Physical Hazards: Vehicles and Occupational Road Use

Core Body of Knowledge for the Generalist OHS Professional

Safety Institute of Australia Ltd

Australian OHS Education Accreditation Board

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The OHS Body of Knowledge for Generalist OHS Professionals has been developed under the auspices of the **Health and Safety Professionals Alliance**

The Technical Panel established by the Health and Safety Professionals Alliance (HaSPA) was responsible for developing the conceptual framework of the OHS Body of Knowledge and for selecting contributing authors and peer-reviewers. The Technical Panel comprised representatives from:

The Safety Institute of Australia supported the development of the OHS Body of Knowledge and will be providing ongoing support for the dissemination of the OHS Body of Knowledge and for the maintenance and further development of the Body of Knowledge through the Australian OHS Education Accreditation Board which is auspiced by the Safety Institute of Australia.

Synopsis of the OHS Body of Knowledge

Background

A defined body of knowledge is required as a basis for professional certification and for accreditation of education programs giving entry to a profession. The lack of such a body of knowledge for OHS professionals was identified in reviews of OHS legislation and OHS education in Australia. After a 2009 scoping study, WorkSafe Victoria provided funding to support a national project to develop and implement a core body of knowledge for generalist OHS professionals in Australia.

Development

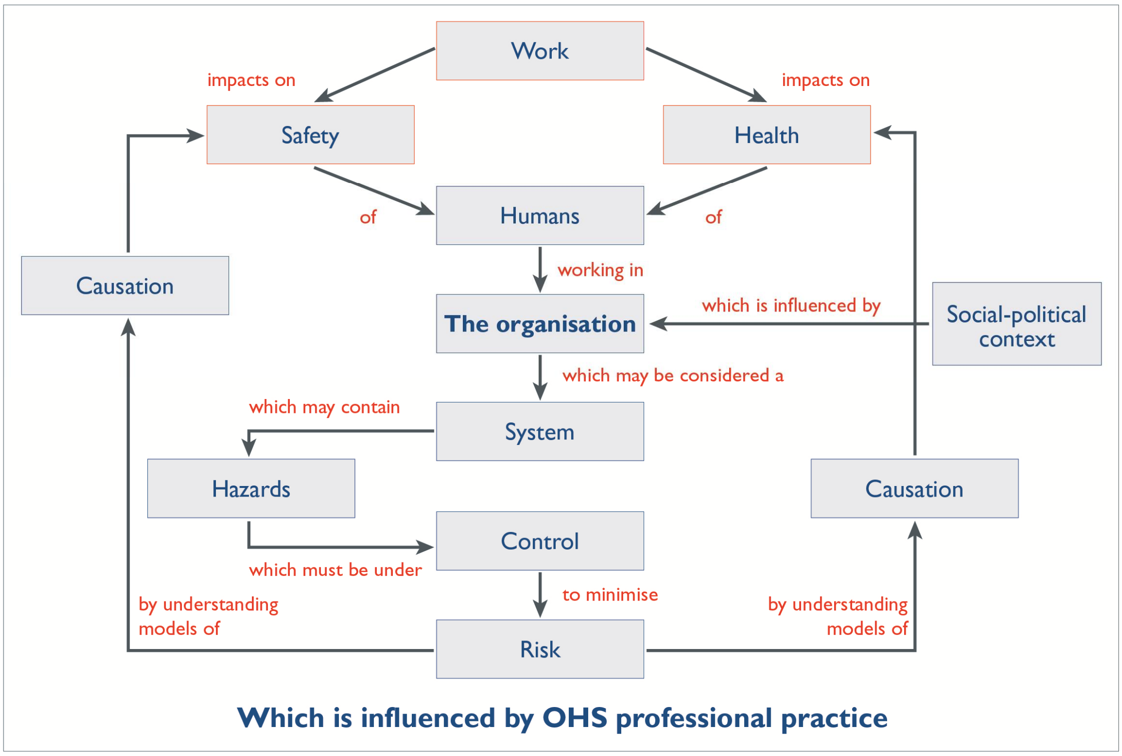
The process of developing and structuring the main content of this document was managed by a Technical Panel with representation from Victorian universities that teach OHS and from the Safety Institute of Australia, which is the main professional body for generalist OHS professionals in Australia. The Panel developed an initial conceptual framework which was then amended in accord with feedback received from OHS tertiary-level educators throughout Australia and the wider OHS profession. Specialist authors were invited to contribute chapters, which were then subjected to peer review and editing. It is anticipated that the resultant OHS Body of Knowledge will in future be regularly amended and updated as people use it and as the evidence base expands.

Conceptual structure

The OHS Body of Knowledge takes a ‘conceptual’ approach. As concepts are abstract, the OHS professional needs to organise the concepts into a framework in order to solve a problem. The overall framework used to structure the OHS Body of Knowledge is that:

> **Work** impacts on the **safety** and **health** of humans who work in **organisations**. Organisations are influenced by the **socio-political context**. Organisations may be considered a **system** which may contain **hazards** which must be under control to minimise **risk**. This can be achieved by understanding **models causation** for safety and for health which will result in improvement in the safety and health of people at work. The OHS professional applies **professional practice** to influence the organisation to being about this improvement.

This can be represented as:



Audience

The OHS Body of Knowledge provides a basis for accreditation of OHS professional education programs and certification of individual OHS professionals. It provides guidance for OHS educators in course development, and for OHS professionals and professional bodies in developing continuing professional development activities. Also, OHS regulators, employers and recruiters may find it useful for benchmarking OHS professional practice.

Application

Importantly, the OHS Body of Knowledge is neither a textbook nor a curriculum; rather it describes the key concepts, core theories and related evidence that should be shared by Australian generalist OHS professionals. This knowledge will be gained through a combination of education and experience.

Accessing and using the OHS Body of Knowledge for generalist OHS professionals

The OHS Body of Knowledge is published electronically. Each chapter can be downloaded separately. However users are advised to read the Introduction, which provides background to the information in individual chapters. They should also note the copyright requirements and the disclaimer before using or acting on the information.

Physical Hazards: Vehicles and Occupational Road Use

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Abstract

Roadways are workplaces for occupational-vehicle users and road workers. Occupational road-vehicle users ï drivers of short- and long-haul, light and heavy vehicles, including trucks, buses, vans, cars and utilities ï face risks experienced by all road users as well as risks specific to work design and occupational demands. The work environment of occupational road users is atypical, shared with non-work road users, and regulated by both work- and road-related policy. While heavy-vehicle users are a readily identifiable occupational-road-use group and their significant injury burden is well documented, injury and fatality data for other occupational road users is difficult to access and fraught with definitional complexities. Regardless, occupational road use is the most common cause of work-related traumatic injury and death in most western countries, including Australia. This chapter summarises contemporary occupational-road-use exposures and research, and describes work- and road-related risks and models for Occupational Health and Safety (OHS) risk-management intervention.

Keywords

road, vehicles, work, OHS, safety

Contents

1 Introduction

Australia is a large country that relies heavily on road transport; many rural and remote areas have no rail access, but do have a relatively well-constructed road system. Traditionally, commercial occupational road-vehicle use has involved heavy-vehicle drivers in transport and storage industries; it is estimated that these drivers form 5% of the Australian workforce (Duke, Guest & Boggess, 2010). In contemporary work, however, many workers use light vehicles for transport between sites, as a work base, and for other work purposes incidental to their primary occupation (Stuckey & LaMontagne, 2005). Work-related road crashes are the leading cause of occupational injury and fatality in Australia and many other countries, and are responsible for significant numbers of commuter and bystander fatalities (Mitchell, Driscoll & Healey, 2004).

Occupational Health and Safety (OHS) policy and practice for occupational road users is complex; these workers work away from traditional work places, and are regulated by both work- and road-related policy, including regulations covering many aspects of driving and vehicle design and condition. This chapter outlines issues related to occupational road use, describes relevant risk-management models and considers the implications for OHS practice.

1.1 Definitions

Work vehicles ï road vehicles used in the course of employment for work purposes ï include heavy and light, short- and long-haul engine-powered vehicles with four or more wheels[1] (including transporters/trucks, buses, emergency vehicles, vans, utilities, four-wheel drives, cars).

- *Heavy vehicles* weigh more than 4.5 tonnes Gross Vehicle Mass (GVM) and are designed to transport goods, passengers or materials (National Road Transport Commission, 2000, p.1). They are of various sizes and shapes ranging from tray-trucks to B-triples and road trains
- *Light vehicles* weigh 4.5 tonnes GVM or less and have a seating capacity of up to 12 persons including the driver (Stuckey & LaMontagne, 2005)

This chapter focuses on a *worker population* that includes:

- Occupational-road-vehicle users (i.e. truck, bus, taxi, courier, hire-car drivers, emergency service workers, light-vehicle drivers and passengers, etc.) employed to drive or use a road vehicle as a ótoolô in the course of employment, but whose occupation title is not necessarily ódriverô (Stuckey & LaMontagne, 2005)

[1] This chapter excludes vehicles with fewer than 4 wheels as these are frequently used in environments other than roads, (e.g. footpaths and agricultural environments), and are beyond the scope of this chapter.

- Road construction and maintenance workers.

The worker population excludes workers travelling to or from their place of employment unless this travel is included in their employment contract,

2 Historical context

Transportation was crucial to the progression from agricultural to industrial economies. Isard (1942) demonstrated the existence of a transport-building cycle fundamental to urban development; for example, an escalation in industry and building activity was preceded by the development of railroads, and followed by an even greater rate of motor vehicle use. Decades ago, the rate of motor vehicle registrations was identified as an important dimension of socioeconomic modernisation and political development (Isard, 1942; Olsen, 1968).

Increased urbanisation resulted in increased demand for goods and services, and a corresponding increase in demand for freight transport, which continues to grow as modern industry is concentrated in fewer sites, using just-in-time production practices (EASHW, 2011). Economies of scale have led to larger freight vehicles and smaller light vehicles. Changes in work patterns have increased the demand for more mobile and accessible workers using vehicles equipped with portable facilities to allow work away from employer-controlled work sites (Eost & Flyte, 1998).

In the last decade, there has been increased recognition of OHS issues related to occupational road use. In Australia, Mitchell et al. (2004), who used Australian National Census data to elucidate work-related road deaths between 1989 and 1992, demonstrated that work-road fatalities were a significant OHS and public health issue, with 1.7 per 100,000 workers and 0.78 per 100,000 bystanders killed per year (Mitchell et al, (2004). The US National Institute of Occupational Safety and Health (NIOSH) *Global Road Safety for Workers* project was instigated in the mid-2000s to advance the state of OHS knowledge in occupational road users (Pratt, 2003). In 2007, NIOSH published a *Worldwide Occupational Road Safety Review Project* report, which summarised international sources of occupational crash data and road safety research (Murray, 2007). In 2009, NIOSH initiatives included a White Paper (IDS, 2009) and the first international conference on road safety at work, which drew presenters and participants from more than 40 countries. The White Paper and conference proceedings provided an extensive international literature review and summary of the state of occupational road safety, including OHS-intervention initiatives (particularly relating to heavy-vehicle use and multinational companies), and practice and research gaps (IDS, 2009; NIOSH, 2009).

3 Modern occupational vehicle-usage conditions

Generally, there has been a reduction in the cognitive and physical demands required to operate vehicles, and for most types of vehicles both active and passive safety features have been introduced to protect usersô health and safety. Increasingly, technology applications facilitate monitoring and management of work vehicles and their users. Long-haul trucks, transporters and other heavy vehicles frequently have on-board computer planning, monitoring and communication systems. Satellite links enable mobile tracking and registration of data concerning the journey, the vehicle and the driver (EASHW, 2011). Navigation systems assist route planning and, consequently, save time and reduce cognitive demands, and also provide the employer with methods to track and monitor the remote driver. Digital tachographs and smart cards provide systems for monitoring driver compliance with rules, particularly in regards to vehicle speed and driving breaks, and can register an individual driverôs behaviours for weeks at a time. Tracking and fleet-management systems can follow and trace vehicles or loads (EASHW, 2011). While mobile phones offer safety advantages with increased contact with work and family, their use (along with that of several other technological applications such as information screens in taxis and emergency vehicles) can increase cognitive demands and related OHS risks. Indeed, technology use and other distracting activities, such as eating and drinking, can seriously impair driving and potentially contribute to crashes (Nevile & Haddington, 2010). Increasingly, across all vehicle types and work purposes the vehicle is being used as a mobile office as well as a means of personnel or freight transport.

Additional to the demands of working within the vehicle, the external road environment provides challenges to work-vehicle users through increasing congestion and shared roads. While other road users are participants in the occupational road userôs work environment, they are neither fellow workers nor customers, but rather disinterested parties and potential hazards.

4 Extent of the problem

Aside from the devastating injury and fatality costs to individual workers and their families, other occupational-road-use-related costs include loss of productivity and human resources, vehicle and property damage, medical and other liability expenses, and broader socioeconomic impacts. In 2004, the World Health Organisation (WHO) estimated the annual direct global economic cost of road crashes to be US$518 billion, and the work-related injury burden to be 3% of total road injury in the US and 13% in Australia (the Australian data also included commuting crashes) (WHO, 2004).

Registrations of road-based work vehicles in Australia is increasing, and the available data suggests crashes involving work-related vehicles and particularly articulated heavy vehicles, contribute significantly to both road and work-related deaths. Data compiled from several sources has been used in Table 1 to illustrate both the increasing number of registrations of heavy vehicles, and their significant crash involvement and related contribution to the 2010-2011 Australian road-fatality toll.

Table 1: Reported Australian commercial vehicle registration and fatality crash data with calculated incident rates of fatalities per number of registrations, and of all road fatalities

Vehicle Type[a]	No. Of commercial vehicle crash fatalities, 12 months to March 2011[a]	No. of registered commercial vehicles, Australia, 1/2011[b]*	% change in commercial vehicle registrations, 2006 – 2011 [b]	Fatality incident rate per vehicle type commercial registrations	% of commercial vehicles crash fatalities of all road crash fatalities, 12 months to March 2011 (n=1,388[c])
Articulated Trucks	140	85,965	+20.7	0.0016	10.0%
Heavy Rigid trucks	78	318,233	+10.8	0.0002	5.6%
Buses	23	87,833	+17.2	0.0003	1.7%
Occupational Light Vehicles	*No OLV-user fatality data available*	*No OLV-user fatality data available*	*No OLV-user fatality data available*	*No OLV-user fatality data available*	*No OLV-user fatality data available*

a: Department Of Infrastructure and Transport (2011a) Fatal heavy vehicle crashes Australia quarterly bulletin Jan-March 2011: Fatal crashes involving heavy vehicles, Australia ï moving annual total. ñKey featuresò.
b: ABS (2011) Motor Vehicle Census Australia. 9309.0 Table 1: Motor vehicles on register, type of vehicle ï census years 2006, 2010 and 2011. P.7. *The registration data is for January, 2011, the nearest comparative data available. This report notes that ñ*For ease of comparison with data in previous years, all percentage movements in this publication have been converted to an annual basis",* (p.2).
c: Department Of Infrastructure and Transport (2011b) Road deaths Australia, March 2011. Number of road crash deaths in each state / territory. Road deaths by State/Territory for current month, year to date, 12 months ended March, and five year trend, p.2

Data accurately identifying the morbidity and mortality rates for the light occupational road-vehicle user population and road workers and bystanders are difficult to access, and fraught with definitional and identification complexities and anomalies. Most available surveillance figures are reliant on workersô compensation data, which have been demonstrated to be a poor proxy for the full OHS picture (Mitchell et al., 2004; Stuckey & LaMontagne, 2005). Regardless, occupational road use is a significant cause of vehicle-user and other road-worker injury that raises complex and multifactorial issues for the OHS practitioner, and requires a systems approach to risk assessment and management.

5 Understanding OHS issues related to occupational road use

This section addresses the knowledge required by the generalist OHS professional in understanding the hazards associated with occupational road use. It begins by examining the generic risks and then examines the risk and issues and associated with heavy vehicles and occupational light vehicles (OLV). The section concludes by examining roadside workers as a particular risk group.

5.1 Generic occupational road-vehicle-user risks

There is an extensive body of generic road safety literature and identified risks that also applies to most occupational road users. The 2004 WHO report on road-traffic injury prevention classifies the main risk factors for road-traffic injuries into four categories (Table 2).

Table 2: Main risk factors for road traffic injuries (WHO, 2004, p. 71)

Factors influencing exposure to risk	Risk factors influencing crash involvement	Risk factors influencing crash severity	Risk factors influencing severity of post-crash injuries
• Economic factors, including social deprivation • Demographic factors • Land use planning practices which influence the length of a trip or travel mode choice • Mixture of high-speed motorized traffic with vulnerable road users • Insufficient attention to integration of road function with decisions about speed limits, road layout and design	• Inappropriate or excessive speed • Presence of alcohol, medicinal or recreational drugs • Fatigue • Being a young male • Being a vulnerable road user in urban and residential areas • Travelling in darkness • Vehicle factors ï such as braking, handling and maintenance • Defects in road design, layout and maintenance which can also lead to unsafe road user behaviour • Inadequate visibility due to environmental factors (making it hard to detect vehicles and other road users) • Poor road user eyesight	• Human tolerance factors • Inappropriate or excessive speed • Seat-belts and child restraints not used • Roadside objects not crash protective • Insufficient vehicle crash protection for occupants and for those hit by vehicles • Presence of alcohol and other drugs	• Delay in detecting crash • Presence of fire resulting from collision • Leakage of hazardous materials • Presence of alcohol and other drugs • Difficulty rescuing and extracting people from vehicles • Difficulty evacuating people from buses and coaches involved in crash • Lack of appropriate pre-hospital care • Lack of appropriate care in the hospital emergency rooms

Unlike recreational or social road users, occupational road users generally do not choose when or where they drive, or what vehicle they use, and their vehicle-use activity is primarily motivated by income and other occupational imperatives. Therefore, many of the hazards and exposures experienced by occupational road users are additional to those faced by other road users, and relate to workforce demographics, and organisational, economic and policy imperatives.

A recent European Agency for Safety and Health at Work report (EASHW, 2011) provided a summary of OHS issues relevant to the road-transport sector (Table 3).

Table 3: OHS issues in the road-transport sector (EASHW, 2011)

Risks related to a male-dominated workforce	Risks related to an ageing workforce	Risks related to work organisation	Other work-risk characteristics
• Family unfriendly hours and limited maternity and care leave • Poor work-life balance • High percentage of precarious jobs • Vehicle and cabin designs based on male anthropometry • Fume and other hazardous environmental exposures • Lack of female oriented infrastructure, e.g. appropriate toilet facilities • Unstructured rest breaks	• Chronic musculoskeletal disorders • Noise-related hearing loss • Vibration-related health issues • Long-term shift work, fatigue and chronic sleeping problems • Increased difficulty tolerating extended work hours • Inadequate or disrupted rest breaks • Inconsistent work patterns	• Work pressures, including just-in-time management • Pace of work • Lack of job control • Lack of job content control • Lack of workplace support • Monotonous and repetitive work • Long hours, e.g. up to twice as many bus and taxi drivers work night shift than other workers	• Precarious or part-time employment • Relatively low wages • Violence and harassment, including robbery • Face-to-face services to public • Handling cash transactions • Working alone or in small numbers • Working early morning or overnight • Operating from unsecured/mobile ṕremisesô • Working in disadvantaged, rural and remote areas • Transporting dangerous or hazardous loads

5.2 Long-haul and heavy vehicles

In Australia, OHS regulation specific to long-haul and other heavy vehicles is relatively well developed as heavy vehicles are readily identifiable and unlikely to be used for private driving. In 2001, a landmark review of the long-haul trucking industry, recommended increased harmonisation between road transport and OHS legislation, and greater interagency cooperation to address a number of serious limitations in trucking safety (Quinlan, 2001). In 2002, Johnstone advocated a systems approach to OHS in the Australian heavy vehicle or trucking industry, arguing that:

> é the OHS statutes provide for a óchain of responsibilityô very similar to the provisions to be found under the road transport regulations in most jurisdictions ï that is, it imposes duties on a range of parties involved in the road trucking contractual chain (Johnstone, 2002, p. 4).

Since then, reforms to national road-transport laws have introduced requirements that make all those who exercise control over conduct affecting the ability of a heavy-vehicle user to comply with relevant OHS and road policy to be both accountable and responsible if they fail to discharge that responsibility. This óchainô of duty holders includes the vehicle driver and their employer as well as any other party involved in the road-freight system, including organisers of trip schedules, consignors, importers, retailers or primary producers (Johnstone, 2002).

Links between remuneration and safety performance have been identified and investigated by researchers in the US and Australia (Quinlan & Wright, 2008; Rodríguez, Rocha, Khattak & Belzer, 2003). In a heavy-vehicle-industry review for the National Transport Commission, Quinlan and Wright (2008, p. 11) cited evidence of ña clear and significant link between scheduling pressures, unpaid waiting time, insecure rewards and access to work, and hazardous practices such as speeding, excessive hours and drug use by drivers.ò Quinlan and Wright (2008) found ñthat the overwhelming weight of evidence indicates that commercial/industrial practices affecting road transport play a direct and significant role in causing hazardous practicesò (p. 49), and recommended ñthat a national scheme for setting mandatory safe rates covering both employee and owner/drivers be established in the heavy vehicle industryò (p. 61). A recent study by several prominent Australian researchers of heavy-vehicle OHS aimed to elucidate key postulated risk factors for heavy-vehicle crashes:

1. Employer/company related factors such as scheduling, shift length, driving and rest habits of the driver and payment rates and income;
2. Driver characteristics such as fatigue, sleep apnoea, drug and alcohol use and health status including body weight, body mass index and self reported co-morbidities;
3. Vehicle characteristics such as truck configuration and safety features, loads carried and vehicle mass (Stevenson et al., 2010).

Stevenson et al. (2010) concluded that the strength of association between factors such as remuneration, scheduling and sleep apnoea, and heavy-vehicle crash risk remains unclear, and warrants further research to inform safe-driving policy development.

The Council of Australian Governments (COAG) agreed for a single national heavy-vehicle regulator to be established by the end of 2012 to regulate all vehicles over 4.5 tonne GVM (DITRDLG, 2009). One of the objectives of this reform ï which is intended to provide a framework for ñseamless, national, uniform and coordinated system of heavy vehicle regulationò ï is the ñprovision of a safe transport system that meets Australiaôs mobility, social and economic objectives with maximum safety for its usersò (DITRDLG, 2009b, p. i). The regulating entity ï the National Transport Commission ï works in partnership with peak industry bodies and government to develop land-transport policy; associated responsibilities encompass many safety and compliance issues, including the review of medical standards for assessing fitness to drive for commercial-vehicle drivers (NTC, 2011).

5.3 Light short-haul vehicles

Friswell et al. (2006) identified driver- and work-risk characteristics specific to light short-haul (LSH) transport that differ from those relevant to heavy-vehicle use, and found that light-truck or van drivers experience at least as much of a problem with fatigue as long-distance heavy-truck drivers. Although LSH road users have not been the focus of as much research, in 2008 they comprised 80ï 90% of registered freight-carrying vehicles (Friswell & Williamson, 2010).

LSH-transport drivers typically collect or deliver freight items in urban areas, predominantly working in daylight hours and making frequent stops for delivery or re-loading during each work shift (Hanowski et al., 1999; Friswell & Williamson, 2010). Friswell & Williamson (2010) found that LSH drivers were more likely to suffer injury (particularly musculoskeletal injury) as a result of goods-handling activities than from vehicle crashes. Four clusters of LSH hazards were identified:

- Work-organisation hazards, including poor schedules resulting in time pressures, excessive work hours and fatigue, and poorly packed or loaded freight
- Vehicle-related hazards, including prolonged exposure to vibration, glare, uncomfortable temperatures, poorly designed seats, poor vehicle handling and mechanical breakdowns
- Road-related hazards, including dangerous actions by other road users, heavy traffic volumes and roads in poor condition
- Interpersonal hazards, including conflict with workers and customers and violence (Friswell & Williamson, 2010).

Drivers reported speeding, illegal parking and not wearing seatbelts as a result of time and workload pressures. Their most common perceptions of safety problems related to other road users (particularly light-vehicle users) and poor road conditions, hazards more likely to result in serious consequences than their work-related off-road hazards (Friswell & Williamson, 2010).

LSH-vehicle OHS is not regulated in the same way as heavy or long-haul vehicles. Research into risks for these occupational road users is limited, as they are difficult to distinguish from other professional drivers or other van or light-truck users in compensation and road-crash data. The available research (much of which has been undertaken in Australia) has identified that the road-related component of LSH work is a significant OHS issue (see, for example, Friswell & Williamson, 2008).

5.4 Occupational light vehicles

Occupational light vehicle (OLV) fleet safety has been well researched in the UK and more recently in Australia (Haworth, Tingvall & Kowadlo, 2000; HSE, 2003; Murray, 2001; Stradling, Meadows & Beatty, 2001). However, OLV use is a much broader issue than that of employer-owned fleet vehicles; it includes all light vehicles used for work purposes (e.g. cars, station wagons, vans, utilities, four-wheel drives and LSH-vehicles less than 4.5 tonne) in all types of work arrangements, including employees using their own vehicles, the self-employed and contractors.

These work-vehicle users are unlikely to be occupationally classified as drivers; generally, the driving component of their work is incidental to their primary occupation (i.e. the vehicle enables them to carry out their work, and often provides a mobile work-base or office). In the 12 months to October 2007, OLV use comprised 76% of all business-vehicle use kilometres travelled in Australia, compared to 23% for rigid and articulated trucks and buses (ABS, 2007, p. 18). The proportion of workers using light vehicles is growing as workers are increasingly required to move between workplaces, and as the number of people employed in contingent and precarious work arrangements increases (Stuckey & Lamontagne, 2005). OLV-user-related injury and fatality data specific to OHS are difficult to access as many work-related crashes occur away from traditional workplaces and are included in road trauma rather than work data.

As with other groups of occupational road users, OLV-user OHS risks include a combination of the road-use-related risks applicable to all light-vehicle users and risks related to organisational and work arrangements. However, OLVs and their user population differ significantly from private light vehicles and their user population in several aspects, including the OLV use of newer and more powerful vehicles, and a much greater proportion of load-carrying vehicles (e.g. vans and utilities) (Stuckey, LaMontagne, Glass & Sim, 2010a).

A study of risk and protective factors for OLV crash outcomes associated vehicle design (and related age and load shape) with nearly doubling the risk of a fatality outcome (Stuckey, LaMontagne, Glass, Wolfe & Sim, 2010b). Important work-organisation risk factors included sole-trader type of employment arrangement of the crashed OLV driver and farmer and taxi types of work use for which the OLV was registered. Crashes involving only one OLV had an almost six-fold increased risk of a casualty outcome, and were twice as likely as multiple vehicle crashes, regardless of the other vehicle type involved, to result in a fatal outcome. Other significant risk factors for a fatality outcome in an OLV crash included not using a seatbelt and crashes in high-speed zones (Stuckey et al., 2010b). OLV-injury-prevention strategies require the implementation of standards for safer vehicles, trip planning, and other work-organisation considerations relating to user fatigue, road exposures, and journey purpose; these require action from all relevant stakeholders, including manufacturers, industry and worker representatives, road and work-related data collectors, and OHS regulatory agencies (Stuckey et al., 2010b).

5.4.1 OHS models for light vehicles

Since 1973, OHS researchers and professionals have applied the Haddon matrix to injury prevention and response strategies in many contexts, including road safety. The matrix has three injury-control phases ï pre-event, event and post-event (Haddon, 1973). For each of these phases, controls may involve changes to human behaviours, vehicles or other equipment, or the physical or socioeconomic environment (Williams, 1999).

Recently in Australia, Newnam and Watson (2011) developed a theory-driven framework for intervention strategies for passenger fleet vehicles, advocating that ñwork-related driving safety can be more effectively managed through giving adequate attention to the identification of the social-psychological and organisational mechanisms underlying change in driving behaviourò (p. 379).

Several other systems-based models described in the NIOSH White Paper (IDS, 2009) address OLV use and extend the more traditional road safety models to include work-related organisational and policy-related factors. For example, Australian researchers have developed:

- the WIPE fleet safety process model to assist managers to develop a business case for their fleet safety focus, to determine appropriate interventions, and to evaluate their outcomes (Murray, Newnam, Watson, Davey & Schonfeld, 2003, as cited in IDS, 2009).
- a ten-step fleet safety process model designed to be used for gap analysis, benchmarking, fleet-safety-improvement workshops and the development of fleet-safety manuals and improvement programs (Mooren, 2007, as cited in IDS, 2009).
- an OLV-use systems model designed to guide intervention research, policy and practice for all light vehicles used by workers in the course of employment regardless of their work arrangement or occupational designation. This model examines influences on the health outcomes of vehicle users, including factors related to the drivers and passengers, the vehicles, the road environment, the work

arrangement or environment, and the work- and road-related policy environments (Stuckey, LaMontagne & Sim, 2007, as cited in IDS, 2009; Stuckey et al., 2007).

5.5 Roadside workers (road maintenance and construction)

Because of their proximity to moving vehicles, workers in highway work zones have been identified as being at risk from the movement of construction vehicles and other equipment within the construction zone, and from passing traffic (Pratt, Fosbroke & Marsh, 2001). Construction-vehicle operators are at risk of injury due to vehicle overturning, collision or worker entanglement in moving equipment, while other workers such as ótraffic controllersô are at risk of being struck by traffic. Road-work sites are temporary workplaces and frequently the work is undertaken in low light, all types of weather and without the conveniences expected in other workplaces such as sanitary facilities. Frequently, the nature of this work exposes roadside workers to high volumes of traffic moving at unsafe speeds, often with congestion and related aggression from passing drivers. In addition to equipment- and vehicle-related hazards, road workers are at risk from injury related to contact with overhead-power lines, falls from machinery or structures such as bridges, explosions from gas or other pipelines, and being hit by falling or moving objects or materials (Pratt et al., 2001).

In Victoria, the *Road Management Act 2004* requires permits and specific risk-management practices for work undertaken in road reserves (State Government of Victoria, 2004). Australian Standards and VicRoads (and road transport authorities in other jurisdictions) prescribe uniform design and set-up of road construction zones, and the development of temporary traffic control plans (NSW RTA, 2006, SA, 2009, VicRoads, 2003, WorkSafe Victoria, n.d.a). OHS management for roadside workers must focus on separating workers from passing traffic as well as construction vehicles and any other environmental hazards, regardless of the temporary disruption this may cause to normal highway functions. Bai & Li (2011) reported that the majority of construction-site road crashes are caused by passing driver inattention and speeding, and take place in one-lane, two-way work zones where these conflicting imperatives are likely to be the most pressured. The majority of fatalities to road workers on foot occur within the work zone, when passing vehicles have left the traffic space and intruded into the work space (Pratt et al., 2001).

Passing-traffic-control devices range from hand-held signs instructing the traffic to stop or move slowly, to semi- and fully-automated temporary traffic-control devices such as portable traffic light systems. Other effective traffic-control options include lighting devices, modified optical speed bars, channelising devices, portable changeable-message signs, pavement markings and rumble strips, and flashing lights used in conjunction with barriers, etc. (Bai & Li, 2010). Workers undertaking short-term road works, especially maintenance (e.g. sealing cracks, filling potholes, line marking or replacing reflective pavement markers), are at particular risk as they are often only at the location for a short time and their protection has to be fairly simple and easily moved; thus there is a heavy reliance on vehicle-mounted signs and flashing lights to ensure adequate protection.

6 Legislation and standards

The challenging complexity of occupational road vehicle use OHS is in part because of the mix of related legislation and other regulatory requirements. Road use and safety legislation applies to all vehicles used on public roads and include specific requirements for worker fitness to drive; vehicle, (plant), design and roadworthiness, and the work-road environment road.

Employers and employees and other workers who either drive for work or work on roads have obligations under all Australian OHS Acts to ensure these workers are fit for this work. Worker fitness to drive includes the ability to maintain constant attention, make responsive and appropriate judgments and be physical capable of operating the vehicle. All States and Territories in Australia have laws about reporting health conditions that might affect the ability to drive safely. These laws require reporting any permanent or long-term illness that is likely to affect the ability to drive safely to the relevant Driver Licensing Authority and applies to workers as well as private drivers. If a driver is impaired formal assessment of Fitness to Drive is undertaken according to two sets of medical standards - private (or non-commercial or OLV) driver standards, and commercial vehicle driver standards. The commercial vehicle driver standards apply to drivers of heavy vehicles; bus drivers, taxi drivers, chauffeurs, drivers of hire cars and small buses etc; and those authorised to carry bulk dangerous goods (Austroads, 2011). Road- worker fitness requirements include the ability to safely perform the inherent requirements of the particular site related tasks. All work-road users must also comply with jurisdictional road safety legislation including requirements relating to speeding, mobile-phone use, seatbelt-use, alcohol and other drug related legislation.

Vehicles are classified as mobile plant under Australian model OHS legislation. As well as general plant regulations specific guidelines are provided by OHS regulators such as the WorkSafeô Victoriaǒs ñWarning devices and other safety measures for mobile powered plantò which provides practical information on prevention of collisions between powered mobile plant and users and bystanders through the implementation of identification, assessment and risk control measures (WorkSafe Victoria, 2000). National standards for vehicle safety are included in the Australian Design Rules (ADR). These ADRs are generally performance based and cover issues such as occupant protection, structures, and braking, and are administered by the Australian Government under the *Motor Vehicle Standards Act 1989.* This Act requires all road vehicles to comply with the relevant ADRs as at the time of manufacture, according to the relevant state or territory government's legislation (Department Of Infrastructure and Transport, 2011a). The ongoing development of a single national system framework for heavy vehicle regulation, COAG's Heavy Vehicle Regulatory Reform, (see 4.2 above) will be established at the end of 2012 to regulate all vehicles over 4.5 gross tonnes, ending the separate and at times conflicting jurisdictional regulatory imposts on the heavy vehicle industry (Department Of Infrastructure and Transport, 2011b). All Australian States and Territories have legislative responsibility for the transport of Dangerous Goods, many of which are also categorized as hazardous substances. Relevant legislation includes the National Transport Commission's Australian Dangerous Goods Code Road and Rail (ADG Code) which is referenced in OHS regulations such as the Victorian Dangerous Goods (Storage and Handling) Regulations 2000, and Dangerous Goods (Explosives) Regulations 2000 (Department of Infrastructure and Transport, 2010, Worksafe, n.d.b).

Regulatory protections for road workers are discussed above (see 4.5). The International Standards Organisation is currently developing ISO/DIS 39001 Road Traffic Safety (RTS) Management Systems – Requirements with Guidance for Use with a target publication date of 19/12/2012 (ISO, 2011). Employer obligations to ensure a safe place of work apply to consideration of potential risks within the work environment and both the protection from harm of roadside-workers and consideration of the condition of the roads on which employees are driving.

7 Control of hazards related to vehicles and occupational road use

Although the quantity and quality of research into occupational road use has increased in the last decade, particularly in Australia, there continues to be a dearth of intervention evaluation. Gregerson (1996) and Salminen (2008) demonstrated that the use of group discussion about driving-related risks combined with a commitment by senior management to the risk-management process, provide the most successful risk-management intervention for drivers in selected workforces. More intervention research is needed.

Risks associated with occupational road use should be addressed through integrated OHS risk-management processes. Identification of occupational-road-use risks and related hazards, and the implementation of appropriate control strategies should be based on a hierarchical approach, which recognises that the vehicle is the equipment being used and the road is the work environment. Engineering controls should include the use of evidence-based vehicle (or equipment) selection using resources such as the Australian New Car Assessment Program (see ANCAP, 2010), and the implementation of managed maintenance and procurement programs. As well as vehicle safety ratings, the vehicle selection and implementation process should consider user anthropometrics, the vehicle purpose and the various environments in which it will be used, based on sound ergonomics practice and a systems or ecological model.

While many organisations have developed Safe Driving Policies as part of their overall OHS program, it is important to recognise that these are unlikely to succeed if they rely on the expectation of changing driver behaviour alone. Administrative controls, which have been the basis of many public health road-safety programs, are unlikely to be effective within an OHS risk-management program unless they are supported by practical engineering controls (e.g. the use of safer vehicles on safer roads), with strategically supported trip management (e.g. the provision of accommodation on long trips, rather than continued driving). Traffic infringements (speeding or other driving offences) should be considered OHS incidents and managed through the same injury-management system as any other identified risk or hazard. Fitness to drive or work on roads should be managed in the same way as any other aspect of fitness to work, with particular regard to the task demands and the hazards and exposures of occupational-road-use activity. The use of in-vehicle equipment should be restricted unless there is an evidence base for its safe use. Such restrictions may involve elimination, substitution by a safer system, or engineering controls to prevent the activity from taking place while the vehicle is being driven. Programs to assist employers and other road users to address occupational road use as a component within their broader OHS program have been developed by, for example, WorkSafe and the Traffic Accident Commission in Victoria (Worksafe Victoria & TAC, 2008), the NSW Roads and Traffic Authority (NSW RTA, 2011), and the Swedish Vision Zero initiative presented in the Organisation for Economic Cooperation and Development International Transport Forum (OECD, 2008).

8 Implications for OHS practice

Many of the persons killed or injured in crashes associated with occupational vehicles and road use are members of the public, demonstrating that occupational road use is a public health issue as well as an OHS issue (Duke, Guest & Boggess, 2010; Mitchell et al., 2004). Occupational road-vehicle users and road workers comprise a significant group within the total workforce and the risks described in this chapter present serious challenges for contemporary OHS practice. Furthermore, these challenges are likely to increase with a growing mobile workforce and changing work patterns. Despite the OHS importance of issues associated with occupational vehicles and road use, because the related risks are generally experienced outside the traditional and relatively controlled workplace environment there is a potential for them not to be considered a ‘core’ area of attention for the generalist OHS professional.

The generalist OHS professional may be involved in the development and implementation of policies relating to:

- Vehicle procurement
- Vehicle maintenance
- Procurement and use of in-vehicle equipment

- Driving hours and trip management
- Vehicle- and road-use incident reporting, including speeding and traffic infringements
- Fitness for driving assessment.

Ongoing challenges for OHS professionals working with occupational road safety include the difficulty in accessing reliable occupational-road-use-related data and the limited research available to provide a reliable evidence base for intervention. Until OHS policy and practice overtly recognises all occupational road users as workers and their vehicles as workplaces, and subsequently regulates and manages this form of work, this challenge is likely to persist. Regardless of the vehicle type used, OHS professionals must manage work-road risks as they would any OHS risk, using an ecological approach to systematically address all risk factors regardless of mobility of this work environment and the peripatetic nature of the work.

9 Summary

Occupational vehicle and road use raises serious OHS issues that present generalist OHS professionals with unique challenges in developing innovative and systemic actions to influence worker, vehicle, organisational, environmental and policy-related risk management. After brief consideration of the historical context and extent of the problem, this chapter discussed physical hazards associated with occupational vehicles and road use relevant to light and heavy vehicles, and roadside workers. Legislation and risk-management strategies were discussed and, finally, implications for OHS practice were considered.

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