisor norms* or perceived *co-worker norms*) unless referring to both constructs.

accepted behaviour in the industry and anyone in the same situation would engage in the same or similar behaviour, operationalised as the perceived behaviours occurring more widely in the industry. Descriptive norms describe an individual's perception of the prevalence of the behaviour in the industry (Lapinski & Rimal, 2005; White et al., 2009). Based on the 'follow the leader' theme identified in Study 3, it is therefore hypothesised that these *descriptive norms* will have a positive influence on behavioural intentions, so:

> *H3. Descriptive (industry) norms will positively influence behavioural intentions toward leaving site immediately following a shift block.*

10.2.7 Injunctive norms and behavioural intentions

Injunctive norms from a social and personal perspective were identified in the in-depth interviews, particularly associated with the encouragement (or otherwise) to get home as soon as possible after the end of a shift. Extending this concept, there was also discussion about the rules associated with the commute, which implies that there is a morality associated with leaving immediately after a shift block. The in-depth interviews support the finding that workers acknowledge the safety risks associated with commuting immediately following shifts. As such, it is unlikely that important social reference groups would approve of leaving immediately, or that the workers themselves would consider engaging in the behaviour as something they ought to do (see Section 7.5.2). Hence higher injunctive (moral) norms will result in a lower intention to leave site immediately following a shift block:

> *H4. Injunctive (moral) norms, (a) social and (b) personal, will negatively influence behavioural intentions toward leaving site immediately following a shift block.*

10.2.8 Habit, behavioural intentions

A key theme identified in the in-depth interviews was routinised, habitual behaviour. Routinised behaviour was associated with the pre-journey routine and the routine during the journey. While the routine during the journey serves as an interesting discussion point as to why leaving work immediately following a shift can be considered unsafe, behaviours that occur during the journey are outside the scope of this research (e.g., stopping for a rest break).

From the perspective of the pre-journey routine, the in-depth interviews describe a process that these workers engage in prior to leaving site. This process includes the routine associated with getting ready for the commute prior to the shift (in some instances), and the steps taken at the end of the shift to leave the site 'on time'. This pre-journey routine enables the workers to leave the site at a similar time each time they finish a shift block. It is proposed that, similar to PBC, habits not only influence intentions but also have a direct and positive influence on behaviour of leaving site immediately following a shift block. It is therefore hypothesised:

> *H5. Habitual behaviour will positively influence behavioural intentions to leave site immediately following a shift block.*

10.2.9 Journey safety participation

There was a high degree of safety awareness associated with the findings of the in-depth interviews, indicating that these workers accept safety as a part of their role. The findings in Chapter 9 report a significant, positive relationship between intentions and journey safety participation for the day sample and a significant, negative relationship for the night sample. As proposed in Section 9.7.3, given the only significant relationship identified across both the day and night sample was with *journey safety participation*, this task-specific safety climate construct has been used as the key safety climate variable. Other safety climate variables were excluded in Study 4a to maintain a parsimonious model. While the in-depth interviews (Study 3) describe safety awareness being used to justify engaging in an immediate journey home, the *journey safety participation* construct measures the perception of engagement in safe practices. Hence a negative relationship between *journey safety participation* and *intention* should be expected. For example, high *journey safety participation* results in a lower intention to leave immediately, so it is hypothesised:

> *H6. Journey safety participation will negatively influence behavioural intentions to leave site immediately following a shift block.*

10.3 METHOD – ANALYSING THE TPB

This chapter describes the preparation of the data for analysis and to perform analyses associated with individual and social factors, and is the second of three chapters which report the results of the survey. Analyses performed are described in the following sections of this chapter.

10.3.1 Study design and procedure

A survey was developed for the purpose of Study 4. This chapter explores the application of the TPB to explain workers' intentions to drive home immediately following shift blocks.

10.3.1.1 Measures

Items used to measure *attitude*, *subjective norms*, *PBC*, *perceived group norms*, *descriptive norms*, *injunctive norms*, and *habit* were detailed in Chapter 8 (see Section 8.4.1) in line with the methods proposed by Ajzen (1991, 2002b). As described in Chapter 8, the dependent variable, *intention*, was measured by assessing the likelihood of driving home immediately following a shift in the last month. The rationale for the examination of each of the TPB and additional constructs identified during the in-depth interviews was discussed in Chapter 7 (see Section 7.5.1 and Section 7.5.2, respectively).

10.3.1.2 Participants

Participants were recruited via convenience sampling. The method used to recruit these participants and information about data collection and confidentially used the same method detailed in Section 8.5. An overview of the profile of the participants can be found in Section 9.4.

10.3.1.3 Analyses

As with Chapter 9, all data were analysed using IBM SPSS Version 22.0. A variety of statistical analyses were used to test the hypotheses in Study 4b. Three types of analyses were performed in this chapter. The procedure adopted for each analysis is detailed prior to the presentation of the results. Normative factors were initially analysed to confirm the underlying factor structure. A principal components analysis (PCA) was performed to confirm the factor structure. The process adopted for the PCA is detailed in a later section.

Bivariate correlations using Pearson's Product-Moment Correlation test were performed to examine the relationships between the TPB and the additional proposed constructs with intentions and behaviour to drive home immediately following shift blocks. Following the assessment of the bivariate correlations, two hierarchical multiple regression analyses were performed to test the 10 hypotheses detailed in Section 10.2. These analyses examined those constructs that predict intention to drive home immediately following shift blocks in line with the hypotheses presented. As with the previous analyses, the same procedure was applied to the day and night samples.

10.3.1.4 Missing data

Data were screened to ensure that responses had been entered correctly and to review missing values. Missing data were deleted pairwise in order to minimise the impact of deletion (Tabachnick & Fidell, 2007). The outcome and treatment of missing data was consistently applied in Studies 4a, 4b, and 4c and was detailed in Section 9.3.1.4.

10.4 PRELIMINARY RESULTS: TPB CONSTRUCTS AND MEASUREMENT ITEMS

The following section discusses the suitability of forming constructs with the measurement items used in the survey instrument in order to test the hypotheses presented earlier. The first part of this section assesses the relatedness of items measuring normative influences. The following sections report internal consistency of related items to justify the creation of composite scores from multiple items.

10.4.1 Assessing normative measurement items

This study adopted a large number of normative measures following the results of the in-depth interviews. Normative factors are known to be erratic predictors of behavioural intentions (Armitage & Conner, 2001; Godin & Kok, 1996). As highlighted in the literature review and following the findings of the in-depth interviews, normative factors are typically difficult to measure (White et al., 2009). Thus, due to the large number of normative measures examined in this research program and previous research demonstrating the instability of these measures, a Principal Components Analysis (PCA) was used to condense the number of variables into a smaller number of dimensions or constructs and to ensure that items were reliably measuring intended constructs (Field, 2013).

A PCA was performed on the 11 normative influence items which were adapted from previous research and included in the current research due to the findings of the in-depth interviews. The data were assessed to ascertain their suitability to be factor-analysed by examining the correlations between items. The correlation matrix showed that all variables had at least one correlation greater than 0.3, supporting the use of the PCA (Tabachnick & Fidell, 2007). Bivariate correlations demonstrated multicollinearity problems between social injunctive (moral) norms items and subjective norms items. Considering subjective norms are of key interest to the theoretical model presented, social injunctive (moral) norms were removed from the factor analysis and further analysis within this research.

An initial analysis reported a two-factor solution. However, the inclusion of co-worker group norms was disrupting the interpretability of the results, so co-worker group norms items were also excluded from further analyses. Furthermore, the one item included to measure personal injunctive norms was loading with subjective norms, and the other item was loading on a separate factor in a different direction. Given personal injunctive norms are about what is important to the individual, not to significant others, a content review of the measures which were intended to make up the personal injunctive norms construct was triggered. Upon further review of these measures, content validity issues were identified. These content validity issues resulted in personal injunctive norms being excluded from further analyses.

A Kaiser-Meyer-Olkin measure of .73 was achieved from the analysis of the remaining normative items, satisfying the generally accepted .60 threshold (Field, 2013; Tabachnick & Fidell, 2007). There was support for the factorability of the correlation matrix due to a significant Bartlett's Test of Sphericity ($p < .001$). The final analysis used Direct Oblimin with Kaiser Normalization rotation. Oblique rotation (Direct Oblimin) was used rather than orthogonal rotation, as there is substantial theoretical and empirical basis for expecting that the constructs will be correlated with one another (Field, 2013). This analysis tested the factorability of subjective norms, descriptive norms and perceived supervisor norms. A two-factor solution was initially revealed. However, given the distinct definition which describes individual perception of behaviour of the industry (descriptive norms), perceived approval of supervisors (perceived supervisor norms), and perceptions associated with the journey by important reference groups (subjective norms), there were strong theoretical reasons to force a three-component solution. Table 10-1 details that the PCA reduced the expected number of components from six to three. PCA revealed three components that had eigenvalues greater than one and that explained 59.1%, 17.2% and 13.3% of the total variance, respectively. Visual inspection of the scree plot indicated that three components should be retained. In addition, a three-component solution met the interpretability criterion, so three components were retained. The three-component solution explained 89.6% of the total variance.

Table 10-1.

Pattern matrix for subjective, perceived supervisor norms and industry normative factors

	Component		
Items	**1**	**2**	**3**
Subjective norms (those who are important to me)	.940		
Subjective norms (opinions I value)	.958		
Descriptive norms (prevalence industry wide)		.964	
Perceived supervisor norms (it is a good thing to do)			.850
Perceived supervisor norms (how many engage in the behaviour)			.892

Extraction Method: Principal Component Analysis
Rotation Method: Direct Oblimin with Kaiser Normalization
Rotation converged in 5 iterations
Factor Loadings below .30 were not included in this table

10.4.2 Theoretical model reliability analyses

A Cronbach's α of at least 0.5 for each construct is considered to be adequately reliable (Field, 2013). The results of reliability (Table 10-2) showed TPB constructs have satisfactory values, ranging from .75 to .96 across the day and night survey, indicating acceptable levels of internal consistency.

Table 10-2.

Mean, standard deviation and Cronbach's α for TPB constructs split by shift type

			Day shift			Night shift		
Construct	**No. of items**	**Range**	***M***	***SD***	**Cronbach's *α***	***M***	***SD***	**Cronbach's *α***
Intention	3	1 - 7	5.33	1.90	.95	4.82	1.99	.96
Attitude	5	1 - 7	4.96	1.72	.93	4.29	1.69	.91
Subjective norms	2	1 - 7	4.98	1.92	.94	4.37	1.89	.89
PBC	3	1 - 7	5.72	1.34	.82	5.31	1.42	.75
Habit	4	1 – 7	4.75	1.92	.92	4.24	1.87	.91

Table 10-2 and Table 10-3 detail the outcomes of reliability analyses which demonstrate strong internal consistency amongst the normative measures (*subjective norms* and *perceived supervisor norms*) ranging from .71 to .94 across both the day and night surveys. Therefore, it is considered that these measures of normative factors are reliable and valid. The internal consistency of *descriptive norms* was unable to be assessed due to the reliance on a single item to measure this construct. Section 9.5.1 reported the internal reliability of *journey safety participation*.

Table 10-3.

Mean, standard deviation and Cronbach's α for group and indsutry norms split by shift type

			Day shift			Night shift		
Construct	**No. of items**	**Range**	***M***	***SD***	**Cronbach's α**	***M***	***SD***	**Cronbach's α**
Perceived supervisor norms	2	1 - 7	4.45	1.85	.76	3.62	1.65	.71
Descriptive norms	1	1 - 7	4.98	1.10	n/a	5.13	1.07	n/a

10.4.2.1 Creation of composite scores to test the theoretical model

Composite scores were calculated by summing the total observations for a respondent (by construct) and dividing by the number of items (Hair et al., 2009). For all constructs, this technique provided a mean score with a low of 1 and a high of 7. To account for missing data, mean scores were calculated providing no more than one item was missing from the scale. If more than one item was missing, it was decided that the case did not have sufficient information to calculate a valid score and was recorded as missing data for that case.

10.5 THEORETICAL MODEL RESULTS

This section analyses the extended theoretical model. As previously presented, the analysis aligns closely with the TPB. This analysis specifically focuses on Research Question 5. Bivariate correlations are presented and discussed. Hierarchical multiple regressions then test the hypotheses presented earlier in this chapter.

10.5.1 Preliminary analyses

Inspection of the correlations between variables in Table 10-4 reveals a number of statistically significant relationships. For the day and night sample, *intention* had a significant, positive relationship with *attitude*, *subjective norms*, and *PBC*. *Perceived supervisor norms* and *descriptive norms* also demonstrated a moderate to strong positive relationship with *intentions* for the day and night sample. There was no relationship between *journey safety participation* and the other TPB constructs. As discussed in Chapter 9, *journey safety participation* held a weak relationship with intention. The relationship was positive for the day sample and negative for the night sample.

Habit was strongly, positively correlated with intention for both day (r = 87, p <.05) and night (r = 87, p <.05) shifts. The frequency in which the construct of habit was identified (see Chapter 7) provides strong justification for the inclusion of this construct within the questionnaire and within this program of research. However, the high correlation between *habit* and *intentions* has been discussed within previous literature (Ajzen, 2002c). Thus, to prevent problems with multicollinearity, and given the discussion in previous literature (Ajzen, 2002c), *habit* was excluded from further analysis within the current research.

Attitude, *subjective norms*, and *PBC* were also strongly correlated with intention for both day and night data (see Table 10-4). However, unlike the *habit* construct, the r value fell just below the rule of thumb of .8, therefore *attitude*, *subjective norms*, and *PBC* were included in further analyses and the collinearity statistics (e.g., variance inflation factor (VIF)) were assessed against a generally accepted rule of thumb of less than 10 in order to adequately consider the effect of multicollinearity on the outcome (Tabachnick & Fidell, 2007).

Table 10-4.

Bivariate correlation matrix for theoretical model variables following day and night shifts

Variable	1	2	3	4	5	6	7	8
1. Past behaviour	1	.75*** *n*=218	.60*** *n*=210	.52*** *n*=217	.55*** *n*=217	.37*** *n*=206	.40*** *n*=214	-.20** *n*=218
2. Intention	.78*** *n*=237	1	.77*** *n*=214	.79*** *n*=221	.78*** *n*=221	.50*** *n*=210	.43*** *n*=218	-.21** *n*=222
3. Attitude	.61*** *n*=233	.69*** *n*=234	1	.72*** *n*=214	.65*** *n*=213	.57*** *n*=205	.36*** *n*=210	-.18** *n*=214
4. Subjective norms	.66*** *n*=237	.79*** *n*=238	.63*** *n*=234	1	.72*** *n*=220	.51*** *n*=209	.29*** *n*=217	-.11 *n*=221
5. PBC	.50*** *n*=237	.71*** *n*=238	.54*** *n*=234	.69*** *n*=238	1	.34*** *n*=209	.40*** *n*=218	-.17* *n*=221
6. Perceived supervisor norms	.61*** *n*=230	.59*** *n*=230	.58*** *n*=226	.66*** *n*=230	.49*** *n*=230	1	.31*** *n*=206	-.15* *n*=210
7. Descriptive norms	.39*** *n*=232	.43*** *n*=232	.28*** *n*=228	.38*** *n*=232	.40*** *n*=232	.37*** *n*=227	1	-.01 *n*=218
8. Journey safety participation	.16* *n*=237	.13* *n*=237	.07 *n*=233	.10 *n*=237	.10 *n*=237	.12 *n*=230	-.09 *n*=232	1

****Correlation is significant at .001 (2-tailed)*
***Correlation is significant at .01 (2-tailed)*
**Correlation is significant at .05 (2-tailed)*
Light grey shaded cells represent correlations for the night survey and white cells represent correlations for the day survey

The assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were met (Tabachnick & Fidell, 2007). Residual and scatter plots indicated that the assumptions of normality, linearity and homoscedasticity were all satisfied.

10.5.2 Predictors of workers' intention to drive home immediately following day shifts

In order to assess the relationship between identified constructs and *intention* following day shifts, a series of hierarchical multiple regression analyses were used to explore the relationship between the TPB constructs and intention to drive home immediately following shifts. The procedure was based on previous research which has been frequently used to assess behavioural intentions using the TPB (Ajzen, 1991; Cooke, Sniehotta, & Schüz, 2007; Hankins, French, & Horne, 2000). A two-step hierarchical regression was conducted to test the hypothesised relationships. The TPB variables of *attitude*, *subjective norms*, and *PBC* were entered on the first step. On the final step, *perceived supervisor norms*, *descriptive norms*, and *journey safety climate* were entered. The results of the analysis are reported in Table 10-5.

Table 10-5.

Hierarchical regression for variables predicting workers' intention to drive immediately following day shifts

	B	*95% C.I.*		*β*	*p*	*VIF*	R^2	*Adj.* R^2	ΔR^2
		Lower	**Upper**						
Step 1							.73	.72	
Attitude	.30	.20	.40	.27	.000***	1.73			
Subjective norms	.41	.31	.52	.42	.000**	2.33			
PBC	.41	.27	.55	.29	.000**	2.06			
Step 2							.74	.73	.01
Attitude	.30	.19	.40	.27	.000**	1.89			
Subjective norms	.39	.27	.50	.39	.000**	2.85			
PBC	.37	.22	.51	.26	.000**	2.17			
Descriptive norms	.17	.03	.30	.10	.016**	1.28			
Perceived supervisor norms	.01	-.09	.11	.01	.812	2.03			
Journey safety participation	.09	-.04	.22	.05	.172	1.04			

****p<.001, ** p < .02, * p < .05*

Step one of the hierarchical regression analysed the influence of *attitude*, *subjective norms*, and *PBC* on *intention*. These TPB constructs predicted 73% of the variance in *intention* to leave immediately, $F(3, 217) = 192.49$, $p = .000$. The final step of the hierarchical regression included *descriptive norms, perceived supervisor norms* and *journey safety participation* as independent variables. The inclusion of these three constructs explained a further 0.6% of the variance in intention to leave immediately following *day shifts*, $F(3, 214) = 2.47$, $p = .06$. This finding was approaching significance.

At step two of the hierarchal regression, *attitudes*, *subjective norms*, *PBC*, and *descriptive norms* were revealed as positive, statistically significant predictors of workers' *intention* to drive immediately following day shifts (see Table 10-5)[20].

10.5.3 Predictors of workers' intention to drive home immediately following night shifts

The same procedure as in the previous section (see Section 10.5.2) was applied to test the predictors of workers' intention to drive home immediately following night shifts. Results are reported in Table 10-6.

Table 10-6.

Hierarchical regression for variables predicting workers' intention to drive home immediately following night shifts

	B	*95% C.I.*		*β*	*p*	*VIF*	*R^2*	*Adj. R^2*	*ΔR^2*
		Lower	**Upper**						
Step 1									
Attitude	.39	.27	.51	.33	.000***	2.24	.77	.77	
Subjective norms	.36	.25	.48	.34	.000***	2.71			
PBC	.45	.30	.59	.31	.000***	2.23			
Step 2									
Attitude	.32	.20	.44	.27	.000***	2.58	.79	.78	.02**
Subjective norms	.36	.24	.48	.34	.000***	2.96			
PBC	.40	.26	.54	.28	.000***	2.43			
Descriptive norms	.22	.08	.36	.11	.003**	1.25			
Perceived supervisor norms	.06	-.04	.17	.05	.239	1.68			
Journey safety participation	-.14	-.28	-.01	-.07	.043*	1.06			

****$p<.001$, ** $p < .02$, * $p < .05$*

[20] An additional analysis was performed to control for distance home (kilometres) and number of years in industry. These two variables were entered at step 1 of the hierarchical multiple regression analysis, with the TPB and additional independent variables being entered in the same sequence as presented above at steps 2 and 3. Distance and years in the industry were not statistically significant predictors of intention following day shifts. There was no change in the predictors of intention when controlling for these variables.

The results revealed a similar outcome for the hierarchical regression following day shifts. *Attitude*, *subjective norms*, and *PBC* statistically significantly predicted *intention*, $F(3, 197) = 222.51$, $p = .000$, explaining 77% of the variation in *intention*. The inclusion of *descriptive norms*, *perceived supervisor norms*, and *journey safety participation* as independent variables in step two of the hierarchical regression led to a statistically significant increase in R^2 of .013, $F(3, 194) = 5.30$, $p = .002$ in predicting *intention* to leave site immediately following night shifts.

As with the results revealed in the previous section in respect to day shifts at step two of the hierarchical multiple regression, *intentions* to drive immediately following night shifts were positively and statistically significantly predicted by *attitudes*, *subjective norms*, *PBC*, and *descriptive norms* (see Table 10-6) [21]. *Journey safety participation* negatively predicted *intention*. This negative relationship was statistically significant.

10.6 DISCUSSION

This study explored and statistically examined the remaining key influences of the travelling workforce, *individual factors* and *social (normative) factors,* with consideration afforded to some journey characteristics (distance home), organisational factors (journey safety participation) and demographics (number of years in the industry) (see *Figure 10-1*). The study tested 10 hypotheses (see Section 10.2). The key objective of this study was to respond to Research Questions 4 and 5. Building on the in-depth interviews and literature review, Study 4b examined the use of the TPB as a model to explain the behavioural intentions of mine workers driving home immediately following shift blocks. Given the findings of the in-depth interviews and following some preliminary analyses in Study 4a, several additional constructs were examined in addition to the traditional TPB constructs. These additional constructs aimed to further explain normative influences and safety

[21] As with the day shift sample, an additional analysis was performed to control for distance home (kilometres) and number of years in industry. Distance and years in the industry were not statistically significant predictors of intention following night shifts. Again, there was no change in the predictors of intention when controlling for these variables.

climate from a task-specific perspective. The following sections discuss the results and implications from practical and theoretical perspectives. The final section of the chapter discusses the application of the TPB to understanding intentions of driving home immediately after shifts, presents strengths and weaknesses of the study, and summarises the findings.

10.6.1 Individual and normative influences measured using the TPB

Individual factors, as contemplated by the TPB, are associated with *attitude*, *subjective norms* and *PBC*. The relationship between these individual constructs and intention was measured. The following sections discuss the findings of the day and night surveys and discusses the support for each hypothesis.

10.6.1.1 TPB predictors of behavioural intentions

A hierarchical multiple regression was performed to explore the application of the TPB to this context. The first step of the regression analysis (see Section 10.3.1.3) examined the TPB constructs of *attitude*, *subjective norms* and *PBC*. Each of the TPB constructs statistically significantly predicted *intention* to drive home immediately following day and night shifts. The TPB constructs of *attitude*, *subjective norms* and *PBC* explained a large amount of variance in behavioural intention for both the day (73%) and night (77%) surveys, with each TPB construct significantly predicting the variance in intention in this first step, with only a small increase of 1% of the explained variance in intention for both day and night shifts when including *descriptive norms*, *perceived supervisor norms* and *journey safety participation*. The variables examined report a large proportion of the variance of intention to drive home immediately following both day and night shifts. The strength of this finding is evident when considering other road and workplace studies which have used the TPB, and report large findings when explaining over 50% of the variance in intention (e.g., Elliott, Armitage, & Baughan, 2005; Evans & Norman, 2003; Fogarty & Shaw, 2010; Rivis et al., 2011).

Step two of the hierarchical regression included additional normative constructs and journey safety participation. The results demonstrated that those participants with a positive attitude toward the behaviour, who perceived greater approval from significant others, who had a greater perception of control, and who perceived others in the industry engaged in the behaviour, were associated with an increased intention to drive home immediately following day shifts. For the night sample, those participants with a positive attitude toward the behaviour, who perceived greater approval from significant others, who had a greater perception of control, who perceived that others in the industry engaged in the behaviour, and who were less likely to apply safe journey practices, were associated with an increased intention to drive home immediately.

PBC strongly, positively influenced *intention*. *PBC* was the strongest predictor of *intentions* for the night sample, when accounting for *attitude*, *subjective norms*, *descriptive norms*, *perceived supervisor norms*, and *journey safety participation*. The strength of the *PBC* construct is consistent with previous research (Armitage & Conner, 2001). The relevance of *PBC* to driving home immediately following a shift can be discussed in the context of the extent that leaving immediately is within individual control. The in-depth interviews (Chapter 7) and the critical review (Chapter 5), describe a high level of workplace control in respect to safety rules on-site in general. The difference between site-related behaviours and this off-site related behaviour of commuting is evident in the findings presented in Chapter 5, whereby the grey, blurred boundaries are discussed. If fatigue management in respect to commuting were a little clearer, there may have been a negative relationship between *PBC* and *intention* to leave immediately, or no relationship at all, rather than the strong positive relationship observed.

Attitude toward the behaviour also statistically significantly predicted an increase of *intentions* when analysing the complete model for both the *day* and *night* samples. This finding is consistent with previous research when examining meta-analyses (Godin & Kok, 1996), as well as specific studies within road safety research

(Elliott et al., 2007; Fogarty & Shaw, 2010). *Attitude*, as a combination of both instrumental and affective attitudes, informs the positive or negative evaluation of leaving site immediately following a shift. On average, respondents tended more toward the positive end of the scale when associating leaving immediately after *day shifts*, but tended to be closer to neutral following *night shifts*. The positive result of attitude toward the behaviour indicates that in general, these workers have a positive association toward driving home from site immediately following shift. As highlighted in the in-depth interviews, given that these workers see the drive as 'their time' and they 'just want to get off site', this positive association with intention to drive home immediately is not surprising.

The final TPB predictor, *subjective norms*, was also a strong, positive predictor of *intentions* for both the *day* and *night* samples, which was a surprising finding. This finding was observed despite previous meta-analyses identifying *subjective norms* as a weak predictor of *intention* (Godin & Kok, 1996). The limitation of the findings drawn in some meta-analyses is the variation in the context of the behaviour; this limitation is despite Ajzen (1991, p. 188) arguing that "the relative importance of attitude, subjective norm, and perceived behavioural control in the prediction of intention is expected to vary across behaviours and situations". When categorising behaviour-type, the correlations between subjective norms and intention and behaviour are strongest when the behaviour has an element of risk (McEachan et al., 2011). In the current study, *subjective norms* were found to be a strong, statistically significant predictor of increased *intention* for both the *day* and *night* samples. *Subjective norms* were the strongest predictor of *intentions* for the day sample. The strong positive relationship between subjective norms and intentions identified in the current research may be associated with the risky nature of the behaviour, and the reliance on the support and opinions of others to assist and approve of driving home immediately despite those risks. Given the strong reliance on the opinions of significant others in respect to driving home immediately after shifts, there is an obvious opportunity to target education messaging toward these reference groups in an attempt to change the behavioural intentions of these workers following both shift types.

The results reported in Study 4b support *H1a*, *H1b*, and *H1c* in respect to *intention* to leave site following *day* and *night shifts,* supporting the use of the TPB to explain driving intentions immediately following shifts. This finding reflects the findings of previous research that the TPB can predict behavioural intentions (Ajzen, 1991) and suggests that *attitudes*, *subjective norms*, and *PBC* are good predictors of *intentions* in this context for both *day* and *night* samples. Overall, the TPB was a very useful framework to assist in explaining the phenomenon of why mine workers drive home immediately following shift blocks. As posited by Ajzen (1998), how well *attitudes*, *subjective norms* and *PBC* predict intention will be different depending on the behaviour, situation and context under examination. As identified in the current study, the importance of the TPB variables differed in the current study compared to meta-analyses and other studies which use the TPB to explain intention and behaviour.

10.6.1.2 Additional predictors of behavioural intentions

The addition of the normative influences and *journey safety participation* statistically significantly increases the amount of variance explained in intention for the night shift sample and shows that normative factors are important in the assessment of *intention* to leave site immediately following *night shifts* (see Table 10-6). An assessment of adjusted R^2 revealed that these findings are not purely due to the inclusion of additional independent variables, as the adjusted R^2 value increases in the second step of the regression procedure (Hankins et al., 2000). For the day sample, the inclusion of the normative influences increases the amount of variance explained in intention; however, this result, while not statistically significant at a 95% level of confidence, is approaching significance (p = .07) (see Table 10-5). As with the night shift sample, the adjusted R^2 value increased in the second step of the procedure, indicating that the result is not due to the inclusion of additional variables.

There was self-reported support for normative beliefs in respect to co-workers, supervisors, and the industry in general (see Section 7.5.2). While the influence of *perceived co-worker norms* was unable to be measured in the current research program, the analysis showed that there was no relationship between *perceived supervisor norms* and *intention* following *day* or *night shifts*. Therefore, *H2b* was not supported in respect to workers leaving site immediately following *day shifts*. While the inclusion of *perceived supervisor norms* did not explain variance in *intention*, the finding itself is important given the reference to supervisors in the in-depth interviews themselves driving home immediately following a shift. Given that the in-depth interviews revealed that the workers' perception is that the journey home is their responsibility, the lack of relationship between what the supervisor 'thinks' about the worker driving home immediately following shifts and the intention to drive immediately is not surprising. Workers' intentions are not influenced by their supervisors' agreement with the behaviour of driving home immediately following day or night shifts or if they engage in that behaviour themselves. Practically, this result demonstrates that providing education material through the supervisory team on-site may have little to no influence on worker intentions. This research revealed these normative influences were applicable at the industry level but not in respect to the specific reference group of supervisors.

Descriptive norms positively statistically significantly predicted *intention* to leave site immediately following day and night shifts. This finding provides support for *H3*. The positive relationship between *descriptive norms* and *intention* describes that intention to drive immediately is influenced by the workers' perception of what everyone else in the industry does. While the positive relationship between *descriptive norms* and *intention* was as hypothesised, the relationship was not as strong as in previous research (Rivis & Sheeran, 2003). Despite the difference in strength between the current study and previous research, this research program provides evidence for the continued support for the inclusion of industry (descriptive) norms as a predictor of intention in the TPB. The inclusion of this construct has the support of previous research (Rivis & Sheeran, 2003).

The results revealed that there was no statistically significant relationship between *journey safety participation* and *intention* for the *day shifts*. However, for the *night* sample there was a negative, statistically significant relationship with *intention*. This finding indicates that those who are less likely to apply safe journey practices are more inclined to hold the intention to leave immediately following *night shifts*. Based on the theory presented in Section 2.9.5, this finding means that there would be limited contribution to the safety environment on site by those who hold an intention to drive home immediately following night shifts. This finding is not surprising given that these workers do not consider that the site has any responsibility in respect of journey safety, the high-level of safety awareness exhibited in the in-depth interviews (see Section 7.4.3) and the relationship between site safety and journey safety reported in Section 9.6.2.1. However, as explained in Section 9.5.1, this finding should be treated with caution: future research should consider the inclusion of this variable for further assessment.

Injunctive norms and *perceived co-worker norms* were not tested for the reasons outlined in Section 10.4.1 and *habit* was not tested due to the reasons outlined in Section 10.5.1, hence there are no findings for *H2a*, *H4a*, *H4b*, and *H5*.

10.6.1.3 Summary of results addressing hypotheses

The summary of the hypotheses tested in this study is presented in Table 10-7. Overall, the results of this study provided support for the efficacy of the TPB in predicting intentions associated with driving home immediately following both day and night shifts.

Table 10-7.

Summary of results addressing the hypotheses

Hypotheses	Support		
	Day shift	Night shift	Not tested
H1a. Attitude will positively influence behavioural intentions to drive home immediately following a shift block	✓	✓	
H1b. Subjective norms will positively influence behavioural intentions to drive home immediately following a shift block	✓	✓	
H1c. PBC will positively influence behavioural intentions to drive home immediately following a shift block	✓	✓	
H2a. Perceived co-worker norms will positively influence behavioural intentions to drive home immediately following a shift block			×
H2b. Perceived supervisor norms will positively influence behavioural intentions to drive home immediately following a shift block	×	×	
H3. Descriptive (industry) norms will positively influence behavioural intentions toward driving home immediately following a shift block	✓	✓	
H4a. Social injunctive norms will negatively influence behavioural intentions toward driving home immediately following a shift block			×
H4b. Personal injunctive norms will negatively influence behavioural intentions toward driving home immediately following a shift block			×
H5. Habitual behaviour will positively influence behavioural intentions to drive home immediately following a shift block			×
H6. Journey safety participation will negatively influence behavioural intentions to drive home immediately following a shift block	×	✓	

Key:
✓: Support for hypothesis within sample
×: No support for hypothesis within sample or hypothesis not tested

10.6.2 Implications

There are both theoretical and practical implications associated with the findings of Study 4b. These implications are somewhat intertwined and therefore will be discussed together. From the perspective of the TPB predictor, *subjective norms*, the strength of the relationship between the influence of important others and intention is unusual (Godin & Kok, 1996). This finding supports the proposition of McEachan et al. (2011) that reliance on the influence of important others in risky situations, such as driving home following long shifts, is strengthened. Future research using the TPB to assess intentions and risky behaviours should further assess this relationship. The strong relationship identified in the current study further supports the exploration of specific reference groups in line with the social norms approach (e.g., White et al., 2009). The exploration of these specific reference groups within the current research demonstrated theoretical implications for the inclusion of industry (descriptive) norms into future TPB research. As discussed in Section 10.6.1.2, there is support in previous literature for the ongoing inclusion of descriptive norms, which is supported by this research.

From a practical perspective, an understanding of the positive influence of the prevalence of the behaviour in the industry on intention indicates a need to change industry thinking. Further research is required to understand the actual prevalence of the behaviour in the industry prior to considering an appropriate intervention. Beyond these implications and opportunities for interventions, practically the findings about normative influences demonstrate that interventions should target those who are important to the individual, and given that there is no relationship between perceived supervisor norms and intention, these messages should not be delivered by supervisors. Education and messages should perhaps target significant others, rather than just the worker.

Implications resulting from the positive relationship between attitudes and intentions are practical in nature and provide additional understanding about workers' perceptions of driving immediately after shift. Assessing attitudes indicates that these workers do not perceive that driving home immediately after shift is wrong. On average, the day shift sample tended toward the positive end of the scale, and the night shift sample responded closer to neutral. This difference indicates that that there is a less positive evaluation of the behaviour following a night shift, which possibly explains why these workers are more inclined to stay on site for a few hours following a night shift to take a break. However, a few hours break after shift does not negate the risk associated with the sleep debt and finishing night shifts. Future studies could further investigate the perceived differences in risks between day and night shifts to identify opportunities for interventions, given the difference in attitude between the day and night sample.

There is a strong positive relationship between PBC and intention, indicating that the worker considers that driving home immediately following a shift is within their control. This supports the finding in Study 2b that the workers' expectations override organisational policies and that enforcement is very difficult. Given the strong positive relationship between PBC and intention, it is clear that organisational policies are not taken into consideration by these workers, which is supported by the findings of the focus group (Study 2b) and the in-depth interviews (Study 3). Practically, additional education is required in respect to whose responsibility it is if something were to happen on the way home, particularly given the misalignment between practice and policy.

Finally, there is also limited support for the consideration of safety climate concepts, particularly when there is a perception of a safety risk (e.g., driving after a night shift when tired). Future research of these concepts in work-related, road safety studies is warranted.

10.6.3 Strengths, limitations and future research

A key strength of this study is the use of a well-validated theoretical framework. The sample was relatively large (day n = 239, night n = 222) drawn from one mine site in the Bowen Basin. This mine site is a DIDO mine with a limited number of workers opting to FIFO. There are limitations in the generalisability of these results given the focus of this study on one DIDO site. Since there was such a high response rate (93.7%), which included representation across all levels of the organisational structure, it is argued that the sample is generally representative of the mining population. Furthermore, while the sample was only drawn from one mine site, the average number of years in the industry for participants indicates a high level of experience in the industry. However, future research should consider similar research across multiple sites.

Chapter 10 provides support for the use of the TPB to explain the immediacy of workers driving home after shift. This chapter contributes to research evidence on the applicability of the TPB in understanding factors which influence driving intentions immediately following both day and night shifts. Moreover, there is some support for the predictive utility of an extended TPB (additional normative factors and task specific safety climate factors) in this context. Practically, interventions should respond to the positive association of driving home immediately following shift blocks.

There are limitations associated with this study which should be acknowledged. Due to operational requirements, a subsequent measure of behaviour, as contemplated by the TPB procedure (Ajzen, 2002a), was unable to be obtained. The results, therefore, only report worker intentions to drive home immediately following shifts. There is research which supports intentions as a strong predictor of behaviour (Sheeran, 2002). There is strong support in Chapter 9 that intention to drive immediately following a shift leads to the worker actually leaving site immediately following both day and night shifts (see Section 9.7.2.1).

The participants were asked to self-report their journey following shift blocks. The self-reporting requirement and the completion of the surveys during work hours may have led participants to respond in line with company commuting policy. It is noted that 51% of respondents admit to leaving site within two hours of the shift block, suggesting that participants understood that the information they provided was confidential.

10.7 CHAPTER SUMMARY

Chapter 10 presented the second analysis of Study 4. The chapter has mainly explored individual and social influences which influence worker intentions and behaviour to drive home immediately following shift blocks. The chapter reported the TPB as a very useful theoretical framework to explain worker decisions in respect to driving home immediately following day and night shifts.

The next chapter reports the findings associated with the final analysis of Study 4. Chapter 11 also examines individual and social influences on commuting behaviour with a focus on behavioural, normative and control beliefs as posited by the TPB. The chapter will report on a series of multiple regression analyses conducted in line with the methods proposed by von Haeften et al. (2001).

Chapter 11: Critical Beliefs of Driving Home Immediately after Shifts

11.1 INTRODUCTION

Chapter 11 represents the final chapter of three chapters which report the findings of Study 4. Similar to Chapter 10, Chapter 11 (Study 4c) also reports on individual and social factors that influence intention to drive immediately after shifts. More specifically, Chapter 11 analyses the critical beliefs associated with that intention. The aim of this study was to refine the outcomes of the in-depth interviews using the TPB as a theory-led approach to guide analysis. The study focuses on exploring behavioural, normative, and control beliefs through a critical beliefs analysis. This chapter contributes to the overall research program by addressing Research Objective 3 to *explore and examine the interrelations between individual, social, organisational and situational influences on worker commuting behaviour and how these key influences impact workers' decisions about driving home shortly after a shift block.* Study 4c also addresses Research Objective 4 to *identify opportunities for interventions regarding driving home from site immediately following a shift block.*

Section 11.2 describes the rationale for the focus of Study 4c. The method used to analyse the critical beliefs is described in Section 11.3. The results for each step of the analysis is then reported (Section 11.4). Section 11.5 discusses the key findings, the theoretical and practical implications (opportunities for interventions), strengths and limitations, as well as direction for future research, with Section 11.6 summarising the chapter.

11.2 STUDY AIM AND RESEARCH OBJECTIVES

While opportunities for interventions were discussed in line with the results reported in Chapter 10 (Section 10.6.2), those interventions discussed in the previous chapter were quite broad. More specific opportunities for interventions can be identified through understanding the most salient beliefs underpinning individual intentions and behaviour (von Haeften et al., 2001). In order to understand where future research and industry should focus their attention, it is important to understand the most critical beliefs *(advantages, disadvantages, approvers, disapprovers, facilitators, and barriers)* associated with workers' decision to drive home immediately after finishing a shift block. Chapter 11 analyses and discusses these critical beliefs, and identifies opportunities for interventions to address the limitations associated with current organisational policies in line with Research Objective 4.

11.3 METHOD − ANALYSING TPB BELIEFS

The in-depth interviews identified salient beliefs influencing worker intentions to leave site immediately following a shift block which were identified during the in-depth interviews (Section 7.5.3). The following sections report on the preliminary results associated with underlying beliefs associated with attitudes, subjective norms and PBC. As described in Chapter 2, underlying beliefs influence each behavioural antecedent in the TPB. As such, it is expected that underlying beliefs (behavioural, normative, and control beliefs) should be correlated with intention and behaviour. For the purpose of this study, the examination of underlying belief constructs was not associated with specific hypotheses. The relationship of each critical belief item and *intention*[22] was measured in line with the method proposed by von Haeften et al. (2001).

11.3.1 Critical beliefs approach

A theory-based approach to assessing the determinants of behavioural intention provides an understanding of the key contributors of individual decisions and resulting behaviour. Approaching behavioural analysis using the TPB identifies the variation in underlying beliefs between those who engage in the behaviour and those

[22] The critical belief items were not measured against behaviour, given a measure of behaviour was not collected during the survey period due to the limitations previously described (see Section 8.3).

who do not (von Haeften et al., 2001). As discussed in Section 2.9.1, the TPB is useful to understand a variety of behaviours, but is also useful in identifying opportunities for theory-based interventions – a key research objective. Theory-based interventions based on the TPB have been developed to support behavioural change in a variety of contexts, including breast self-examination (Mason & White, 2008), concealed texting while driving (Gauld, Lewis, & White, 2014), compliance with speed limits (Elliott et al., 2005), and condom use (von Haeften et al., 2001), with three of these examples opting for the approach proposed by von Haeften et al. (2001). The TPB constructs of attitude toward the behaviour, subjective norms, and PBC are based on underlying beliefs (see Section 2.9.1). Literature posits that in order to change intention, interventions should target one or more of attitudes, subjective norms and PBC (Mason & White, 2008; von Haeften et al., 2001). However, in addition to considering attitude, subjective norms and PBC, interventions should primarily focus on the underlying beliefs that most strongly predict behavioural intention to increase effectiveness (von Haeften et al., 2001).

11.3.2 Study design and procedure

The behavioural, normative, and control beliefs identified during the in-depth interviews and the inclusion of each belief were discussed in Chapter 7 (see Section 7.5.3). As described previously, a questionnaire was developed for the purpose of Study 4. Study 4c examines which of these identified beliefs predicts workers' intention to leave site immediately following day and night shifts. As discussed in the previous chapters, a subsequent measure of behaviour was unable to be obtained due to operational requirements. The independent variables represent *behavioural beliefs* (advantages and disadvantages of performing the behaviour), *normative beliefs* (those who approve or disapprove engaging in the behaviour), and *control beliefs* (facilitators and barriers). These independent variables are tested against behavioural intention in accordance with the method proposed by von Haeften et al. (2001). Industry experts described a difference between the behaviour of workers finishing day shifts and those finishing night shifts, so scores on the dependent variable *intention* were analysed for both the *day* and *night* samples. Respondents were requested to provide responses to *intention* to drive home immediately following a shift on a continuous scale.

11.3.2.1 Measures

Statements associated with measuring critical beliefs were developed in line with the methods proposed by Ajzen (1991, 2002b) (see Section 8.4.1.2). Items measuring critical beliefs were in line with the behavioural, normative, and control beliefs identified in Section 7.5.3. The dependent variable in this analysis was intention to drive home immediately following a shift in the last month.

11.3.2.2 Participants

Participants were recruited via convenience sampling. The method used to recruit these participants and information about data collection and confidentially has been previously detailed in Section 8.5. An overview of the profile of the participants can be found in Section 9.4.

11.3.2.3 Analysis

In line with the method proposed by Von Haeften et al. (2001), the critical beliefs were analysed using a three-stage approach. This approach provides a method to identify the most salient beliefs when a large number of critical beliefs are being analysed (Gauld, Lewis, White, & Watson, 2016). Each step was performed twice to analyse critical beliefs following both a day and night shift. The first step analysed the correlations with intention and each of the belief statements. The second step of the procedure requires those beliefs which were significantly correlated with intention to be analysed using multiple regression. Four multiple regressions were performed, one for behavioural beliefs; normative beliefs and control beliefs were split between facilitators and barriers due to the large number of items. Two additional multiple regressions were performed in line with the stepwise approach using those critical beliefs which were found to have a statistically significant relationship with intention in step two. This final step analysed the statistically significant results identified in step two using intention as the dependent variable.

11.3.2.4 Missing data

Data were screened to ensure that responses had been entered correctly and to review missing values. Missing data were deleted pairwise in order to minimise the impact of deletion (Tabachnick & Fidell, 2007). The outcome and treatment of missing data were consistently applied in Studies 4a, 4b, and 4c and was detailed in Section 9.3.1.4.

11.4 RESULTS

The following section presents the results in line with the stepped approach described above. The assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were met (Tabachnick & Fidell, 2007). Residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied, and collinearity statistics (e.g., VIF) were within acceptable limits (i.e., less than 10) (Tabachnick & Fidell, 2007).

11.4.1 Step 1 - Correlations of critical beliefs with behavioural intention

The first step required assessing the correlation of each critical belief with behavioural intention. Complete results of the correlations of *behavioural beliefs*, *normative beliefs* and *control beliefs* (facilitators and barriers) with *intention* are presented at Appendix E (see Table 13-1, Table 13-2, and Table 13-3). Those critical beliefs which were significantly correlated with behavioural intention for both day and night shifts are presented in Table 11-1 and Table 11-2, respectively. In line with the analysis of von Haeften et al. (2001), these beliefs were included in Step 2 of the analysis.

Table 11-1.

Critical beliefs significantly correlated with intention – day shifts

Critical belief		
Behavioural beliefs	• Putting others at risk • Putting me at risk • Getting home as soon as possible • Comply with SSE instructions	• Breaking the road rules Uninsured • Involved in a crash • Involved in a near miss • Taking a risk
Normative beliefs	• Family • Friends	• Co-workers • Supervisor
Control beliefs - facilitators	• Carpooling • Following what others do • Needing to be somewhere • Routine • My family want me home	• Experienced distance driver • Car made for country roads • Sick of being on site • To get the drive over with
Control beliefs - barriers	• Avoiding dawn/dusk driving • Avoiding night driving • Feeling tired	• Training in fatigue management • Not get home tired

Table 11-2.

Critical beliefs significantly correlated with intention – night shift

Critical belief		
Behavioural beliefs	• Putting others at risk • Putting me at risk • Making the most of my time off • Seeing my family as soon as possible • Getting home as soon as possible	• Getting off site as soon as possible Comply with SSE instructions • Breaking the road rules • Uninsured • Involved in a crash • Involved in a near miss • Taking a risk
Normative beliefs	• Family • Friends	• Co-workers • Supervisor
Control beliefs - facilitators	• Carpooling • Following what others do • Needing to be somewhere • Routine • My family want me home	• Experienced distance driver • Car made for country roads • Sick of being on site • To get the drive over with
Control beliefs - barriers	• Family concerns • Complying with site rules • Avoiding dawn/dusk driving • Seeing a crash occur	• Wanting to get home in one piece • Not get home tired

11.4.2 Step 2 - Regression analyses of critical beliefs

The second step required those beliefs significantly correlated with intention to be analysed using multiple regression. Complete results of the second step of the procedure are presented at Appendix E (see Table 13-4, Table 13-5, Table 13-6, and Table 13-7). Those critical beliefs which significantly predicted behavioural intention following regression analyses for both day and night shifts are presented in Table 11-3. These beliefs presented in Table 11-3 formed the basis for Step 3 of the analysis.

Table 11-3.

Step 2 – Critical beliefs that significantly predicted intention

Day shift	
• Putting others at risk • Getting home as soon as possible • Uninsured • Family	• Friends • Routine • My family want me home
Night shift	
• Putting others at risk • Involved in a crash • Involved in a near miss • Family	• Carpooling • Routine • Sick of being on site • Not get home tired

11.4.3 Step 3 – Critical beliefs underpinning behavioural intentions to drive home immediately following shifts

The final multiple regression analysis required all significant beliefs to be included in the same regression analysis. The results from the final multiple regression analyses which revealed the significant critical beliefs predicting behavioural intentions are presented in Table 11-4 and Table 11-5.

11.4.3.1 Critical beliefs underpinning behavioural intentions following day shifts

The final analysis using von Haeften et al.'s (2001) procedure analysed the ability of *behavioural beliefs* (putting others at risk, getting home as soon as possible and uninsured), *normative beliefs* (family and friends) and *control beliefs* (routine and family want me home) to predict *intention*. These critical beliefs predicted 56% of the variance in *intention* to drive home immediately, $F(8, 226) = 56.60$, $p = .000$. The results of the multiple regression analysis are presented in Table 11-4.

Table 11-4.

Step 3 - regression of critical beliefs predicting workers' intention to drive home immediately following day shifts

Critical beliefs	***B***	***95% C.I.***	***VIF***
Putting others at risk	-.17**	[-.27, -.07]	1.40
Getting home as soon as possible	.14**	[.03, .24]	1.14
Uninsured	-.09	[-.18, .01]	1.48
Family	.29***	[.14, .45]	4.71
Friends	.15	[-.02, .32]	4.64
Routine	.08	[-.02, .18]	1.68
My family want me home	.07	[-.05, .18]	1.73

****$p<.001$, **$p < .02$, *$p < .05$*

The multiple regressions revealed that there were behavioural and normative beliefs that were statistically significant predictors of *intention* to drive home immediately following day shifts (see Table 11-4). The behavioural belief of *putting others at risk* had a significant negative relationship with intention, indicating that these workers are conscious of other road users or passengers when forming their intentions to drive home immediately following *day shifts*. *Intention* to drive home immediately was positively influenced by the advantage of *getting home as soon as possible*, which is in line with the findings of the in-depth interviews (see Section 7.4.5). Finally, examination of the normative belief of *family* revealed a positive, statistically significant relationship with intention, indicating that, on balance, the workers sampled perceive that their families approve of them intending to drive home immediately after day shifts.

11.4.3.2 Critical beliefs underpinning behavioural intentions following night shifts

The final step analysed the ability of *behavioural beliefs* (putting others at risk, involved in a crash and involved in a near miss), *normative beliefs* (family), and *control beliefs* (routine, carpooling, sick of being on site, and not get home tired) to predict *intention* to drive home immediately following night shifts. These critical beliefs predicted 67% of the variance in *intention* to drive home immediately, $F(8, 209) = 51.66$, $p = .000$. The results of the multiple regression analysis are presented in Table 11-5.

Table 11-5.

Step 3 - regression of salient beliefs predicting workers' intention to drive home immediately following night shifts

Critical beliefs	***B***	***95% C.I.***	***VIF***
Putting others at risk	-.15**	[-.27, -.03]	2.16
Involved in a crash	.19	[-.03, .41]	6.87
Involved in a near miss	-.14	[-.38, .10]	7.62
Family	.26***	[.16, .36]	1.88
Carpooling	.10**	[.01, .18]	1.34
Routine	.32***	[.22, .42]	1.91
Sick of being on site	.17***	[.08, .25]	1.43
Not get home tired	-.11*	[-.20, -.01]	1.29

$^{***}p<.001$, $^{**}p < .02$, $^{*}p < .05$

The results presented in Table 11-5 revealed statistically significant relationships between a number of behavioural beliefs, normative beliefs, and control beliefs with intention. Similar to the day shifts sample, the behavioural belief of *putting others at risk* negatively predicted intention to drive immediately following *night shifts* and *family* approval positively predicted intention. *Routine* and *being sick of being on site* also positively predicted intention. However, this relationship was only evident in the night shift sample.

11.5 DISCUSSION

Study 4c examined the critical beliefs which significantly predicted intention to drive home immediately following day and night shift. Salient beliefs assessed in this study were associated with behavioural beliefs, normative beliefs, and control beliefs. As highlighted earlier, these beliefs underpin each antecedent of intentions in the TPB framework. This chapter identified *the most salient beliefs (advantages, disadvantages, approvers, disapprovers, facilitators, and barriers) associated with workers' intentions to drive home immediately following a shift block.*

The disadvantage of *putting others at risk* was a negative predictor of *intention* across both the *day* and *night samples*. The findings of the in-depth interviews report that these workers are cognisant of the risks associated with the commute (see Section 7.4.3 and Section 7.4.9). Therefore, workers are aware that holding an *intention* to drive home immediately following shift blocks has the potential to put others at risk. The discussion in Chapter 7 in respect of the high safety awareness of these workers (see Section 7.5.5.3) is supported by the finding that these workers are aware that driving home immediately is risky and may directly affect other road users.

Getting home as soon as possible is a clear advantage of driving home immediately following a shift block. However, this advantage was only identified as a predictor of *intentions* in the day shift sample. The in-depth interviews (Chapter 7) and the focus group (Chapter 6) both support workers' desire to get home as soon as possible. There have been several reasons posited throughout the thesis (see Section 6.4.3.3) regarding the motivations and workers' reliance on the lifestyle roster.

Sick of being on-site was a common theme in the in-depth interviews and was supported as a facilitating control belief following night shifts. *Sick of being on site* had a positive, significant relationship with intention to drive immediately following night shifts. As highlighted in the in-depth interviews, close to the end of their shift, these workers just want to get home and get away from the isolation of mining life. Night shift is particularly isolating and difficult, which may explain the relationship between this facilitating belief and intention to drive home immediately following a night shift.

Family support of workers' intention associated with driving home immediately at the end of both day and night shifts was a positive relationship for both the day and night samples. This result indicates that family approves of workers driving home immediately following day and night shift blocks, which at first glance is inconsistent with the findings of the in-depth interviews (see Section 7.4.10). However, the in-depth interviews also described that significant others, while conscious of the risks to their loved one, trust their judgement regarding the commute. An explanation for the approval associated with this normative belief may be due to the family trusting the workers' judgement to leave at a time that they will be safe to drive home. Family approval should be examined further in future research, particularly in respect of whether the family understands and comprehends the risks associated with leaving site immediately. Given the measure of family approval is the perception of the worker, it is important to understand if there is a misalignment between the perception of the worker and the actual approval of the family. According to the social norms approach, providing normative feedback to correct misperceptions of norms is critical to changing behaviour (Berkowitz, 2004).

The convenience and flexibility of carpooling was identified as an issue for some who carpool or who have considered carpooling (see Section 7.4.8). *Carpooling* was positively related to *intention* to drive immediately following night shift blocks. The parallel between the findings of the in-depth interviews and the night shift findings is associated with the inconvenience associated with carpooling. If workers agree to carpool, the time the carpooling vehicle leaves the site relies on the agreement of those travelling. This agreement dictates the time the workers leave the site and thus informs the *intention* to drive home immediately following a night shift block (or otherwise).

Not wanting to get home tired had a negative relationship with *intention* to drive home immediately following *night shifts*. The in-depth interviews found that there are two methods for managing finishing night shifts. The first method is to leave site immediately: once workers have arrived home, they stay awake until the following evening and then sleep during the night to ensure their body returns to a normal rhythm. The second method is to have a few hours' sleep after the shift and leave site later during the day. When considering *Figure 9-5*, the breakdown of workers leaving site every two hours following the end of the final night shift, both methods are evident within the sample. The negative relationship identified between *not wanting to get home tired* and *intention* may be associated with the worker trying get their body into a normal circadian rhythm. Therefore, not wanting to get home tired is actually a facilitator of intentions to drive home immediately following night shifts.

While *routine* significantly predicted *intention* to drive immediately following night shifts, it did not predict *intention* following day shifts. The variation between the two samples may be associated with the fact that driving home following night shifts results in the journey occurring during the day. Conversely, driving home following day shifts results in the journey occurring at night. According to the in-depth interviews, a similar post-shift routine is adopted prior to leaving site. Workers may stick to their post-shift routine more stringently following night shifts so as to get home and make the most of the day. However, following day shifts, the routine may not be as consistent, as the journey occurs at night when loved ones at home are asleep, so regardless of when these workers leave site they are not missing out on their day.

The beliefs that are consistent across the day and night samples are the negative relationship between *putting others at risk* and *intention* to drive home immediately following shifts, as well as the positive relationship between *family approval* and *intention*. Targeting beliefs in an intervention that are consistent across both day and night shift reveals a potential starting point for developing interventions. However, the limitations associated with a one size fits all approach should be acknowledged.

11.5.1 Implications

The use of the TPB to explain commuting decisions outlines another area of research that supports the application of the TPB in respect to beliefs. This study reinforces the findings of Chapter 9 and Chapter 10 that there are individual and social factors that influence the decision to drive immediately following shifts. A further implication of this research is the identification of beliefs to discover the shortcomings of the current approach adopted within the industry, highlighting the applicability of this theory to guide and support practical changes to organisational safety policy and education.

The critical beliefs analysis identified a number of beliefs underlying worker intentions to drive home immediately following shifts. There were some differences between the day and night samples in respect to those beliefs which predicted intention to drive home immediately. The behavioural belief consistent across both samples was the disadvantage that driving home immediately would put others at risk and the normative belief associated with family approval to drive home immediately. These findings are consistent the findings of Study 3, particularly in respect to the relationship between the behaviour and normative influences, as well as the high level of safety awareness associated with engaging in the behaviour.

Previous research has identified limited lasting effects where interventions attempt to change behaviour by focusing on normative beliefs (Lapinski & Rimal, 2005). However, given the strength of the influence of family as a normative belief, and the strength of the relationship between subjective norms predicting intention, integrating family approval into a suite of intervention opportunities seems logical. It should be noted that, given the results of this research program, if the perception of the workers is that families approve of driving home immediately after shift, there is a strong likelihood that the intention of the worker will be to leave immediately after shift. Interventions should challenge family approval directly, in line with the social norms approach (Berkowitz, 2004). Currently, the focus of journey management falls to providing training to the worker only. Future interventions should provide information to families about the risks associated with the drive home in an attempt to open a dialogue between the worker and their family about the journey, to ensure both parties are aware of the risks associated with commuting home immediately following shifts.

Interventions should also closely consider the disadvantage of putting others at risk following both day and night shifts. Based on these findings, there may be benefit associated with an education and messaging campaign for industry primarily associated the risks posed to other road users. The findings support the high level of safety awareness of these workers and their acknowledgement that there are risks associated with the commute immediately following shifts which cannot be completely ignored. A campaign could outline the frequency of incidents involving mine workers during the commute home, how those workers' families are impacted, and drill down into the concept of how, why, and what consequences result from driving immediately following a shift. While journey claims from the resource industry make up only a small proportion of overall journey claims, the majority come from coal mines. As an example, the results presented in Study 1 report a large difference between the compensation paid for those involved in a workplace incident when compared to those involved in a road crash, indicating that road crashes are more frequently severe, and involve a long period for the worker to return to work, which has a negative effect on the worker's life, family, colleagues, the organisation, and society in general. This campaign could examine how many lives are impacted by an adverse outcome if the decision is made to drive immediately. The focus on the behavioural belief of putting others a risk, along with the normative belief of family, should be prioritised, given the finding were consistent for both the day and night samples. Targeting these critical beliefs has the potential to impact the entire cross-section of workers, regardless of shift type.

When considering the self-reported time following both shift types (i.e., between 40 and 60% of workers leave site within two hours of the end of the shift), as well as the difference in intention to leave immediately after the different shifts, it is clear that proposed interventions should vary. There were a number of critical beliefs that predicted intention following night shifts. A targeted intervention following night shifts should focus on routine as the strongest predictor of intention. Worker routine being the reason behind the intention to leave immediately following a night shift should be challenged. For example, education could target how routine does not allow for a change of situation or appropriate assessment of 'fitness to commute'. This focus should be in addition to the campaign relating to putting others at risk. For interventions targeting day shifts, the advantage of getting home as soon as possible should be the focus. Messages should challenge the advantages of getting home as soon as possible following day shifts (e.g., arriving tired in the middle of the night, family is asleep or not having enough sleep to make the most of one's time off).

11.5.2 Strengths, limitations, and future research

A large number of strengths and limitations of this approach align with those already presented in Section 10.6.3, given the use of the TPB framework to explain the behaviour. Using the TPB, this study was able to provide an initial understanding of the critical beliefs associated with driving immediately following a shift block. A key strength of this study is the use of a well-validated theoretical framework. The critical beliefs examined for the purpose of this chapter were revealed as an outcome of the in-depth interviews rather than through the structured process as prescribed by the TPB, so the critical beliefs presented may be limited to the themes presented in the semi-structured interview protocol. Future research should further examine these beliefs using a more structured approach.

All the proposed targets for interventions are associated with the intention to drive and may be different to the focus for actual behaviour. While much research argues that intentions are predictors of behaviour, the inability to measure behaviour in the current research program results in a limitation about the translation of these intentions into actual behaviour. Future research should further examine the ability of the significant critical beliefs to predict behaviour.

11.6 CHAPTER SUMMARY

Chapter 11 has explored behavioural, normative, and control beliefs through a critical beliefs analysis supported by the application of the TPB. The results revealed that there were differences between the critical beliefs relating to intention following day shifts and night shifts. The variation in intention following day and night shifts supports a difference in proposed interventions between shift types.

The following chapter discusses the overall research findings in line with the Research Objectives and Questions and presents opportunities for interventions based on the research program, the benefits of the proposed approach, the practicalities of implementing those proposed interventions, and the limitations of the interventions given industry guidelines and operational policy.

Chapter 12: Final Discussion and Concluding Remarks

12.1 INTRODUCTION

Chapter 12 provides a general discussion of the findings from the research program. A summary of the key findings is presented, as they relate to each other and to the research questions and objectives (Section 12.2). This summary will also refer to the key research question of *why some mine workers drive home immediately following a shift.* The theoretical implications of the research are then discussed (Section 12.3). Section 12.4 provides an overview and discussion of the practical implications. Overall opportunities for interventions are presented in Section 12.6. Section 12.6 details the strengths and limitations of the research program, which guides the discussion of future research opportunities presented in Section 12.7. The chapter concludes with some overall remarks about the research program and the importance of this research to road and workplace safety (Section 12.8).

12.2 OVERVIEW OF RESEARCH PROGRAM

The aim of this program of research was to examine the key influences affecting workers' decisions to drive home from the worksite immediately after a shift block and to identify opportunities for interventions to reduce the relatively high number of road incidents on a commute home. In order to achieve this aim, the research had four key objectives which were addressed by five research questions. Firstly, in order to understand the issue in a tangible way, it was necessary to *examine the costs of motor vehicle crashes associated with the mining industry workforce in Queensland*. Secondly, self-reported evidence described a situation whereby organisations have limited legislative control over worker decisions to leave site immediately following a shift (Section 5.5.1). Thus, it was important to *explore the parameters of legislative requirements in respect of commuting within a Queensland and Australian mining context*. Thirdly, the relevant literature describes the interaction of various factors in driver decisions, therefore Research Objective 3 aimed to *explore and examine the relationships of individual, social, organisational, and situational influences on worker commuting behaviour and how these key influences impact workers' decisions about driving home immediately following a shift block*. Finally, based on the identified interrelations, the final objective of this research program was to identify opportunities for interventions regarding commuting home from site following a shift block.

The literature review identified a need for further examination of driving home following shifts, specifically in the unique context that is the Australian mining industry. As mentioned previously, the workforce of the mining industry in Australia has been shaped into a long distance commuting workforce due to the distances between sites and major town centres or cities, and the changes associated with the construction of mining camps after the 1980s. The detail in *Figure 12-1* was subjected to iterations during the research program to illustrate the focus on the inter-relationships between the findings of each study and the literature review. The influences on the travelling workforce identified through the research program are detailed in *Figure 12-1*. Those influences with no identified relationship following the completion of Study 4 are illustrated in a lighter font. These key findings will be discussed in the following sections, following a brief overview of each study and its contribution to each of the five Research Questions.

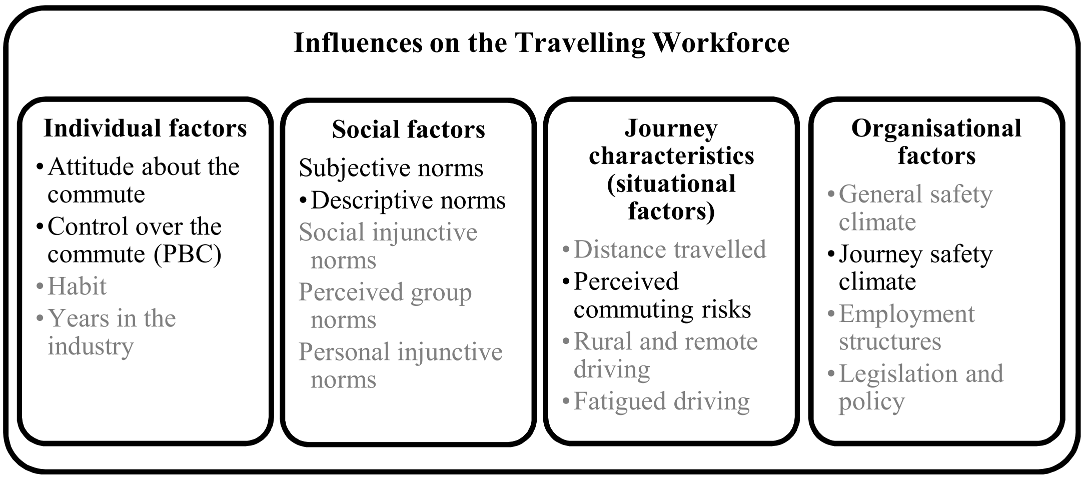


Figure 12-1: **Key influences identified and discussed in this research program**

12.2.1 Summary of key findings

The research program used a mixed methods approach to meet the research objectives. There were four complementary studies. A summary of the key findings and the relationship to the Research Objectives is presented in the following sections.

12.2.1.1 Research Question 1 and 2: Crash circumstances and compensation costs

In order to determine opportunities for interventions, it was important to understand *why workers drive home immediately following shifts and what key influences affect worker decisions to commute immediately after a shift block*. This research program examined the circumstances in which commuting crashes occur in the mining industry. Study 1 was an exploration of workers' compensation journey claims data relating to crashes associated with the mining industry workforce in Queensland between June 2009 and July 2013. The compensation journey claims data were secondary data collected for the purpose of claim lodgement. These data were provided to the researcher by Workplace Health and Safety – Queensland. This study reported on 282 cases. The results highlighted an over-representation of motorcycle crashes, a high proportion of crashes involving animals, crashes occurring in line with peak times during the day, and only a small proportion of crashes being attributable to fatigue or distraction in the sample. From the perspective of compensation claims costs, a large difference between journey claims and workplace-related claims was identified at approximately $20,000, illustrating one measure of the financial impact resulting from commuting-related crashes. A high rate of time lost claims was also identified, arguably a measure of safety performance. This study identified situational factors for further examination within the research program and using secondary data, the importance of further examining the commuting behaviours of mine workers.

Contributing to Research Objective 1, risk factors associated with commuting home from site were identified using workers' compensation journey claims data.

Understanding the risks associated with the commute highlights the suitability of concentrating on a fatigue management approach to managing driving home following shift. As discussed in Chapter 5 (see Section 5.6), the industry focuses on ensuring that the worker is fit to perform their duties once they arrive on site, but little attention is afforded to fitness to commute home. This focus means that workers arrive on site in sufficient time to be well rested prior to work, but does not consider that there is a need to be well-rested prior to commuting home.

While Study 1 was the primary contributor to answering this research question, there were also risks identified through the in-depth interviews (Study 3) which inform this discussion. These risk factors during the journey were analysed using descriptive analyses (Chapter 9) to discuss the situational aspects of the commute. The three key situational factors that were considered as a result of the analysis in Study 1 were the difference between day and night driving, the contribution of fatigue and distraction to crashes, and the involvement of animals in crashes. The results identified that there was an over-representation of motorcycle crashes in the data. Additional risk factors perceived by these workers were also detailed in Section 7.4.9. These factors include storms, other drivers, vehicle maintenance and the road itself. The sample reported details that relate to fatigued driving and rural and remote driving. The results of Study 4 revealed that during the journey home, encountering animals and driving home without stopping were the two factors these workers admitted to encountering frequently across both the day and night samples.

An understanding of the compensation costs associated with these journey-related motor vehicle crashes provides a preliminary estimation of the extent of the problem. While there were a relatively small number of reported crashes over a four-year period, the compensation costs are 40% higher when comparing time lost claims associated with workplace events and journey claims, with a 19 percentage point difference between time lost claims. This result means that journey claims are more likely to result in the worker being away from work for an extended period of time.

Time lost claims resulting from these crashes represent economic and socio-economic loss and further supports the importance of this research effort.

12.2.1.2 Research Question 3: Legislative controls and industry guidelines

Study 2a reported a critical examination of the legislation, internal, and external policies associated with safe work systems within the coal mining industry in Queensland, Australia. This study discusses journey management and fatigue management in the context of on-site and off-site safety. The review of relevant legislation and policy was conducted using a top down approach to highlight the interrelations between legislation and policy, and identify key policies associated with journey management. This review provided an understanding of what commuting behaviour is encouraged or discouraged, which contributed to defining the organisational influences on the travelling workforce. Overall, the legislation and policy blurs the boundaries between on-site and off-site fatigue management. An organisation's fatigue management plan typically considers the journey to work to ensure the worker is fit to perform their duties, but does not consider the journey home as closely. Legislative controls adopted in the mining industry have limited control over the workers leaving site immediately after a shift. The main function of fatigue management plans is to ensure that the worker is able to perform their duties on- site.

Study 2b examined the perceptions of site safety experts regarding the legislation and commuting issue through a focus group. Focus group participants were identified through a pool of site safety experts using expert sampling. The focus group consisted of eight participants. The findings describe three themes. There is an expectation that the workforce complies with the fit for work and fatigue policy, both of which reference commuting. However, the expectations of the site, the enforcement of the policies, and the expectations of the workforce are incompatible. The expert focus group identifying the lifestyle expectations of the workforce highlighted the need for examination of individual and social influences on commuting behaviour.

12.2.1.3 Research Question 4 and 5: Key influences on the travelling workforce and the relationships between identified influences

Study 3 was an exploratory study designed to investigate worker commuting decisions. This study was conducted using in-depth interviews with 37 mine workers from the target mine site. Contributing to Research Objective 3, Study 3 extended the findings of Study 2b, particularly in respect to the workforce expectations theme. Eight themes were identified using a theory-led approach to analysing the data. These themes were discussed in line with the four key influences of individual, social, organisational and situational factors. The in-depth interviews showed that these workers are very safety aware. However, the propensity for these workers to ignore acknowledged risks associated with driving home immediately following shifts is associated with lifestyle, wanting to see family and friends, and that the drive immediately following shift is the responsibility of the worker, not of the mine site.

In line with Research Objective 3, Study 4 statistically explored the outcomes of Study 3 through descriptive analyses and applying the TPB, to determine the most salient and statistically significant influences and the impact of those influences on the immediacy of the commuting decision. A cross-sectional survey was developed based on the findings of Studies 1, 2, and 3. There were 461 responses in total, split between the day (n=239) and night survey (n=222). Participants consisted of workers from all levels of the mine site. The results of the final study, Study 4, were reported across three chapters (Chapters 9, 10, and 11). The results show that these workers travel an average of 437 kilometres (SD = 315kms) to get home. This result highlights that a large number of workers on-site are not complying with the 14 to 16 hour work day (work and commuting time) prescribed by site policy and industry guidelines. It was revealed that those workers finishing day shifts were more likely to leave immediately or stay on site for the night and then drive home the following day. By comparison, there were still a large proportion of night shift workers who left site immediately following the shift; however, the remaining workers slowly leave site during the course of the day following the end of their shift block. There was no notable difference between contracting and permanent employee in respect to time leaving site. From an organisational and journey safety climate perspective, there was support that the target site exhibited a strong safety culture. However, the strong relationship between organisational and journey safety climate had no relationship with intention to drive home immediately after shifts.

The TPB was found to be a satisfactory exploratory framework to describe worker intentions to drive immediately following shifts. Following hierarchal multiple regression analysis, the results showed that the TPB constructs of *attitude*, *subjective norms*, and *PBC*, as well as *descriptive norms* explained 73% and 79% of the variance in *intention* to drive home immediately after day shifts and night shifts, respectively. As reported, the amount of variance explained by the model is much greater than reviewed meta-analyses which report R^2 of .34 (Godin & Kok, 1996) and .39 (Armitage & Conner, 2001). *Group norms* relating to supervisors were not statistically significantly related to *intentions*.

Opportunities for interventions were identified in line with Research Objective 4. Understanding the critical beliefs which underpin individual intentions reveals opportunities for interventions (von Haeften et al., 2001). An analysis of the beliefs identified in the in-depth interviews was performed using Von Haeften et al.'s (2001) proposed analysis method. The results revealed three critical beliefs predicting intention to drive home immediately following day shifts and six critical beliefs for the night shift sample. Following day shifts, the behavioural beliefs of *putting others at risk* and *getting home as soon as possible* significantly predicted intention to drive immediately. Family approval also significantly predicted intention following day shifts. While there were similarities in the results following night shifts in respect to *putting others at risk* and *family approval*, the night sample also revealed statistically significant control beliefs. These beliefs included the facilitators of *carpooling* and *routine*, as well as the barriers of *sick of being on site* and *not wanting to get home tired*.

This research program was exploratory in nature given the focus of previous research on frequency and location of incidents, the practicalities of driving to and from mine sites, as well as physiological studies (Di Milia, 2006; Di Milia & Bowden, 2007; Di Milia et al., 2011). Mining-related research provides an understanding of the effect mine sites have on communities (Carrington & Pereira, 2014) and the impact of FIFO (Taylor & Simmonds, 2009), as well as an understanding of life as a mine worker (McLean, 2012; Misan & Rudnik, 2015). However, to the best of this writer's knowledge, there is no examination or exploration of the decisions associated with driving home immediately following shifts, despite the associated risks.

12.3 THEORETICAL IMPLICATIONS

The findings from the research presented here have a number of theoretical implications. The research was predominantly exploratory in nature, questioning the sole focus of the recommendations of the Coronial Inquiry regarding fatigue management. The contribution of this thesis is the presentation of four key factors to explore and explain why workers drive home immediately following shifts, including individual, normative, and organisational factors, as well as journey characteristics (see *Figure 12-1*). These four key factors distil anecdotal and self-reported evidence and themes. These factors are then examined using an extended TPB framework to describe the statistical significance of the relationships identified throughout the research program.

12.3.1 The TPB – challenging the focus of journey management

This thesis contributes to theory through the exploration of the immediacy of driving decisions following shift blocks. The examination of the decision using the TPB provided structure to the examination of the four key influences identified and discussed throughout the thesis. The presentation of the critical beliefs in Chapter 11 identifies a new direction for post-shift safety in respect to driving home in the mining industry. While a significant amount of policy and academic literature focuses on fatigue management, this thesis presents a new perspective by bringing together and discussing many aspects. Ultimately, the thesis illustrates that key opportunities for interventions lie with the specific behavioural and normative beliefs identified in Chapter 11. However, this thesis reiterates that a one-size fits all approach should not be adopted, and interventions for both day and night shift workers must be considered. This thesis confirms that there is a 'follow the leader' mentality in the mining industry. The inclusion of descriptive norms to explain this behaviour confirms the anecdotal evidence of the expert focus group that there is a perception that driving immediately following a shift is what everyone does in the industry. This perception legitimises driving home immediately following shifts in the minds of all workers.

The TPB framework presented in Chapter 10 enabled the travelling workforce influences which were identified throughout the research program to explain behavioural intentions to leave site immediately following shifts in a parsimonious way. While there was some support for the extended TPB, the results supported the focus on normative (social) factors when developing interventions.

There is a significant amount of policy underpinning fatigue management within the mining industry, particularly in respect to on-site behaviour. However, the application of the TPB through the consideration of the PBC construct reveals a positive relationship with *intention*. PBC specifically measures self-efficacy and perceived control regarding engaging in the behaviour. The strong safety climate of the sample in respect to site and task-related safety climate should result in an increased level of safety performance (Neal et al., 2000). Theoretically, this means that these workers would not engage in risky behaviour (e.g., driving immediately after shifts). However, this thesis demonstrates that these workers acknowledge the risks yet show a high level of intention to engage in the behaviour of driving home immediately following shifts. These workers may actually consider that they are being safe in line with the discussion of the in-depth interviews, thus explaining the high safety climate for the task-related activity.

12.3.2 Safety climate, safety awareness and task-related climate

A further contribution of this research program is associated with the separation of the concept of safety climate into a task-related factor. Given the off-site related task and the findings in Chapter 7 of the perception that commuting safety is the responsibility of the worker, the site safety climate was incomplete in this context; as such, a task-specific measure of safety climate was developed. The findings demonstrated that there is a strong safety climate on-site in respect to both general safety climate and journey safety climate. Literature supports that a strong safety climate is a mediator of safety performance (Neal et al., 2000). While the level of safety performance was not measured in respect to the target site, there are several aspects that should be noted. Study 1 showed that journey claims were over-represented in respect of time lost claims. A large number of time lost claims is usually an indicator of poor safety performance of the organisation. Taking that into consideration, it is arguable that the over-representation of time lost journey claims in the mining industry is an indicator that the safety performance of the industry is relatively poor, despite being a safety conscious industry. Additionally, analysis of the safety climate of the target site describes a high safety climate, from both a general safety climate and site safety climate perspective. However, despite this result, there is significant evidence that the workers on the site are not complying with the fatigue management policies in respect of journey management. This finding is evidenced by the large number of workers who leave site immediately following shifts with more than two hours to drive home. Hence it is argued that safety related behaviours are realised differently on-site compared with off-site behaviours. Overall, there is evidence to suggest that a strong safety climate, which is created through management commitment to safety, education and policies, will have little influence on the intention to drive home immediately following a shift.

Safety awareness, particularly in respect to fatigue management, was identified in the in-depth interviews. The expert focus group also highlighted that workers are aware of their obligations, but the fit to commute home decision is a self-assessment undertaken by the worker without any specific structure or guidance (see Section 6.4.3.1). Given the site perceives that there is little or no control over the commute home, the workers push the boundaries even when there are (limited) organisational policies which prescribe maximum length of work (e.g., 14 to 16 hours including commute). Study 4 indicates a strong safety climate (both task and site), which, in conjunction with the finding of the in-depth interviews in respect to safety awareness, indicates that these workers are aware of the risks (safety awareness) and have an understanding of how to manage the risk associated with driving home after shifts (journey safety motivation). These workers also hold the perception that management supports journey safety (journey safety climate). These findings further show that safety climate does not explain behaviours in environments where there is a positive safety climate but unsafe behaviours intentionally occur. The examination of task safety climate in this context further demonstrates the limitation of safety climate by clearly presenting a situation where a positive safety climate exists and unsafe behaviour intentionally occurs. However, exploring this behaviour using a well-known theoretical framework like the TPB allows further explanation of why, despite these workers having an understanding of the risks, they continue to drive immediately following shifts.

The results associated with journey safety participation should be treated with caution given the limitations associated with the reliability of the measure. These results demonstrate some support for further consideration of task-specific safety climate factors as predictors of behavioural intentions when applying the TPB framework. Upon reflection, there are limitations in the measures used for task-specific safety climate. This limitation is discussed further in the strengths and limitations section presented later in this chapter.

12.3.3 The relative importance of individual, social, situational, and organisational factors on the immediacy of commuting decisions

The iterative identification of factors associated with individual, social, situational and organisational influences provided the framework for the research program and discussion throughout this thesis. Figure 12.1 details the key influences on the travelling workforce following the final study in the research program. Chapter 7 supported the further exploration of social influences in respect to the immediacy of the commuting decision. The importance of social influences on the commuting decision was then supported in Study 4b and Study 4c, with the opinions of others, particularly family, influencing the decision to commute immediately following both day and night shifts. Reflection on the results of the research program supports a primary focus on social influences over the other influences discussed throughout this study. Despite the primary focus on social influences, there was still strong support for individual influences such as attitude about the commute and control over the commute as key influences of the immediacy of commuting intentions following shifts. Chapter 7 supported the importance of these two factors through the themes associated with the responsibility of the commuting decision and the necessity of the commute. Journey characteristics, or situational influences, were acknowledged in respect to perception of the risks associated with the commute itself. Journey characteristics are important in respect to assessing perceived risks; however, while distance travelled does not appear to be a significant predictor of intention to travel immediately (see Section 10.5.2 and Section 10.5.3), there is clear support that workers are more likely to take breaks during longer distance journeys. Finally, organisational influences discussed throughout this study show (theoretically) that the legislation and policy has limited ability to change the immediacy of the commuting decision resulting in workers' non-compliance with organisational policy.

12.4 PRACTICAL IMPLICATIONS

The strong industry-based research program has resulted in a number of practical implications. These implications are discussed in the following sections.

12.4.1 Responsibility for the commute

There is a difference in perception of where the responsibility lies for the commuting. A large proportion of the qualitative sample believed that the responsibility rests with the worker and not the mine site. This assumption leads to the mine worker believing that the site has no control over the workers' commute home from site. However, the mine site considers that there is a dual role (i.e., the worker is responsible for their own safety, as they are when they are on-site), but the primary responsibility falls to the site to ensure that the worker is fit to commute (i.e., the worker has had adequate rest and is able to perform the task of driving the distance to their home).

12.4.2 The difference between day and night shifts

There was a notable difference between driving immediately following day and night shifts. While it was originally reported that there is a tendency for workers to stay on site following a day shift in order to avoid night driving, the results reveal that only a small number of workers stay on site following day shifts. While more workers leave immediately following day shifts when compared to night shifts, there was a tendency to leave site immediately overall. However, if day shift workers do not leave immediately, they take a longer break before driving home. The anecdotal reporting of the variation between behaviour following day and night shifts was originally provided during the expert focus group. While the premise may be correct, there are still a greater number of workers leaving site immediately following day shifts and driving during night hours.

12.4.3 Situational considerations

The situational influences were drawn primarily from Study 1 and Study 3. The risk management response being applied by these workers is in an attempt to reduce the impact of the risk and the probability of the risk occurring (e.g., driving a car made for country roads or being an experienced country driver). These workers are not avoiding the risk completely by leaving at a time when kangaroos are not as active (i.e., times other than dawn or dusk), or resting following a shift and leaving once well-rested rather than immediately. The findings in this study highlight potential considerations for environmental constraints which may impact commuting behaviour (e.g., animals, rural and remote driving, as well as other drivers). These situational factors will assist in understanding the types of factors taken into account prior to the journey home, and these factors may impact commuting behaviour (e.g., time driving, fatigue, and distraction).

12.4.4 Application of risk management to off-site behaviour

The in-depth interviews discussed the concept of safety awareness. Safety awareness stems from individual involvement in a relatively safety conscious industry. There is strong support that the level of safety awareness in the sample was very high. This safety awareness and the associated practical application of safety awareness (risk assessments) were being applied to this out-of-work scenario of commuting home from work. However, the assessments that were being made were biased toward the outcomes in favour of travelling home at a specific time following a shift block (e.g., the reliance on a large vehicle to combat the animals on the road, or a 10-minute rest stop to ensure that the driver is adequately rested). While the principles are being applied appropriately, the risk mitigation strategies arguably do not reduce the likelihood or consequence of an adverse outcome associated with the commute.

12.5 OPPORTUNITIES FOR INTERVENTIONS

Practical implications are associated with the identified factors that should be targeted to complement the current approach to journey management in the mining and resource industry in Australia. The purpose of this research program was to explore the issue of driving-related commuting decisions and present opportunities for interventions. While there are instances where interventions are described, these proposals are made to contextualise the opportunity rather than provide recommended approaches. Further research is required in respect to the messaging and content of these intervention approaches.

The research program has uncovered a number of opportunities for interventions. These opportunities are presented in Table 12-1. Some of these opportunities have been discussed in previous chapters; however, to obtain a complete picture of the potential interventions this research program has identified, it is worthwhile to present these opportunities and the association between them. The opportunities identified in Table 12-1 only consider interventions which could apply to the entire site, regardless of shift type. The shift specific opportunities are presented and discussed in the previous chapters and remain important for more targeted interventions. However, the practicalities of having a targeted intervention strategy for both shift types when workers alternate between shifts on a fortnightly basis must also be considered.

The most important intervention opportunity is related to the journey and was identified through the justification of the scope of the current research. Following discussions with the site and understanding the organisational policy, it became apparent that there is a significant focus on the journey to work and little attention paid to the journey home, so shifting the focus toward targeted journey management strategies for the journey home was vital.

Table 12-1.

Opportunities for intervention based on the findings of the research program

Opportunity for intervention		Focus and requirement	Supporting evidence	Related intervention
1	Interventions should target the journey home.	Policy, education and messaging should focus on targeting the journey home from work.	Study 4a discusses the focus of the material and guidelines which ensure that the worker is fit for work when they arrive on site.	All
2	What are the risk factors?	Education and messaging should communicate the risk factors and peak crash times across a 24 hour period to increase awareness of the risks and promote discussion of the issue and to discuss the appropriateness of proposed risk mitigation strategies. Discuss fatigue-related risks associated with rest breaks.	Study 1 details the risks associated with driving-related commuting from the perspective of workers' compensation claims, including understanding peak crash times. Chapter 3 discusses the application of risk mitigation strategies. Chapter 9 reveals limited rest breaks during journey home, despite 70% of workers leaving within four hours of the end of the shift.	Opportunities for intervention 3 and 5
3	What do the significant others know, particularly family?	Messaging campaigns targeting significant others to ensure awareness of the risks associated with workers leaving immediately after shifts.	Studies 4a and b reveal a strong, positive relationship between the approval of significant others (family particularly) and the intention to leave immediately following shifts. Research supports that workers will rely on the approval of significant others given the behaviour is risky (McEachan et al. 2011)	Opportunities for intervention 2 and 5
4	Who has control over the journey – responsibility?	Education about the allocation of responsibility between worker and employer in respect to the journey.	Studies 2a, 2b and 3 reveal that the worker considers they are primarily responsible for the commute. It is argued that the perception of responsibility results in the limited influence organisational policy has on the commuting decision.	None
5	Changing the attitude about the commute – putting others at risk.	Education about how leaving immediately after a shift puts others at risk in an attempt to influence the attitude about the commute.	Studies 4b and c reveal that workers responded more favourably toward the attitudinal questions about leaving immediately, however workers' intentions are influenced by putting others at risk.	Opportunities for intervention 2 and 3

Education and messaging should focus on identifying the risks of leaving immediately following shifts and how these risks affect others. This education and messaging, should not just focus on the workers themselves, but should also target the workers' families and significant others. There is a strong relationship between the education and messaging requirement of opportunities 2, 3 and 5 outlined in Table 12-1. Finally, workers require education regarding the allocation of the responsibility of the commute. There continues to be a perception that the worker is responsible for their journey home, which arguably limits the effectiveness of organisational policies.

12.5.1 Acknowledging the need for an integrated approach

The title of this thesis calls for a challenge to the current journey management approach adopted in the mining industry in Australia. Chapters 5 and 6 demonstrate that there are limitations in respect to the journey management approaches currently adopted, from unclear responsibilities between the mine site and the worker, to fatigue management on site. These fatigue management guidelines focus on scheduling, hours of service, and fitness to perform site duties in an attempt to manage this multi-faceted problem. The Coronial Inquiry pinpointed a need for additional fatigue countermeasures and fatigue awareness training. While these interventions are necessary, this research has demonstrated that these workers are risk aware and have the skills to perform risk assessments, but despite these factors, still engage in driving immediately following shifts. This research does not underestimate the importance of workers having a working knowledge of the legislation and policy frameworks they operate within. These guidelines address the factors that are in the direct control of the organisation; however, limited attempts have been made to address the social or individual factors that may contribute to the commuting risk. The policies do not attempt to assess the likely social and individual impacts on the commuting decision or even make reference to managing risk, through acknowledging these factors.

This research illustrates that there are attitudinal, normative, and control factors that influence workers' intentions to drive immediately after shift. Beyond those factors, these workers rely on family approval, routine, and being sick of being on site to justify the intention to drive immediately. However, there is concern associated with putting others at risk by leaving immediately. While it is acknowledged that these factors are difficult to implement into guidelines and policies, understanding these factors and beliefs and developing appropriate messaging and education to complement the fatigue management approach is necessary. The anecdotal evidence is that these workers present for work earlier than expected to ensure that they are fit to perform their duties on-site at the beginning of a shift. This behaviour may be associated with the policies and motivations associated with work. However, motivations associated with the end of shift are very different but are not integrated into a journey management approach in the same way as the start of the shift. The problem of driving home following shifts is currently framed in the same way that on-site and journey to work fatigue management issues are framed. As such, this research, motivated from the findings of the Coronial Inquiry, questions the approach of implementing fatigue management countermeasures and providing updated fatigue management training, particularly if the focus remains on-site related issues, such as rostering, hours of work, and fitness for work. While practical recommendations such as developing fatigue management parameters and clearer guidance material to workers should be considered, any training or education should be an integrated approach that considers both on- and off-site expectations.

12.6 STRENGTHS AND LIMITATIONS OF THE RESEARCH PROGRAM

The strengths and limitations associated with each study have been presented throughout this thesis. This section will discuss the strengths and limitations of the overall research program.

This research is the first to present a theoretically-based direction for interventions associated with driving home immediately following shifts. The research is based on a solid theoretical framework and examines and provides structure to anecdotal evidence offered by site safety experts within the mining industry.

A limitation of the research is the focus on one site, which was due to the need for an exploratory examination. As outlined in Chapter 3, as an initial step toward understanding the influence of safety climate on driving home immediately following shift, as well as the influence of specific site safety requirements, the examination of one site was necessary. There are limitations in the generalisability of these results given the focus on one DIDO site. However, the sample is generally representative of the mining population, since a large proportion of the site was sampled (93.7%). Furthermore, the sample covered all levels of the organisation, from operational-level workers through to management. While the sample was only drawn from one mine site, the average number of years in the industry for participants indicates a high level of experience in the industry. A further limitation of the sample was the treatment of small number of daily commuters within the survey sample as a single group. As discussed in Section 3.2, given the remoteness of the site and the distances these daily commuters are required to travel home, there are still risks associated with the commute. Future research should consider similar research across multiple sites.

The focus on Queensland, Australia is an identifiable limitation, particularly in respect to the examination of legislation and policy. Given that this research distilled information to focus on specific aspects of commuting behaviour, the context of this behaviour needed to be identified. Future research could undertake similar research in other mining communities in Australia and internationally to determine if these results are specific to Queensland-based workers, Australian workers or if the identified influences for driving are replicable internationally in other mining-heavy countries.

The site roster was based on a 7 day on, 7 day off day, night rotation. While the site was identified as a DIDO site, there was a chance that a small subset of the sample travelled to and from the site on a daily basis. While the survey did not specifically address this question, there were few commuters travelling less than 200 kilometres. Furthermore, given the distance to the closest township, there continue to be risks that require addressing, as identified in Section 3.2. As highlighted in Chapter 2, some sites have a mid-roster change from day to night and this may influence commuting behaviour following shift. The focus on one shift type during a rotation is a limitation given the variation in shift types across the industry. This limitation means that there may be differences between sites that operate using a mid-shift change from day to night shift. However, the exploratory nature of this research called for an understanding of behaviour and intentions following night shifts and day shifts. The clear distinction between shift type because of the roster benefited this exploratory design as the workers could clearly distinguish their behaviour when finishing day shift or night shifts.

The measures used to assess general and journey safety climate demonstrated that there was no relationship between safety climate and intention to drive immediately following shifts. Upon reflection, these measures examined the journey home in general, rather than driving immediately following shifts, particularly to examine the association with intention using the TPB. For example, *"management places a strong emphasis on not driving home immediately following a night shift"* could be used to more appropriately measure journey safety climate and its relationship with intention in the TPB framework. Future research should consider constructing journey safety climate measures in line with the above proposal.

Upon reflection, the concept of responsibility for the commute should have been included in the survey to further understand the perceived control the worker has over the commute. The strength of responsibility throughout the research provides support for the proposed opportunity for intervention; however, further research should examine the relationship between PBC and responsibility to confirm the appropriateness of this intervention.

The data collected are based on the self-reported intentions of these workers engaging in a behaviour that is known to be a contentious issue on the worksite. These self-reported data are subject to self-presentational biases due to the self-reporting requirement and the completion of the surveys during work hours. Participants may have responded in line with their perceptions of the company's commuting policy, ill-defined as that is. While this limitation should be acknowledged, data collected in respect of past behaviour (e.g., time to leave site) provides evidence that these workers are reporting their intention. It is noted that 51% of respondents admit to leaving site within two hours of the shift block. While the site safety experts debated a joint responsibility in respect to the journey home, the in-depth interviews highlight a firm belief that these workers believe that they are individually responsible for safe commuting.

12.7 FUTURE RESEARCH PRIORITIES

This thesis focused on the mining sector given the unique nature of travel within the industry. There are applications of this research to other industries, especially where shift-work is a dominant form of rostering. These shift-work-heavy industries arguably have the same problem in respect to commuting following shifts (e.g., medical practitioners and transport operators, such as taxi and bus operators). While these occupations are not required to travel significant distances following shifts, fatigue research presented here demonstrates that there is still an increased crash risk following shift-work, even when only travelling short distances. Rather than implementing fatigue-based guidelines as the only solution in these other industries, consideration should be afforded to examining those factors that influence these workers driving rather than taking public transport or having a friend or family member drive them home after shift. As with this research, opportunities for interventions could be considered.

The present research evidence demonstrates that commuting following shifts is problematic, specifically following night shifts. Lessons from this research should identify that even in highly risk-conscious industries, workers will assess the risks associated with the commute. However, there is limited weight placed on the outcome of the risk assessment. It is likely that workers will justify their commute home using risk mitigation techniques. Future research should further explore the reliance on these risk mitigation strategies to justify risk exposure.

A limitation of this thesis was the constraint in measuring planned or actual behaviour. Future research should consider methods to capture this construct. Future research should also examine objective data to provide comparisons between the actual times that workers leave the site and their recorded breaks. These data could be captured through observations at the site gate.

This thesis only examined the journey home after finishing a shift and did not consider the journey to work. Future research should compare behaviours between driving to work and driving from work. The focus group highlighted that the policies are easier to enforce travelling to work than travelling home. Research could examine the difference between behaviour and expectations when travelling to work compared to travelling home.

There was a strong suggestion in the in-depth interviews that habits are an important predictor of commuting decisions. However, the construct was not a predictor of intention (Chapter 10). Upon reflection, the control facilitator of routine was a better way to measure habitual behaviour. Given there were limitations in respect to the behaviour construct, further research should measure routine against intention and behaviour to see if there are potential interventions here.

Finally, future research must examine the value of the interventions proposed, particularly relating to the opportunities for interventions identified in Table 12-1. While it is acknowledged that this research would have benefited from trialling or piloting the proposed interventions, the research program was positioned as exploratory in order to define the problem for further examination. Furthermore, the resource constraints associated with the research program were inhibitory. Table 12-1 identifies five interventions which could form independent research projects relating to changing the commuting behaviour of the DIDO workforce.

12.8 CONCLUDING REMARKS

This thesis contributes to the theoretical and practical understanding of commuting behaviour within the mining industry in Australia. The exploration of driving decisions following shifts was guided by the well-known TPB and ultimately presented opportunities for interventions to complement fatigue management policies and education. While previous research reports that there are only a small number of reported journey crashes, this industry represents the highest contributor of journey crashes among all industries (Safe Work Australia, 2012). When a crash does occur, compensation payments far exceed other workplace incidents, with the compensation cost of a journey claim averaging nearly 40% more than a workplace incident. This result emphasises the need for an alternative approach to journey management to limit the number of crashes occurring.

This research is unique in a number of ways. Through an exploratory methodology, this research identified the key influences of workers' decisions to drive home immediately following shifts. As a result of the Coronial Inquiry in 2011, the mining industry in Queensland has attempted to control the driving-related commuting problem by the introduction of *QGN16*, increasing fatigue countermeasures and fatigue awareness training. In the introduction, this study described responses to these recommendations as relatively ad hoc. The iterative investigation of the driving-related commuting problem throughout this thesis has revealed that while the recommendations to implement fatigue training are important, there are large gaps in the educative approach. Using an understanding of the organisational policies and identified limitations, this research proposed a new focus for intervention approaches – challenging the focus of journey management. This thesis presents an opportunity for future research to consider the analysis of driving decisions so as to identify evidence-based interventions. Using this approach reveals that while these workers acknowledge the risks associated with driving immediately following shifts, the reward of getting home and seeing their family outweighs those perceived risks.

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Appendices

Appendix A

Expert focus group interview protocol

1. What are the current pieces of legislation you refer to in your day to day work as health and safety experts?
2. How are workers and management informed about rules and regulations on your site?
3. What is the legislation that controls commuting behaviours in Queensland?
4. How does the legislation in Queensland control commuting behaviours?
5. What do you think is not covered by the legislation in respect to commuting?
6. Do you think that the gaps in the legislation expose you to risk? If so, how?
7. Does the legislation require your organisation to include policies regarding commuting in your fatigue management plans or site management plans? If so, how?
8. How does the legislation make it easier or more difficult for you to address this issue as an organisation?
9. Do you think these rules and regulations can be used to provide a platform to address worker commuting behaviour? Why or why not?
10. What are the current industry standards and guidelines you refer to in your day to day work as health and safety experts?
11. What are the current industry standards and guidelines that provide guidance in relation to commuting behaviours?
12. How do current industry standards and guidelines help you to respond to and control commuting behaviours?
13. What does your organisation do to manage workers' journey to and from work? What is your organisational policy? How does your organisation control commuting behaviour?
14. How do your practices differ from practices prescribed in the legislation or in industry guidelines?
15. How do workers' respond to the site's management of this issue?
16. Why don't you think that all workers' respond favourably to the policies you have in place?
17. Do you think that workers see that it's their responsibility or yours to remain safe when commuting? Where do you think the responsibility lies?
18. How do on-site safety behaviours transfer to off-site safety behaviours?
19. How well does the legislation create a safe environment and do you think there is any flow on impact upon behaviours that occur outside work?
20. What control do you have over off-site behaviours i.e., commuting?
21. What is commuting behaviour like at your site?

Appendix B

In-depth interview Protocol

Background, life themes and history

- Age
- Gender
- Occupation
- Shift performed
- Length of time in the industry
- Have you had any incidents before or after work on your trip home?
- What are the reasons that you drive such long distances to and from site?

Circumstances of the commute

- Tell me about your trip to and from work
- How far do you drive to get to and from work?
- What did you think about DIDO work when you first started? What do you think about it now? Why do you do it?
- Do you do anything to prepare for your trip to and from work?
- Do you plan your trip to and from work? Tell me about the types of things you plan OR Tell me why you don't plan your trip.
- Have you considered changing the way you get to and from work in any way?

Driver Safety

- Has there ever been a time that you thought that it was unsafe for you to drive to or from work? Explain the situation.
- Do you consider yourself a safe driver? Why or why not?
- Are there times you worry about driving to and from work?

Company expectations and site culture

- What does your company expect you to do before you drive to or from work?
- How is this site different to other sites?
- Who do you think is responsible for your safety on the road? Why?

Social expectations

- What do your family and/or friends think about DIDO work?
- Do your family or friends make any comments to you about driving to and from work?
- Have you ever discussed the drive to and from work with some of the guys on your crew? What do they think about DIDO work?

Appendix C

Day Survey

DRIVING HOME AFTER DAY SHIFT BLOCKS

Thank you for agreeing to participate in this questionnaire. All the information that you provide is anonymous and confidential.

This questionnaire asks you to consider your commute home from work following a typical day shift block. Your participation primarily involves reading some statements and providing your responses on a scale. The questionnaire should take about 10 minutes to complete.

If you drive home, tell me about your drive. If you fly home, please base your responses on your drive to the airport. If you car pool, please concentrate on the times that you are the designated driver.

Please provide a response to each question – there are no right or wrong answers, we are interested in your thoughts.

A participant information sheet has been provided to you. The participant information sheet contains information about the project, your participation in the project, the expected benefits and risks associated with the research, as well as information about privacy and confidentiality.

You have the right to withdraw from participation at any stage prior to handing your completed questionnaire back to the researcher.

PLEASE NOTE:
For the purposes of this study, please respond about your journey home after you have finished your rostered day shift block. In this case, <u>the term "immediately", includes time for you to pack your car, have a shower, have something to eat and leave the site following your day shift block.</u>
If you don't drive the entire way, please focus on the car leg of your journey. If you car pool, please focus on the times you drive the vehicle.
Each question will require you to respond on a scale and will ask you to circle the number or word which best describes your response to the statement. Please respond to each statement.

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SECTION A: DRIVING HOME AFTER YOUR DAY SHIFT BLOCK

Section A asks questions about driving home after your day shift block

Question 1:

a) In the last month, **I have typically driven home immediately after finishing a day shift block** (please circle the response most appropriate to you):

Never	Rarely	Not often	Sometimes	Slightly often	Often	Very often

Question 2:

a) How many of the **people who are important to you would approve** of you driving home **immediately** after a day shift block in a typical month (please circle the response most appropriate to you):

None	A few	Some	About half	Many	Majority	All

b) During a typical month, how likely is it that the following individuals or groups of **people would approve of you** driving home **immediately** after finishing a typical day shift block (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Family	1	2	3	4	5	6	7
Friends (other than co-workers)	1	2	3	4	5	6	7
Co-workers	1	2	3	4	5	6	7
Supervisor/Manager	1	2	3	4	5	6	7

c) During a typical month, how much would the following individuals or groups of people agree that driving home immediately after a day shift block is a good thing to do (please circle the response most appropriate to you on each line):

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
Co-workers	1	2	3	4	5	6	7
Supervisor/Manager	1	2	3	4	5	6	7

d) During a typical month, how many of the following individuals or groups of people would drive home immediately after a day shift block (please circle the response most appropriate to you on each line):

	None	A few	Some	About half	Many	Majority	All
Co-workers	1	2	3	4	5	6	7
Supervisor/Manager	1	2	3	4	5	6	7

Question 3:

a) How likely is it that the following **factors would encourage you to drive home immediately** after finishing a day shift block in a typical month (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Driving home with others (e.g., car pooling)?	1	2	3	4	5	6	7
Following what others do (e.g., co-workers)	1	2	3	4	5	6	7
Needing to be somewhere by a certain time (e.g., home, airport etc.)?	1	2	3	4	5	6	7
Leaving when I do because that's my routine?	1	2	3	4	5	6	7
Leaving when I do because my family want me home?	1	2	3	4	5	6	7
Being an experienced long distance driver?	1	2	3	4	5	6	7
Owing a car made for country roads?	1	2	3	4	5	6	7
Sick of being on site?	1	2	3	4	5	6	7
To get the drive over and done with?	1	2	3	4	5	6	7

b) How likely is it that the following **factors would prevent you from driving home immediately** after finishing a day shift block in a typical month **(i.e., would result in you taking a break/not leaving shortly after the end of the shift block)** (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Listening to family's concerns about travel?	1	2	3	4	5	6	7
Complying with workplace journey management policies?	1	2	3	4	5	6	7

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Attempting to avoid driving at dusk (e.g., animals on the road)?	1	2	3	4	5	6	7
Avoiding night driving?	1	2	3	4	5	6	7
Feeling tired?	1	2	3	4	5	6	7
Seeing an accident in the past 12 months?	1	2	3	4	5	6	7
Being involved in an accident in the past 12 months?	1	2	3	4	5	6	7
Being trained in fatigue management?	1	2	3	4	5	6	7
Wanting to get home in one piece?	1	2	3	4	5	6	7
Not wanting to get home tired?	1	2	3	4	5	6	7

Question 4:
During a typical month, how likely is it that **driving home** **immediately** after finishing a day shift block **will result in the following** (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Putting other road users at risk?	1	2	3	4	5	6	7
Putting me at risk?	1	2	3	4	5	6	7
Making the most of my time off?	1	2	3	4	5	6	7
Seeing my family as soon as possible?	1	2	3	4	5	6	7
Getting home as soon as possible?	1	2	3	4	5	6	7
Getting off site as soon as possible?	1	2	3	4	5	6	7
Will not comply with what the SSE/site has told us about driving home?	1	2	3	4	5	6	7
Breaking the road rules?	1	2	3	4	5	6	7
Not being covered by insurance if involved in an accident	1	2	3	4	5	6	7
Being involved in a crash on my way home?	1	2	3	4	5	6	7
Being involved in a near miss on my way home?	1	2	3	4	5	6	7
Taking a risk?	1	2	3	4	5	6	7

Question 5:

a) For me, driving home **immediately** after finishing a day shift block in a typical month would be (please circle the response most appropriate to you on each line):

Negative	1	2	3	4	5	6	7	**Positive**
Unnecessary	1	2	3	4	5	6	7	**Necessary**
Breaking the rules	1	2	3	4	5	6	7	**Complying with the rules**
Worthless	1	2	3	4	5	6	7	**Beneficial**
Unwise	1	2	3	4	5	6	7	**Wise**

b) In the industry, **how many people do you think drive home immediately** after a day shift block in a typical month? (please circle the response most appropriate to you):

None	**A few**	**Some**	**About half**	**Many**	**Majority**	**All**

Remember, the term "immediately" in this questionnaire, includes time for you to pack your car, have a shower, have something to eat and leave the site following your day shift block.

Question 6:

Please circle the response most appropriate to you on each line **based on what you would do in a typical month**:

	Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Agree**	**Strongly agree**
I intend to drive home immediately after finishing my day shift block	1	2	3	4	5	6	7
Driving home immediately after finishing my day shift block is within my control	1	2	3	4	5	6	7
I feel that driving home immediately after a day shift block is something I ought to do	1	2	3	4	5	6	7
Most people who are important to me would support me if I drove home immediately after finishing my day shift block	1	2	3	4	5	6	7
Driving home immediately after finishing a day shift block is something I do without thinking	1	2	3	4	5	6	7
It is likely that I will drive home immediately after finishing my day shift block	1	2	3	4	5	6	7

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Driving home immediately after finishing a day shift block is something I do automatically	1	2	3	4	5	6	7
Driving home immediately after finishing my day shift block is up to me	1	2	3	4	5	6	7
The people in my life whose opinions I value would approve of me driving home immediately after finishing a day shift block	1	2	3	4	5	6	7
Driving home immediately after finishing a day shift block is something I have been doing for a long time	1	2	3	4	5	6	7
Driving home immediately after a day shift block would go against my principles	1	2	3	4	5	6	7
It would be easy for me to drive home immediately after finishing my day shift block	1	2	3	4	5	6	7
I am willing to drive home immediately after finishing my day shift block	1	2	3	4	5	6	7
Driving home immediately after finishing a day shift block is part of my end of shift routine	1	2	3	4	5	6	7
Most people who are important to me think that driving home immediately after a day shift block is something that one ought to do	1	2	3	4	5	6	7

SECTION B: ORGANISATIONAL & DRIVING SAFETY PRACTICES

Section B seeks your thoughts about safety practices in the organisation relating to general safety and journey safety.

Question 7:

This section asks about **safety practices relating to your journey home.** For the statements below, please circle the response most appropriate to you on each line:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Management places a strong emphasis on journey management	1	2	3	4	5	6	7
I feel that it is worthwhile to put in effort to improve my personal safety in respect to my journey home	1	2	3	4	5	6	7
Within the organisation, I promote the journey management policies associated with the journey home from work	1	2	3	4	5	6	7

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Journey home policies are given high priority by management	1	2	3	4	5	6	7
I feel that it is important to maintain my safety while driving home at all times	1	2	3	4	5	6	7
I believe that it is important to reduce the risk of accidents and incidents on the road when driving home from work	1	2	3	4	5	6	7
I put in extra effort to improve the safety of my journey home from work	1	2	3	4	5	6	7
Management considers journey home policies to be important	1	2	3	4	5	6	7

Question 8:
The next section asks about **safety practices** **while you are** **on the worksite conducting your duties.** For the statements below, please circle the response most appropriate to you on each line:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Management places a strong emphasis on workplace health and safety	1	2	3	4	5	6	7
I promote the safety program within the organisation	1	2	3	4	5	6	7
I feel that it is worthwhile to put in effort to improve my personal safety onsite	1	2	3	4	5	6	7
I use the correct safety procedures for carrying out my job	1	2	3	4	5	6	7
Safety is given a high priority by management	1	2	3	4	5	6	7
I feel that it is important to maintain safety at all times	1	2	3	4	5	6	7
I use all the necessary safety equipment to do my job	1	2	3	4	5	6	7
Management considers safety to be important	1	2	3	4	5	6	7
I put in extra effort to improve the safety of the workplace	1	2	3	4	5	6	7
I ensure the highest levels of safety when I carry out my job	1	2	3	4	5	6	7
I believe that it is important to reduce the risk of accidents and incidents in the workplace	1	2	3	4	5	6	7
I voluntarily carry out tasks or activities that help to improve workplace safety	1	2	3	4	5	6	7

Question 9:
For the statements below, please circle the response most appropriate to you on each line.

During your journey home following a day shift block in a typical month, <u>how often do you:</u>

	Never	Rarely	Sometimes	About 50% of the time	Most of the time	Majority of the time	Every time
Drive in unfamiliar areas or settings	1	2	3	4	5	6	7
Drive on unsealed roads	1	2	3	4	5	6	7
Encounter wild animals or livestock on the road	1	2	3	4	5	6	7
Drive while tired	1	2	3	4	5	6	7
Drive longer than 2 hours without stopping for a break	1	2	3	4	5	6	7
Drive home without stopping	1	2	3	4	5	6	7
Hit livestock or animal	1	2	3	4	5	6	7
Drive while under time pressure	1	2	3	4	5	6	7
Lose concentration	1	2	3	4	5	6	7
Drive even though you suspect you may be over the legal blood alcohol limit	1	2	3	4	5	6	7
Disregard the speed limit on a highway	1	2	3	4	5	6	7
See an accident or the aftermath of an accident	1	2	3	4	5	6	7
Stop for a nap	1	2	3	4	5	6	7

SECTION C: GENERAL INFORMATION

Section C seeks information about **you and your drive home after your day shift block**. Please provide a response to all questions:

Age: ____________

Are you: ☐ Male ☐ Female

What is your relationship status?
- ☐ Single
- ☐ Married
- ☐ Divorced
- ☐ Separated
- ☐ De-facto

Are you:
- ☐ Permanent employee (employed by the mine)
- ☐ Contractor
- ☐ Other (please specify): ________________________

What is your job at the mine: ____

What is the postcode of your home address: ________________________________

How long (hours/mins) is a typical day shift for you? __________________________

Approximately how many kilometres is it from your home to the worksite?
____

What type of roster do you typically work:
- ☐ 7 on / 7 off
- ☐ 14 on / 7 off
- ☐ 5 on / 2 off
- ☐ 8 on / 6 off
- ☐ 12 on / 9 off
- ☐ Other (please specify):_____________________

Where do you usually drive to after a day shift block
- ☐ Home
- ☐ Airport
- ☐ Friend's house
- ☐ Other (please specify):________________________

What do you think is a reasonable distance for someone to travel to get home from work?
____

Approximately how long (hours/mins) does it usually take you to drive home after a day shift block?
____

How many years have you worked in the industry?
____

In the last three years how many demerit points have you lost from your driver's licence?
____

If you have a break after a day shift block, before you drive home, typically how long (hours/mins) is it?
____

When driving home from site following a day shift block, how many hours do you usually drive before you stop and take a break?
____

If you take a break during your journey home from site following a day shift block, how long do you usually stop for?
____

Typically I spend 50% or more of my journey home following a day shift block:
- ☐ Driving a car
- ☐ As a passenger in a car
- ☐ Flying
- ☐ On a Bus
- ☐ Other (please specify):____________________

If you car pool, who organised it?
- ☐ Manager
- ☐ Crew
- ☐ Myself
- ☐ Other (please specify):______________

Are you paid for your journey home from the worksite after your shift block? ☐ Yes ☐ No

How many times would you normally stop during your trip home following a day shift block?
____

– Thank you for taking the time to complete this questionnaire –

Should you have any questions about this research, please contact Candice Potter: c4.potter@qut.edu.au

Appendix D

Night Survey

DRIVING HOME AFTER NIGHT SHIFT BLOCKS

If you typically work day shifts, please let me know and I will give you a different questionnaire.

Thank you for agreeing to participate in this questionnaire. All the information that you provide is anonymous and confidential.

This questionnaire asks you to consider your commute home from work following a typical night shift block. Your participation primarily involves reading some statements and providing your responses on a scale. The questionnaire should take about 10 minutes to complete.

If you drive home, tell me about your drive. If you fly home, please base your responses on your drive to the airport. If you car pool, please concentrate on the times that you are the designated driver.

Please provide a response to each question – there are no right or wrong answers, we are interested in your thoughts.

A participant information sheet has been provided to you. The participant information sheet contains information about the project, your participation in the project, the expected benefits and risks associated with the research, as well as information about privacy and confidentiality.

You have the right to withdraw from participation at any stage prior to handing your completed questionnaire back to the researcher.

PLEASE NOTE:
For the purposes of this study, please respond about your journey home after you have finished your rostered night shift block. In this case, the term "immediately", includes time for you to pack your car, have a shower, have something to eat and leave the site following your night shift block.
If you don't drive the entire way, please focus on the car leg of your journey. If you car pool, please focus on the times you drive the vehicle.
Each question will require you to respond on a scale and will ask you to circle the number or word which best describes your response to the statement. Please respond to each statement.

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SECTION A: DRIVING HOME AFTER YOUR NIGHT SHIFT BLOCK

Section A asks questions about driving home after your night shift block

Question 1:

a) In the last month, **I have typically driven home immediately after finishing a night shift block** (please circle the response most appropriate to you):

Never	Rarely	Not often	Sometimes	Slightly often	Often	Very often

Question 2:

a) How many of the **people who are important to you would approve** of you driving home **immediately** after a night shift block in a typical month (please circle the response most appropriate to you):

None	A few	Some	About half	Many	Majority	All

b) During a typical month, how likely is it that the following individuals or groups of **people would approve of you** driving home **immediately** after finishing a typical night shift block (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Family	1	2	3	4	5	6	7
Friends (other than co-workers)	1	2	3	4	5	6	7
Co-workers	1	2	3	4	5	6	7
Supervisor/Manager	1	2	3	4	5	6	7

c) During a typical month, how much would the following individuals or groups of **people agree** that driving home **immediately** after a night shift block is a **good thing to do** (please circle the response most appropriate to you on each line):

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
Co-workers	1	2	3	4	5	6	7
Supervisor/Manager	1	2	3	4	5	6	7

d) During a typical month, how many of the following individuals or groups of people **would drive home immediately** after a night shift block (please circle the response most appropriate to you on each line):

	None	A few	Some	About half	Many	Majority	All
Co-workers	1	2	3	4	5	6	7
Supervisor/Manager	1	2	3	4	5	6	7

Question 3:

a) How likely is it that the following **factors would encourage you to drive home immediately** after finishing a night shift block in a typical month (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Driving home with others (e.g., car pooling)?	1	2	3	4	5	6	7
Following what others do (e.g., co-workers)	1	2	3	4	5	6	7
Needing to be somewhere by a certain time (e.g., home, airport etc.)?	1	2	3	4	5	6	7
Leaving when I do because that's my routine?	1	2	3	4	5	6	7
Leaving when I do because my family want me home?	1	2	3	4	5	6	7
Being an experienced long distance driver?	1	2	3	4	5	6	7
Owing a car made for country roads?	1	2	3	4	5	6	7
Sick of being on site?	1	2	3	4	5	6	7
To get the drive over and done with?	1	2	3	4	5	6	7

b) How likely is it that the following **factors would prevent you from driving home immediately** after finishing a night shift block in a typical month **(i.e., would result in you taking a break/not leaving shortly after the end of the shift block)** (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Listening to family's concerns about travel?	1	2	3	4	5	6	7
Complying with workplace journey management policies?	1	2	3	4	5	6	7
Attempting to avoid driving at dawn (e.g., animals on the road)?	1	2	3	4	5	6	7

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Avoiding night driving?	1	2	3	4	5	6	7
Feeling tired?	1	2	3	4	5	6	7
Seeing an accident in the past 12 months?	1	2	3	4	5	6	7
Being involved in an accident in the past 12 months?	1	2	3	4	5	6	7
Being trained in fatigue management?	1	2	3	4	5	6	7
Wanting to get home in one piece?	1	2	3	4	5	6	7
Not wanting to get home tired?	1	2	3	4	5	6	7

Question 4:
During a typical month, how likely is it that **<u>driving home</u> immediately** after finishing a night shift block **<u>will result in the following</u>** (please circle the response most appropriate to you on each line):

	Very unlikely	Quite unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Quite likely	Very likely
Putting other road users at risk?	1	2	3	4	5	6	7
Putting me at risk?	1	2	3	4	5	6	7
Making the most of my time off?	1	2	3	4	5	6	7
Seeing my family as soon as possible?	1	2	3	4	5	6	7
Getting home as soon as possible?	1	2	3	4	5	6	7
Getting off site as soon as possible?	1	2	3	4	5	6	7
Will not comply with what the SSE/site has told us about driving home?	1	2	3	4	5	6	7
Breaking the road rules?	1	2	3	4	5	6	7
Not being covered by insurance if involved in an accident	1	2	3	4	5	6	7
Being involved in a crash on my way home?	1	2	3	4	5	6	7
Being involved in a near miss on my way home?	1	2	3	4	5	6	7
Taking a risk?	1	2	3	4	5	6	7

Question 5:

a) For me, driving home **immediately** after finishing a night shift block in a typical month would be
(please circle the response most appropriate to you on each line):

Negative	1	2	3	4	5	6	7	**Positive**
Unnecessary	1	2	3	4	5	6	7	**Necessary**
Breaking the rules	1	2	3	4	5	6	7	**Complying with the rules**
Worthless	1	2	3	4	5	6	7	**Beneficial**
Unwise	1	2	3	4	5	6	7	**Wise**

b) In the industry, **how many people do you think drive home immediately** after a night shift block in a typical month? (please circle the response most appropriate to you):

None	**A few**	**Some**	**About half**	**Many**	**Majority**	**All**

Remember, the term "immediately" in this questionnaire, includes time for you to pack your car, have a shower, have something to eat and leave the site following your night shift block.

Question 6:

Please circle the response most appropriate to you on each line **based on what you would do in a typical month**:

	Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Agree**	**Strongly agree**
I intend to drive home immediately after finishing my night shift block	1	2	3	4	5	6	7
Driving home immediately after finishing my night shift block is within my control	1	2	3	4	5	6	7
I feel that driving home immediately after a night shift block is something I ought to do	1	2	3	4	5	6	7
Most people who are important to me would support me if I drove home immediately after finishing my night shift block	1	2	3	4	5	6	7
Driving home immediately after finishing a night shift block is something I do without thinking	1	2	3	4	5	6	7
It is likely that I will drive home immediately after finishing my night shift block	1	2	3	4	5	6	7

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Driving home immediately after finishing a night shift block is something I do automatically	1	2	3	4	5	6	7
Driving home immediately after finishing my night shift block is up to me	1	2	3	4	5	6	7
The people in my life whose opinions I value would approve of me driving home immediately after finishing a night shift block	1	2	3	4	5	6	7
Driving home immediately after finishing a night shift block is something I have been doing for a long time	1	2	3	4	5	6	7
Driving home immediately after a night shift block would go against my principles	1	2	3	4	5	6	7
It would be easy for me to drive home immediately after finishing my night shift block	1	2	3	4	5	6	7
I am willing to drive home immediately after finishing my night shift block	1	2	3	4	5	6	7
Driving home immediately after finishing a night shift block is part of my end of shift routine	1	2	3	4	5	6	7
Most people who are important to me think that driving home immediately after a night shift block is something that one ought to do	1	2	3	4	5	6	7

SECTION B: ORGANISATIONAL & DRIVING SAFETY PRACTICES

Section B seeks your thoughts about safety practices in the organisation relating to general safety and journey safety.

Question 7:

This section asks about **safety practices relating to your journey home.** For the statements below, please circle the response most appropriate to you on each line:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Management places a strong emphasis on journey management	1	2	3	4	5	6	7
I feel that it is worthwhile to put in effort to improve my personal safety in respect to my journey home	1	2	3	4	5	6	7
Within the organisation, I promote the journey	1	2	3	4	5	6	7

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
management policies associated with the journey home from work							
Journey home policies are given high priority by management	1	2	3	4	5	6	7
I feel that it is important to maintain my safety while driving home at all times	1	2	3	4	5	6	7
I believe that it is important to reduce the risk of accidents and incidents on the road when driving home from work	1	2	3	4	5	6	7
I put in extra effort to improve the safety of my journey home from work	1	2	3	4	5	6	7
Management considers journey home policies to be important	1	2	3	4	5	6	7

Question 8:
The next section asks about **safety practices while you are on the worksite conducting your duties.** For the statements below, please circle the response most appropriate to you on each line:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Management places a strong emphasis on workplace health and safety	1	2	3	4	5	6	7
I promote the safety program within the organisation	1	2	3	4	5	6	7
I feel that it is worthwhile to put in effort to improve my personal safety onsite	1	2	3	4	5	6	7
I use the correct safety procedures for carrying out my job	1	2	3	4	5	6	7
Safety is given a high priority by management	1	2	3	4	5	6	7
I feel that it is important to maintain safety at all times	1	2	3	4	5	6	7
I use all the necessary safety equipment to do my job	1	2	3	4	5	6	7
Management considers safety to be important	1	2	3	4	5	6	7
I put in extra effort to improve the safety of the workplace	1	2	3	4	5	6	7
I ensure the highest levels of safety when I carry out my job	1	2	3	4	5	6	7
I believe that it is important to reduce the risk of accidents and incidents in the workplace	1	2	3	4	5	6	7

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I voluntarily carry out tasks or activities that help to improve workplace safety	1	2	3	4	5	6	7

Question 9:
For the statements below, please circle the response most appropriate to you on each line.

During your journey home following a night shift block in a typical month, <u>how often do you:</u>

	Never	Rarely	Sometimes	About 50% of the time	Most of the time	Majority of the time	Every time
Drive in unfamiliar areas or settings	1	2	3	4	5	6	7
Drive on unsealed roads	1	2	3	4	5	6	7
Encounter wild animals or livestock on the road	1	2	3	4	5	6	7
Drive while tired	1	2	3	4	5	6	7
Drive longer than 2 hours without stopping for a break	1	2	3	4	5	6	7
Drive home without stopping	1	2	3	4	5	6	7
Hit livestock or animal	1	2	3	4	5	6	7
Drive while under time pressure	1	2	3	4	5	6	7
Lose concentration	1	2	3	4	5	6	7
Drive even though you suspect you may be over the legal blood alcohol limit	1	2	3	4	5	6	7
Disregard the speed limit on a highway	1	2	3	4	5	6	7
See an accident or the aftermath of an accident	1	2	3	4	5	6	7
Stop for a nap	1	2	3	4	5	6	7

SECTION C: GENERAL INFORMATION

Section C seeks information about **you and your drive home after your night shift block**.
Please provide a response to all questions:

Age: ____________

Are you: ☐ Male ☐ Female

What is your relationship status?

- ☐ Single
- ☐ Married
- ☐ Divorced
- ☐ Separated
- ☐ De-facto

Are you:

- ☐ Permanent employee (employed by the mine)
- ☐ Contractor
- ☐ Other (please specify): ________________________

What is your job at the mine: ____

What is the postcode of your home address: ________________________________

How long (hours/mins) is a typical night shift for you? __________________________

Approximately how many kilometres is it from your home to the worksite?
____

What type of roster do you typically work:

- ☐ 7 on / 7 off
- ☐ 14 on / 7 off
- ☐ 5 on / 2 off
- ☐ 8 on / 6 off
- ☐ 12 on / 9 off
- ☐ Other (please specify):_____________________

Where do you usually drive to after a night shift block

- ☐ Home
- ☐ Airport
- ☐ Friend's house
- ☐ Other (please specify):_________________________

What do you think is a reasonable distance for someone to travel to get home from work?
____

Approximately how long (hours/mins) does it usually take you to drive home after a night shift block?
____

How many years have you worked in the industry?
____

In the last three years how many demerit points have you lost from your driver's licence?
____

If you have a break after a night shift block, before you drive home, typically how long (hours/mins) is it?
____

When driving home from site following a night shift block, how many hours do you usually drive before you stop and take a break?
____

If you take a break during your journey home from site following a night shift block, how long do you usually stop for?
____

Typically I spend 50% or more of my journey home following a night shift block:

- ☐ Driving a car
- ☐ As a passenger in a car
- ☐ Flying
- ☐ On a Bus
- ☐ Other (please specify):____________________

If you car pool, who organised it?

- ☐ Manager
- ☐ Crew
- ☐ Myself
- ☐ Other (please specify):______________

Are you paid for your journey home from the worksite after your shift block? ☐ Yes ☐ No

How many times would you normally stop during your trip home following a night shift block?
____

– Thank you for taking the time to complete this questionnaire –

Should you have any questions about this research, please contact Candice Potter: c4.potter@qut.edu.au

Appendix E

Critical belief analyses

Step 1 analyses: Correlations of critical beliefs with intention

Table 13-1.

Step 1 - Mean, standard deviation and correlations of behavioural critical beliefs with intention by day and night shift

	Day shift		Night shift	
Behavioural beliefs	**M (*SD*)**	***r***	**M (*SD*)**	***r***
Putting others at risk	3.45 (1.93)	-.43***	3.93 (1.94)	-.40***
Putting me at risk	3.57 (1.95)	-.40***	4.08 (1.94)	-.39***
Making the most of my time off	4.98 (1.75)	.04	4.62 (1.88)	.33***
Seeing my family as soon as possible	5.15 (1.72)	.10	4.83 (1.84)	.27***
Getting home as soon as possible	5.20 (1.70)	.13*	4.84 (1.83)	.34***
Getting off site as soon as possible	4.80 (1.85)	-.00	4.57 (1.92)	.32***
Comply with SSE instructions	3.82 (2.01)	-.27***	4.04 (1.77)	-.21***
Breaking the road rules	3.26 (2.01)	-.34***	3.52 (1.87)	-.22***
Uninsured	3.52 (2.01)	-.36***	4.08 (2.00)	-.26***
Involved in a crash	3.36 (1.82)	-.32***	3.75 (1.89)	-.29***
Involved in a near miss	3.55 (1.83)	-.33***	3.77 (1.85)	-.35***
Taking a risk	3.50 (1.93)	-.29***	3.88 (1.89)	-.33***

****p<.001, ** p < .02, * p < .05*

Table 13-2.

Step 1 - Mean, standard deviation and correlations of normative critical beliefs with intention by day and night shift

	Day shift		Night shift	
Normative beliefs	**M (*SD*)**	***r***	**M (*SD*)**	***r***
Family	4.83 (2.31)	.69***	4.52 (2.25)	.67***
Friends	5.10 (2.12)	.66***	4.68 (2.02)	.67***
Co-workers	5.25 (1.97)	.59***	5.98 (1.93)	.54***
Supervisor	4.38 (2.17)	.58***	3.38 (2.06)	.39***

****p<.001, ** p < .02, * p < .05*

Table 13-3.

Step 1 - Mean, standard deviation and correlations of control critical beliefs with intention by day and night shift

	Day shift		Night shift	
Control beliefs - facilitators	**M (*SD*)**	***r***	**M (*SD*)**	***r***
Carpooling	5.11 (2.15)	.20***	5.32 (2.18)	.45***
Following what others do	3.34 (2.06)	.30***	3.00 (1.95)	.35***
Needing to be somewhere	5.45 (1.73)	.27***	4.95 (2.08)	.35***
Routine	4.91 (2.09)	.46***	4.67 (2.20)	.69***
My family want me home	4.78 (3.04)	.44***	3.92 (2.16)	.46***
Experienced distance driver	4.41 (1.98)	.39***	4.12 (2.15)	.56***
Car made for country roads	3.85 (2.02)	.40***	3.53 (2.04)	.48***
Sick of being on site	4.52 (2.06)	.30***	4.24 (2.17)	.54***
To get the drive over with	4.18 (2.01)	.29***	3.99 (2.20)	.55***
Control beliefs - barriers				
Family concerns	5.00 (1.77)	-.11	4.84 (1.90)	-.16**
Complying with site rules	4.96 (1.77)	-.05	4.71 (1.79)	-.18**
Avoiding dawn/dusk driving	4.45 (1.91)	-.19***	4.11 (1.99)	-.13*
Avoiding night driving	3.76 (2.07)	-.16**	3.65 (1.99)	-.09
Feeling tired	5.41 (1.81)	-.14*	5.33 (1.88)	-.12
Seeing a crash occur	3.99 (1.83)	-.09	3.72 (2.00)	-.18**
Being in an crash	4.53 (1.98)	-.07	3.95 (2.11)	-.07
Training in fatigue management	4.31 (1.82)	-.22***	3.92 (1.94)	-.10
Wanting to get home in one piece	5.54 91.62)	-.13	5.26 (1.90)	-.20***
Not get home tired	4.31 (1.95)	-.22***	4.42 (1.92)	-.29***

******p<.001, ** p < .02, * p < .05*

Step 2 analyses: Regression analyses of critical beliefs with intentions

Table 13-4.

Regression of behavioural beliefs predicting workers' intention to leave immediately following day and night shifts

	Day		Night	
	B	**95% C.I.**	**B**	**95% C.I.**
Putting others at risk	-.40**	[-.72, -.07]	-.39*	[-.76, -.02]
Putting me at risk	.04	[-.27, .35]	.16	[-.22, .54]
Making the most of my time off	n/a		.20	[-.01, .40]
Seeing my family as soon as possible	n/a		-.02	[-.26, .23]
Getting home as soon as possible	.28***	[.15, .41]	.21	[-.01, .43]
Getting off site as soon as possible	n/a		.11	[-.05, .28]
Comply with SSE instructions	.03	[-.13, .19]	-.13	[-.29,.03]
Breaking the road rules	-.08	[-.26, .11]	.07	[-.11, .25]
Uninsured	-.26***	[-.44, -.09]	-.07	[-.29, .13]
Involved in a crash	.05	[-.26, .36]	.35*	[.01, .69]
Involved in a near miss	.07	[-.26, .40]	-.41*	[-.78, -.03]
Taking a risk	-.01	[-.25, .23]	-.14	[-.36, .08]

****p<.001, ** p < .02, * p < .05*

Table 13-5.

Regression of normative beliefs predicting workers' intention to leave immediately following day and night shifts

	Day		Night	
	B	**95% C.I.**	**B**	**95% C.I.**
Family	.36***	[.18, .54]	.39***	[.22, .56]
Friends	.26*	[.01, .51]	.23	[-.01, .46]
Co-workers	-.02	[-.23, .19]	.09	[-.08, .26]
Supervisor	.01	[-.13, .16]	-.02	[-.14, .10]

****p<.001, ** p < .02, * p < .05*

Table 13-6.

Regression of facilitating control beliefs predicting workers' intention to leave immediately following day and night shifts

	Day		Night	
	B	**95% C.I.**	**B**	**95% C.I.**
Carpooling	.06	[-.07, .19]	.12*	[.01, .22]
Following what others do	-.02	[-.17, .12]	-.04	[-.16, .09]
Needing to be somewhere	-.01	[-.17, .16]	-.00	[-.11, .11]
Routine	.23***	[.08, .37]	.43***	[.31, .55]
My family want me home	.19**	[.03, .35]	-.02	[-.15, .11]
Experienced distance driver	.03	[-.15, .22]	.07	[-.08, .21]
Car made for country roads	.14	[-.03, .32]	.06	[-.08, .19]
Sick of being on site	.08	[-.07, .24]	.16*	[.01, .31]
To get the drive over with	-.08	[-.25, .10]	.06	[-.10, .22]

****p<.001, **p < .02, *p < .05*

Table 13-7.

Regression of barrier control beliefs predicting workers' intention to leave immediately following day and night shifts

	Day		Night	
	B	**95% C.I.**	**B**	**95% C.I.**
Family concerns	n/a		-.05	[-.22, .12]
Complying with site rules	n/a		-.13	[-.30, .04]
Avoiding dawn/dusk driving	-.07	[-.27, .13]	.10	[-.07, .28]
Avoiding day/night driving	-.01	[-.18, .17]	n/a	
Feeling tired	.01	[-.16, .17]	n/a	
Seeing a crash occur	n/a		-.01	[-.18, .15]
Being in a crash	n/a		n/a	
Training in fatigue management	-.12	[-.29, .05]	n/a	
Wanting to get home in one piece	n/a		-.05	[-.23, .13]
Not get home tired	-.11	[-.29, .06]	-.30***	[-.48, -.12]

****p<.001, **p < .02, *p < .05*