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Work-related road safety in Australia, the United Kingdom and the United States of America: an overview of regulatory approaches and recommendations to enhance strategy and practice

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Abstract

Work-related travel and transport by road is fundamental for industry, government and organisations. Traditionally, road safety interventions at societal level have focussed on improving road and vehicle engineering and changing road-user behaviour through transport laws and safety campaigns. Crash data indicate that significant numbers of road-user fatalities occur while driving to or for work. Therefore, workplace initiatives can improve both road and worker safety. This paper reviews regulatory approaches to work-related road safety (WRRS) in Australia, the United Kingdom and United States, identifying significant and consistent gaps in policy, management and research. In all three countries, responsibility for managing and regulating WRRS is spread across government agencies, without a single coordinating body. This paper makes the case that integrating management of WRRS into regulatory and non-regulatory occupational health and safety (OHS) initiatives would foster and support collaboration between research and practice communities, ensuring a comprehensive evidence base for future programs.

Introduction

Road vehicles are driven for many purposes, ranging from social or domestic travel to use by commuters and workers in many occupations and industries. Historically, road transportation has been crucial to the development of industrial economies, with the rate of motor vehicle registrations seen as an important dimension of socioeconomic modernisation and political development [1]. Growing urbanisation results in greater demand for goods and services, and a corresponding increase in demand for freight transport. Economies of scale have resulted in increasingly larger freight vehicles and smaller and more economical light vehicles. Contemporary work patterns have increased the demand for mobile and accessible workers using vehicles equipped with portable facilities to enable peripatetic work away from employer-controlled work sites [2, 3].

Motor vehicle crashes (MVCs) are consistently the leading cause of traumatic work-related fatality and injury in most westernised countries [4, 5]. In Australia, MVCs in traffic accounted for 24% (n=53) of all work-related fatalities from July 2010 through June 2011, and MVCs during commuting resulted in another 110 fatalities [6]. In the United States (U.S.), MVCs in the course of work (on or off public roads, but excluding commuting) accounted for 35% of all occupational fatalities in 2011. Driver-sales workers and truck drivers accounted for 33% of these, with the remainder distributed across all other occupational groups [7]. In the United Kingdom (UK), excluding Northern Ireland, work-related crashes made up 29% of all road traffic fatalities in 2011 and an additional 12% of road traffic fatalities occurred while commuting to or from work [8].

Over the past decade, work-related road safety (WRRS) has gained increased international recognition. In 2008, the United Nations (UN) General Assembly adopted a resolution on 'Improving Global Road Safety,' which '*Encourages organizations in both the private and the public sector with vehicle fleets, including agencies of the United Nations system, to develop and implement policies and practices that will reduce crash risks for vehicle occupants and other road users*' [9]. This UN resolution notes the global importance of vehicle operations to worker and public safety, and justifies action by corporations, governments and other stakeholders to improve road safety for workers. Further, the formal plan for action for the UN Decade of Action for Road Safety 2010-2020 includes numerous elements relevant to WRRS [10].

WRRS encompasses a complex mixture of roads, users and vehicles of all types and sizes. The exposed population includes all users of work vehicles: drivers and passengers of trucks, buses, taxis, courier vehicles, hire-cars, emergency service vehicles, cars, two-wheelers and other light vehicles. Many such workers use vehicles as a 'tool' in the course of employment, but their occupational title is not necessarily 'driver.' Although the legal scope and definitions vary by jurisdiction, often related to insurance and workers' compensation schemes, the significant risks involved in commuting should also be seen as a key element of WRRS.

This paper reviews regulatory approaches to WRRS in Australia, the UK and the U.S., and provides recommendations for the development of systematic and strategic responses for policy, research and workplace practice.

Regulation and the operating environment

Australia

In Australia, the regulating entity for heavy vehicles, the National Transport Commission (NTC), works with peak industry bodies and government to develop land-transport policy and is responsible for many safety and compliance issues, including the review of medical standards for assessing fitness-for-duty for commercial vehicle drivers (Table 1). NTC commercial vehicle driver standards apply to bus, taxi and small bus drivers, chauffeurs and those authorised to carry bulk dangerous goods. The 2012 national Work Health and Safety Regulations cover workplace hazardous substances and dangerous goods under a single framework which includes the NTC's Australian Dangerous Goods Code Road and Rail [11]. Additionally, each Australian State and Territory has its own local vehicle and driver registration agency and OHS regulator.

In 2001, a landmark review of long-haul trucking recommended increased harmonisation between road transport and OHS legislation and greater interagency cooperation to address serious concerns about trucking safety [12]. Subsequent reforms to national road-transport laws introduced requirements that hold all those with control over a heavy-vehicle user's ability to comply with relevant regulations both accountable and responsible if they fail to discharge that responsibility. In addition to drivers and employers, this 'chain of responsibility' includes organisers of trip schedules, consignors, importers, retailers and primary producers [13]. In 2012, a single national system framework, the Heavy Vehicle Regulatory Reform, was put in place to regulate all vehicles over 4.5 gross tonnes [14].

Table 1. Australian federal agencies with responsibility for work-related road safety

Agency	Ministry	Notes
Transport Agencies		
National Transport Commission (NTC)	Department of Infrastructure and Transport	• Administers Australian Design Rules (ADRs): all road vehicles required to comply at the time of manufacture • Administers Australian Dangerous Goods Code • Works in partnership with peak industry bodies and government to develop heavy vehicle land-transport policy • Reviews medical standards for assessing fitness to drive for commercial vehicle drivers
Austroads	None: Comprised of Australian and New Zealand road transport and traffic authorities (including the Department of Infrastructure and Transport)	• Provides expert technical input to national policy development on road and transport issues • Promotes consistency in road and road agency operations • Promotes improved practice and capability by road agencies
OHS Agencies		
Safe Work Australia	Intergovernmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety	• Federal policy-setting body whose role is to improve OHS and workers' compensation arrangements across Australia • Recognises work vehicles as a workplace on public roads • Collates work-road and other work related data • Current WRRS Guides published by WorkSafe Victoria

Under the Australian Work, Health and Safety Act 2011, vehicles used for the purpose of work are classified as a 'workplace.' To date, however, this national legislation has not been fully adopted by all states in Australia [15]. Employer obligations to ensure a safe place of work apply to potential risks within the work-vehicle environment and the roads on which employees are driving. All at-work drivers must comply with jurisdictional road safety legislation including requirements relating to speeding, mobile-phone use, seatbelt-use, alcohol and drugs. In addition, there are obligations under all Australian OHS Acts to ensure workers are fit to drive, both cognitively and physically, including requirements to report any ongoing illness likely to affect the ability to drive safely. If a driver is impaired, formal assessment of fitness to drive is undertaken according to two sets of medical standards: commercial vehicle driver standards, or private driver standards, which apply to all other motorists [16]. Other than generic vehicle requirements for roadworthiness and registration, and responsibilities for the transport of Dangerous Goods [11], there are no specific standards prescribed for light vehicles; the standard for light vehicles is the possession of a current driving licence, regardless of driving competence, experience or the work context.

United Kingdom (UK)

Since the Second World War, various Transport Acts have regulated the heavy-truck and bus sectors, focusing on areas such as vehicle weights, drivers' hours and licencing, and certification of professional competence. Lighter vehicles used for work purposes, including cars and vans, have remained relatively unregulated beyond the Highway Code and general rules of the road. The OHS agency, the Health and Safety Executive (HSE), was created by the 1974 Health and Safety at Work (HSW) Act. The HSE does not exercise its jurisdiction for crashes on public roads, nor does it include them in its data collection on work-related injuries. Generic concepts within the HSW Act are nonetheless relevant to WRRS, notably 'duty of care,' which charges an employer to '*ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees*' (Part I, Section 2 (1)) [17]. This provision has been used to argue that employers' responsibility to provide a safe work environment ought to extend to all workplaces, including motor vehicles.

Because HSE regulations are not directly enforced for at-work driving, basic legislation under the Department for Transport (DfT) has become the de facto source of law for work-related driving in the UK. The Road Transport Act (RTA) of 1988 covers licencing for all classes of

Table 2. British government agencies with responsibility for work-related road safety

Agency	Ministry	Notes
Transport Agencies		
Department for Transport (DfT)		• Oversees the work of public agencies that cover all modes of transport • Transport Statistics unit publishes road crash statistics for Great Britain
Driving Standards Agency (DSA)	Department for Transport	• Sets driver testing standards, including those for the EU-mandated Certificate of Professional Competence (CPC) to drivers of large-goods and passenger transport vehicles • Conducts written and on-road driving tests • Regulates driving instructors
Driver and Vehicle Licensing Agency (DVLA)	Department for Transport	• Issues driving licences, including special endorsements, and vehicle registrations • Agency to which licenced drivers must report medical conditions affecting their ability to drive • Dependent on fully informed, explicit and freely given driver consent, DVLA sells licence endorsement data for entitlement and risk management purposes

Vehicle and Operator Services Agency (VOSA)	Department for Transport	• Enforces safety standards for large-goods vehicles and passenger-transport vehicles
		• Supports work of regional Traffic Commissioners, who review applications and issue the EU-mandated CPCs to companies that transport passengers or freight
		• For all types of vehicles:
		  • Oversees vehicle inspection programs and enforcement of manufacturing standards
		  • Investigates vehicle defects and issues recalls

OHS Agencies		
Health and Safety Commission (HSC)	Independent commission	Sets policy for OHS
Health and Safety Executive (HSE)	Not attached to a ministry	• Implements and enforces OHS regulations • Investigates occupational injuries on employer premises

drivers, manufacturing standards, seat-belt use, impaired and reckless driving, vehicle inspections, fitness to drive, and loading of goods vehicles. Other RTA provisions hold employers and other parties partially responsible for certain road infractions [18]. Since the UK joined the European Union (EU), regulations for heavy vehicles have increasingly been intertwined with EU initiatives covering areas such as working time, driver licencing and driver training via the Certificate of Professional Competence (CPC). To date, EU directives and regulations have not explicitly included the significant numbers of light vehicles being driven for work. However, the 1989 'Framework Directive' for OHS emphasised the employer's responsibility to '*evaluate the risks to the safety and health of workers, inter alia in the choice of work equipment, the chemical substances or preparations used, and the fitting-out of work places*' (Article 6(3)a) [19]. As a directive, this EU legislation charged member states to develop conforming national legislation.

Several high-profile transportation disasters in the 1990's drew the attention of UK policymakers and the public to WRRS. In 1996 and 1997, the Royal Society for the Prevention of Accidents (RoSPA) organised stakeholder meetings around the question of whether employer 'duty of care' under the HSW Act should extend to work-related driving. Arguments in favour of employers taking responsibility for managing WRRS for light as well as heavy vehicles were bolstered by the EU Framework Directive's requirement that employers conduct comprehensive risk assessments. The RoSPA-sponsored meetings led to a consensus that businesses ought to

institute policies and procedures to manage road risk and participants signed a declaration to that effect [20].

In response, a broad-based committee convened by the government recommended that employers manage at-work road risk within the framework that should already be in place for managing all other OHS risks [21]. In 2003, the HSE and DfT jointly issued a guidance document called *Driving at Work* [22]. Although this did not have the force of regulation, it was nonetheless symbolically important because it represented an official entrance into the WRRS policy area by HSE. Moreover, it has come to be accepted as setting core requirements to be followed by organisations, and it applies to all vehicles used for work purposes irrespective of type, size or ownership.

More recently, the 2007 Corporate Manslaughter and Homicide Act allowed criminal negligence lawsuits against businesses when management's failure to exercise its 'duty of care' results in death. The law is intended to complement other legal remedies, including OHS regulations. Lawsuits brought under this law are handled as criminal cases, not labour action [23]. Today, a number of British government agencies under the DfT have responsibilities relevant to WRRS. Many have dual responsibility for managing the same issues for work-related driving and the general motoring public (Table 2).

A growing body of collaborative research from the UK has established risk factors associated with driving for work, the importance of identifying at-risk drivers, and the role of fleet management programs in reducing crash rates. Government-sponsored research [24-27] has allowed the government to be indirectly involved in building the knowledge base for WRRS without imposing new government mandates. Purpose-of-journey data from transportation statistics have identified crash-involved work vehicles by type, which may lead to more effective targeting of interventions [28]. Organisational-level research has focused on driver assessment and improvement

Table 3. U.S. federal agencies with responsibility for work-related road safety

Agency	Ministry	Notes
Transport Agencies		
Federal Highway Administration (FHWA)	Department of Transportation	Issues Manual on Uniform Traffic Control Devices (MUTCD), which provides guidance for setting up highway construction work zones and managing special situations including crash scenes
Federal Motor Carrier Safety Administration (FMCSA)	Department of Transportation	• Develops and enforces safety regulations for all aspects of large-truck and bus operations • Oversees monitoring of carriers' safety performance and roadside inspections of large trucks and buses • Oversees Commercial Driver's License (CDL) program • Medical Program: rules to ensure that physical qualification of drivers reflects current clinical knowledge and practice
National Highway Traffic Safety Administration (NHTSA)	Department of Transportation	• Issues the Federal Motor Vehicle Safety Standards (FMVSS) applicable to all vehicles manufactured for sale or use in the U.S. • Investigates vehicle defects and issues recalls • Collects and maintains national databases on fatal and nonfatal MVCs
OHS Agencies		
Occupational Safety and Health Administration (OSHA)	Department of Labor	• Develops federal OHS regulations and enforces them in cooperation with states • Limited regulations for motor vehicle operations • Investigates occupational injuries on employer premises
Bureau of Labor Statistics (BLS)	Department of Labor	• Collects occupational injury and fatality data in cooperation with states (commuting-related incidents are excluded)
National Institute for Occupational Safety and Health (NIOSH)	Department of Health and Human Services	• Conducts research and makes recommendations for preventing occupational injuries and illnesses, including motor vehicle-related injuries

to help develop a culture of safe driving and reductions in crash rates and costs via a comprehensive fleet safety program [29, 30]. Although a systems-based approach is widely advocated in the UK, researchers have also noted the challenges of assessing the effects of 'packages' of individual interventions [31].

United States

In the U.S., workplace driving takes place in two distinct settings: the U.S. Department of Transportation (DOT) regulatory regime that covers large trucks and buses, and the largely unregulated operation of light vehicles driven for work. Regulations to promote safe operation of large trucks and buses have been part of U.S. federal policy since the 1930's. Today, this regulatory responsibility is carried out by the Federal Motor Carrier Safety Administration (FMCSA) in the U.S. Department of Transportation. FMCSA's primary mission is to ensure the safe operation of large trucks and buses, primarily by promulgating and enforcing safety regulations (http://www.fmcsa.dot.gov/rules-regulations/rules-regulations.htm). Although development and oversight of these regulations occurs at federal level, licencing under the Commercial Driver's License (CDL) program and most enforcement activities are carried out by the states. FMCSA also supports research and non-regulatory safety initiatives related to new technology, management practices, and driver behaviour (Table 3).

In contrast, there are no corresponding regulations applicable to U.S. workers who drive light vehicles for work purposes. At-work driving falls under the Occupational Safety and Health Administration (OSHA) 'general duty clause,' which requires an employer to provide '*employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees*' [32]. OSHA has issued regulations covering some aspects of mobile equipment operation in construction, logging, marine terminals and agriculture. OSHA has no regulations for operation of motor vehicles on public roadways that cover a wide range of vehicles, drivers and work situations (Table 3). The OSHA policy response to occupational risks of light-vehicle operation has included voluntary initiatives, guidance documents, ad hoc advisory committees and a recent enforcement initiative on distracted driving that uses the 'general duty clause' as the basis for action [33]. Operation of most vehicles in the U.S. workplace is in effect governed by traffic laws, augmented by employer policies. In the U.S., laws related to mobile-phone use, seat belts, speed limits, age of licensure, and licence renewal are the responsibility of individual states. Inconsistency in laws and regulations from state to state can complicate road safety management for organisations that operate in multiple states.

Fatality risk is consistently highest in the truck transportation sector. For this reason, the vast majority of U.S. literature on WRRS addresses known and hypothesised risk factors for truck drivers, including driver fatigue and hours of service [34-36], medical conditions [37-40] and use of mobile devices [41, 42]. Published research on the safety of light vehicles driven for work is limited. Reports published in the last decade have addressed MVCs among law enforcement officers [43]; home healthcare workers [44]; workers operating agricultural equipment on public roadways [45, 46]; and workers in the oil and gas extraction industries [47]. One of the few U.S. studies to assess the effectiveness of behavioural interventions was a series of related experiments conducted over many years among pizza delivery drivers [48].

Discussion and recommendations

This review revealed significant and consistent gaps in WRRS policy and research. In all three countries, responsibility for managing and regulating WRRS is spread across government agencies, with no single policy-coordination body. In both Australia and the U.S., the presence of federal, state and territorial jurisdictions is a complicating factor because responsibility for legislation, regulation and enforcement is divided or shared among these levels of government. This may create obstacles to identifying hazards and exposures for all vehicle types, and to establishing coordinated and effective risk management systems; policy, research, and enforcement initiatives; and data systems.

In all three countries, regulations for commercial heavy vehicles that transport freight and people are well-developed, with responsibility assigned to road safety and transport agencies. In contrast, the safety of workers using light vehicles for work purposes is not fully addressed by OHS and transport regulations. In Australia, OHS policy formally recognises all types of work vehicles as workplaces and MVCs are included in data systems on work injuries. In the UK, OHS policy includes the former but not the latter, although public-private cooperative efforts to improve WRRS are otherwise strong. In the U.S., OHS data include at-work MVCs, but light vehicles are not explicitly recognised as workplaces for OHS enforcement purposes, except under general laws that require employers to provide a safe work environment.

Based on the evidence presented, it may be beneficial to conceptualise management of WRRS as an integral part of regulatory and non-regulatory OHS initiatives. For example, the recent adoption of 'Model WHS legislation' across nearly all national jurisdictions in Australia provides a unique opportunity to improve regulatory standards [49]. Other government-led strategies might include recommended core data collection elements, key performance indicators, evaluation methods for use by

public and private sector organisations, and case examples that demonstrate the cost-effectiveness and economic benefits of WRRS programs.

Governments can also foster information exchange between the research and practice communities, which is beneficial to ensuring a comprehensive evidence base to support future policy and practice. Cooperative, non-regulatory initiatives have mushroomed in recent years, e.g., Driving for Better Business (DfBB) in the UK, the Network of Employers for Traffic Safety (NETS) in the U.S., compliance assistance offered to employers in Australia through the Transport Accident Commission/Worksafe, the growth of the Work-related Road Safety Project Group in the UN Road Safety Collaboration, and major road safety conferences worldwide that have wholly or in part addressed WRRS. In addition, stakeholders have developed resources to help organisations manage risk (Appendix 1), which demonstrates the increasing importance ascribed to WRRS and the benefits of cooperation among stakeholders.

In all three countries, many public and private sector employers have recognised the burden of work-related MVCs on their organisations and their workers, and have integrated road safety into OHS risk-management processes. However, in some organisations, awareness of the burden and the implementation and evaluation of countermeasures are not well-developed. For all organisations whose employees drive for work, WRRS is a key component of OHS risk-management systems. Successful implementation requires worker and management commitment, identification of risks and related hazards and exposures, implementation of appropriate control strategies and collection of data to assess risk and track progress [50]. Control strategies should be based on hierarchical approaches, recognising that the vehicle is work equipment and the road part of the work environment. Engineering controls should include the use of evidence-based vehicle selection resources such as New Car Assessment Programs and managed maintenance and procurement programs. Engineering controls should be supported by safe-driving policies, with strategically supported trip management (e.g., accommodation on long trips) and restrictions on use of technology such as mobile phones. In addition, the new International Organization for Standardization (ISO) 39001 standard on road traffic safety management systems provides an opportunity to engage organisations across all the locations in which they operate [50].

The lack of peer-reviewed outcome evaluations is a major WRRS research gap. While employers are being encouraged to implement comprehensive fleet safety programs, the evidence base supporting the efficacy of specific program elements is limited. Within WRRS, the following types of research are urgently needed:

- Formal evaluations by organisations with existing 'good practice' projects (e.g., Fleet Safety Benchmarking, NETS, and DfBB).
- Collaborations between organisations and researchers to evaluate the success of road safety interventions (e.g. peer reviewed studies based on road safety outcomes, involving suppliers of behind-the-wheel training or driver assessment and monitoring systems).
- Use of workers' compensation, social, or general fleet insurance data and resources to target risks associated with work-related driving and commuting.
- Research and demonstration projects focussing on the links between safety, operational efficiency and the environment.
- Studies on structural issues such as excess working hours, unrealistic delivery schedules, the growing home delivery and courier sectors, peripatetic light vehicle users and load piece rate payment systems.
- Research on working conditions where contracting, subcontracting and use of temporary labour are common, to better determine the impact of organisational characteristics on worker health and suggested potential interventions throughout the supply chain.

Several fundamental principles can be consistently applied regardless of country, agency or stakeholder, including: (1) recognition of all types of vehicles as workplaces when they are driven for work purposes; (2) implementation of inclusive and consistent definitions encompassing all users and types of work vehicles and work situations; and (3) development of clear duty-of-care obligations for all at-work drivers, their employers and others, consistent with existing risk-management systems for heavy vehicles such as Australia's 'chain of responsibility' system [13]. These obligations should include strategies to manage fitness-for-task requirements and the introduction of OHS-related standards.

The UN Decade of Action for Road Safety holds great promise for drawing international attention to WRRS. Engagement of private and public sector organisations to prevent work-related crashes for their own workforces can influence a significant component of global road risk. WRRS has many stakeholders: government agencies responsible for transport, OHS, and public health; public and private fleet owners; labour; researchers; and international organisations. Further collaboration across all stakeholder groups may lead to more effective control systems to manage the human, financial and community risks – applying a risk-led systems-based approach.

Conclusion

Based on crash and injury data, the safety of persons who drive for work is a significant issue for the OHS and road-safety policy communities. Employers, governments, and other stakeholders are therefore presented with the challenge and opportunity to address road safety risks for these workers via their workplaces. This paper has described regulatory approaches to WRRS in Australia, the UK and the U.S. and offered recommendations for developing systematic and strategic responses for policy, research and workplaces. The adoption of an OHS-centred and evidence-based approach to WRRS offers the potential to address this significant societal issue. Interventions to address identified risks could reduce human harm while assisting organisations to be safer, more profitable and efficient, with enhanced reputation within their community. Governments, researchers and key stakeholders in organisations requiring their people to travel to or for work are encouraged to undertake efforts to understand, manage and minimise the risks. WRRS is a significant OHS and road-safety issue which is appropriately addressed by government, regulators and other stakeholders in a coordinated and systematic manner. Coordinated policy and practice may reduce the number of workers and others who are likely to be injured or killed while using public roads.

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health and Centers for Disease Control and Prevention.

References

1. Olsen ME. Multivariate analysis of national political development. American Sociological Review. 1968;33(5):699-712.
2. Stuckey R, LaMontagne AD. Occupational light-vehicle use and OHS legislative frameworks: an Australian example. International Journal of Occupational and Environmental Health. 2005 Apr-Jun;11(2):167-79.
3. Eost C, Flyte MG. An investigation into the use of the car as a mobile office. Applied Ergonomics. 1998;29:383-8.
4. CDC. Occupational highway transportation deaths – United States, 2003-2008. MMWR. 2011;60(16):497-502.
5. European Commission. Causes and circumstances of accidents at work in the EU. Brussels: European Commission Directorate-General for Employment, Social Affairs and Equal Opportunities, F4 Unit, 2009.
6. Safe Work Australia. Work related traumatic injury fatalities. Canberra, ACT: Safe Work Australia, 2012.
7. Bureau of Labor Statistics. TABLE A-6. Fatal occupational injuries resulting from transportation incidents and homicides by occupation, All U.S., 2011. Washington, DC: U.S. Department of Labor, Bureau of Labor Statistics, 2013.
8. Department for Transport. Reported road casualties: Great Britain 2011. London: Department for Transport, 2012.
9. United Nations General Assembly. Improving global road safety (A/Res/62/244 of the General Assembly). New York: UN General Assembly, 2008.
10. World Health Organization and UN Road Safety Collaboration. Global plan for the Decade of Action for Road Safety 2011-2020. Geneva, Switzerland: World Health Organization, 2010.
11. Department of Infrastructure and Transport. Transport of dangerous goods. Canberra: Department of Infrastructure and Transport, 2010.
12. Quinlan M. Report of inquiry into safety in the long haul trucking industry. Sydney: University of New South Wales, School of Industrial Relations and Organisational Behaviour, 2001.
13. Johnstone R. The legal framework for regulating transport safety: chains of responsibility, compliance and enforcement (National Research Centre for OHandS Regulation Working Paper 1). National Research Centre for OHandS Regulation, 2002.
14. Department of Infrastructure and Transport. Heavy vehicle regulatory reform [May 8, 2013]. Available from: http://www.infrastructure.gov.au/roads/vehicle_regulation/ris/index.aspx.
15. Parliament of Australia. Work Safety and Health Act 2011 (A2011-35). Canberra, ACT: Parliament of Australia, 2011.
16. Austroads/National Transport Commission. Assessing fitness to drive for commercial and private vehicle drivers. Sydney: Austroads, 2013.
17. HMSO. Health and Safety at Work etc. Act 1974 (Chapter 37) London: HMSO; 1974 [December 31, 2012]. Available from: http://www.legislation.gov.uk/ukpga/1974/37/contents/enacted.
18. HMSO. Road Traffic Act 1988 (1988 Chapter 52) London: HMSO; 1988 [December 13, 2012]. Available from: http://www.opsi.gov.uk/acts/acts1988/ukpga_19880052_en_1.
19. Commission of the European Communities. Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work. Official Journal of the European Communities. 1989;L 183(June 26, 1989):1.
20. Pratt SG. The role of institutional structures, interest groups, and framing in explaining occupational road safety policy in the European Union and member states: an application of the Advocacy Coalition Framework and multilevel governance (Ph.D. dissertation, Department of Political Science). Morgantown, WV: West Virginia University, 2011.
21. Work-related Road Safety Task Group. Reducing at-work road traffic incidents: Report to government and the Health and Safety Commission. London, England: Health and Safety Commission and Department of Transport, Local Government, and Regions, 2001.
22. Health and Safety Executive. Driving at work: managing work-related road safety (INDG382). London: Health and Safety Executive, 2003.
23. Ministry of Justice (United Kingdom). A guide to the Corporate Manslaughter and Corporate Homicide Act 2007. London: Ministry of Justice, 2007.
24. Lancaster R, Ward R. Management of work related road safety (Research Report 018). London: Health and Safety Executive, 2002.

25. Lancaster R, Ward R. The contribution of individual factors to driving behaviour: Implications for managing work-related road safety (Report No. 20). London, England: Health and Safety Executive, 2002.

26. BOMEL Limited. Safety culture and work-related road accidents (Road Safety Research Report No. 51). London: Department for Transport, 2004.

27. Broughton J, Baughan CJ, Pearce L, Smith L, Buckle G. Work-related road accidents (TRL Report 582). Berkshire, England: Transport Research Laboratory, 2003.

28. Clarke DD, Ward P, Bartle C, Truman W. Work-related road traffic collisions in the UK. Accident Analysis and Prevention. 2009;41(2):345-51.

29. Darby P, Murray W, Raeside R. Applying online fleet driver assessment to help identify, target and reduce occupational road safety risks. Safety Science. 2009;47(3):436-42.

30. Murray W, Ison S, Gallemore P, Nijjar H. Effective occupational road safety programs: a case study of Wolseley. Transportation Research Record. 2009;2096:55-64.

31. Institution of Occupational Safety and Health. Work related road safety: a review of the evidence for interventions (summary report of research conducted by the Transport Research Laboratory). London: Institution of Occupational Safety and Health, 2011.

32. United States Congress. Occupational Safety and Health Act, Public Law 91-596, Section 5(a)(1) -- Duties. Washington, DC: United States Congress, 1970.

33. Solís HL. Remarks as prepared for delivery, U.S. Department of Transportation Summit, Prevention of Distracted Driving, Tuesday, September 21, 2010. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2010.

34. Blanco M, Hanowski RJ, Olson RL, Morgan JF, Soccolich SA, Wu S-C, et al. The impact of driving, non-driving work, and rest breaks on driving performance in commercial motor vehicle operations (FMCSA-RRR-11-017). Blacksburg, VA: Virginia Tech Transportation Institute, 2011.

35. Jovanis PP, Wu K-F, Chen C. Hours of service and driver fatigue: driver characteristics research (FMCSA-RRR-11-018). University Park, PA: Pennsylvania State University, 2011.

36. McCartt AT, Rohrbaugh JW, Hammer MC, Fuller SZ. Factors associated with falling asleep at the wheel among long-distance truck drivers. Accident Analysis and Prevention. 2000;32(4):493-504.

37. Wiegand DM, Hanowski RJ, McDonald SE. Commercial drivers' health: a naturalistic study of body mass index, fatigue, and involvement in safety-critical events. Traffic Injury Prevention. 2009;10(6):573-9.

38. Smolensky MH, Di Milia L, Ohayon MM, Philip P. Sleep disorders, medical conditions, and road accident risk. Accident Analysis and Prevention. 2011;43(2):533-48.

39. Orris P, Buchanan S, Smiley A, Davis D, Dinges D, Bergoffen G. Literature review on health and fatigue issues associated with commercial motor vehicle driver hours of work (Commercial Truck and Bus Safety Synthesis 9). Washington, DC: Transportation Research Board, 2007.

40. Hartenbaum N, Collop N, Rosen IM, Phillips B, George CF, Rowley JA, et al. Sleep apnea and commercial motor vehicle operators: statement from the joint Task Force of the American College of Chest Physicians, American College of Occupational and Environmental Medicine, and the National Sleep Foundation. Journal of Occupational and Environmental Medicine. 2006 Sep;48(9 Suppl):S4-37.

41. Olson RL, Hanowski RJ, Hickman JS, Bocanegra J. Driver distraction in commercial vehicle operations (FMCSA-RRR-09-042). Washington, DC: Federal Motor Carrier Safety Administration, 2009.

42. Hickman JS, Hanowski RJ, Bocanegra J. Distraction in commercial trucks and buses: assessing prevalence and risk in conjunction with crashes and near-crashes (FMCSA-RRR-10-049). Washington, DC: Federal Motor Carrier Safety Administration, 2010.

43. Tiesman HM, Hendricks SA, Bell JL, Amandus HA. Eleven years of occupational mortality in law enforcement: the Census of Fatal Occupational Injuries, 1992–2002. American journal of industrial medicine. 2010;53(9):940-9.

44. Sitzman KL, Pett MA, Bloswick DS. An exploratory study of motor vehicle use in home visiting nurses. Home healthcare nurse. 2002 Dec;20(12):784-92; quiz 93.

45. Costello TM, Schulman MD, Mitchell RE. Risk factors for a farm vehicle public road crash. Accident Analysis and Prevention. 2009;41(1):42-7.

46. Gkritza K, Kinzenbaw CR, Hallmark S, Hawkins N. An empirical analysis of farm vehicle crash injury severities on Iowa's public road system. Accident Analysis and Prevention. 2010;42(4):1392-7.

47. Retzer KD, Hill RD, Pratt SG. Motor vehicle fatalities among oil and gas extraction workers. Accident Analysis and Prevention. 2013;51:168-74.

48. Ludwig T, Geller ES. Intervening to improve the safety of occupational driving: A behavior-change model and review of empirical evidence. Journal of Organizational Behavior Management 2000;19(4):1-124.

49. Safe Work Australia. Model Work Health and Safety Act: Safe Work Australia; 2013 [May 10, 2013]. Available from: http://www.safeworkaustralia.gov.au/sites/swa/model-whs-laws/model-whs-act/pages/model-whs-act.

50. International Organization for Standardization. ISO 39001:2012, Road traffic safety (RTS) management systems - Requirements with guidance for use. Geneva, Switzerland: International Organization for Standardization, 2012.

Appendix 1: Workplace practice and resources

Australia
Australasian New Car Assessment Program (ANCAP) independent crash testing information on occupant protection provided by vehicles (2013): http://www.ancap.com.au/about Austroads (2011). Assessing Fitness to Drive (2011): http://www.austroads.com.au/aftd/index.html Murray, W., Newnam, S., Watson, B., Davey, J., and Schonfeld, C. (2003). Evaluating and Improving Fleet Safety in Australia (Road Safety Research Grant Report): http://www.infrastructure.gov.au/roads/safety/publications/2003/pdf/eval_fleetsafe.pdf Department of Infrastructure and Transport (2011). Heavy Vehicle Regulatory Reform: http://www.infrastructure.gov.au/roads/vehicle_regulation/ris/index.aspx Government of Western Australia (2009). Workplace road safety – Launch your own workplace vehicle safety campaign: http://www.ors.wa.gov.au/Documents/workplace-booklet-workplaceroadsafety.aspx Nevile, M., and Haddington, P. (2010). In-car Distractions and their Impact on Driving Activities (Road Safety Grant Report 2010–001). Canberra, ACT: Department of Infrastructure, Transport, Regional Development and Local Government. http://www.infrastructure.gov.au/roads/safety/publications/2010/pdf/rsgr_2010001.pdf NSW Roads and Traffic Authority (2011). Starting a safe driving policy. http://www.rta.nsw.gov.au/roadsafety/saferworkdriving/starting/index.html RoadWise (2006). Fleet Safety Resource Kit: http://www.roadwise.asn.au/resources/resources/fleetsafety/copy_of_fleetsafetyresourcekit TAC: Fleet safety policies and other resources: http://www.tacsafety.com.au/fleet/overviewTAC: How Safe is Your Car Website. Victorian Government Website interactive resource providing new and used vehicle safety ratings: http://www.howsafeisyourcar.com.au/ Worksafe Victoria/TAC (2008). Guide to Safe Work Related Driving. http://www.worksafe.vic.gov.au/wps/wcm/connect/91b8fc004071f37b936cdfe1fb554c40/safe_driving_web.pdf?MOD=AJPERES
United Kingdom
Brake: Road safety charity that offers fleet safety resources: http://www.brake.org.uk/Department for Transport: • A DfT guide to work-related travel (2011): http://webarchive.nationalarchives.gov.uk/20111005181249/http:/www.dft.gov.uk publications/measuring-and-reporting-greenhouse-gas-emissions • Toolkit for assessing and managing occupational road risk (2004): http://webarchive.nationalarchives.gov.uk/20090210013353/http:/www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme2/safetycultureandworkrelate51.pdf Health and Safety Executive: • Work related road safety (2013): http://www.hse.gov.uk/roadsafety/ • Driving at work: managing work-related road safety (2003): http://www.hse.gov.uk/pubns/indg382.pdf Interactive Driving Systems (2013): Fleet Safety Benchmarking: Web site to help companies and organisations that run vehicle fleets to effectively manage road risk. Includes free fleet safety gap analysis and case studies. Royal Society for the Prevention of Accidents (RoSPA). Guidance documents on impaired driving, mobile phones, in-vehicle technology, speed management and road safety for volunteer workers: http://www.rospa.com/roadsafety/resources/employers/ • Driving for work: Fitness to drive (2007): http://www.rospa.com/roadsafety/info/workfitness.pdf • Young Drivers at Work project materials (2008): http://www.rospa.com/roadsafety/youngdriversatwork/default.aspx • Vehicle technology: A manager's guide (2008): http://www.rospa.com/roadsafety/info/vehicle_technology.pdf • Managing occupational road risk: advice for SME's (2009): http://www.rospa.com/roadsafety/info/morr_sme.pdf RoadSafe (2013): • Driving for Better Business: program to develop and coordinate a network of employers and champions to promote good practice in work-related road safety. • Global compilations of employer resources on work-related road safety are available on the FleetSafe page: (see Employer Road Safety Processes, Procedures and Programs and International Web-based Resources)

United States

American Society of Safety Engineers (ASSE): ANSI/ASSE Z15.1–2012, Safe Practices for Motor Vehicle Operations. Des Plaines, IL: ASSE. Voluntary fleet safety standard targeted to organisations operating small to medium sized vehicles not regulated by trucking policy: http://www.asse.org/publications/standards/z15/docs/Z15_1_Tech_Brief_4_2012.pdf

FMCSA:

- Cross-border safety, inspection, and collision statistics by their country of domicile, for registered intrastate and interstate motor carriers operating in the United States: http://ai.fmcsa.dot.gov/international/border.asp
- CMV Web-based Driving Tips: collection of defensive driving tips focusing on common driving errors made by commercial vehicle drivers: http://www.fmcsa.dot.gov/about/outreach/education/driverTips/index.htm
- Safety is Good Business: resources to help motor carriers better understand business responsibilities and economic benefits of safety: http://www.fmcsa.dot.gov/safety-security/good-business/index.htm
- Safety Belt Partnership: initiative to increase use of seat belts among drivers of large trucks and buses: www.fmcsa.dot.gov/safety-security/safety-belt/index.htm

Network of Employers for Traffic Safety (NETS): www.trafficsafety.org

National Institute for Occupational Safety and Health (NIOSH): http://www.cdc.gov/niosh/topics/motorvehicle

National Safety Council (NSC):

- 'Cell Phone Policy Kit' (free for download) and other distracted-driving resources for employers:
  - http://shop.nsc.org/NSC-Cell-Phone-Policy-Kit-Downloadable-P2222.aspx
  - http://www.nsc.org/safety_road/Distracted_Driving/Pages/EmployerPolicies.aspx
- Our Driving Concern: a comprehensive safety manual for use by organisational fleet managers, with numerous checklists and sample policies as well as articles on topics such as distracted driving:
  - http://www.nsc.org/safety_road/EmployerTrafficSafety/Pages/NationalHome.aspx

Occupational Safety and Health Administration (OSHA): http://www.osha.gov/SLTC/motorvehiclesafety/index.html

Transportation Research Board (TRB): produces succinct reviews of a wide range of trucking health and safety topics such as driver wellness, fatigue management, driver selection, and management practices: http://www.trb.org/Publications/PubsCTBSSPSynthesisReports.aspx

U.S. Department of Transportation initiative on distracted driving. Role of employer policies in reducing distraction-related crashes, and materials to encourage employer and employee involvement: http://www.distraction.gov/content/get-involved/employers.html

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Formerly RoadWise – Australia's First Road Safety Journal

Special Issue - Safe Driving for Work

Peer-reviewed papers

- Work-related road safety in Australia, the United Kingdom and the United States of America: an overview of regulatory approaches and recommendations to enhance strategy and practice
- Effects of mobile phone distraction on drivers' reaction times
- Safety performance functions for traffic signals: phasing and geometry
- Use of Kloeden et al's relative risk curves and confidence limits to estimate crashes attributable to low and high level speeding

Contributed articles

- Smarter travel @ work: achieving road safety outcomes by reducing workplace travel
- Corporate road safety: an opportunity to reduce the road toll through integrated government policy
- Children locked in vehicles: implications for organisational and community safety

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Cover image

Traffic on a wet road – driving for work can expose workers to hazardous conditions. Image provided by CARRS-Q.

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