CITATION:

Murray, W. & Faulks, I.J. (2006). Work-related driving and driver distraction: Using the Haddon matrix to identify and manage the distractions. In: I.J. Faulks, M. Regan, M. Stevenson, J. Brown, A. Porter & J.D. Irwin (Eds.). Distracted driving. Sydney, NSW: Australasian College of Road Safety. Pages 641-657.

Work-related driving and driver distraction: Using the Haddon matrix to identify and manage the distractions

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Introduction

Fleet and work-related road safety has grown in prominence in recent years as the scale of the problem has emerged. This includes people involved in crashes as pedestrians when they are commuting to and from work, or walking on work-related errands, people involved in crashes whilst working by the roadside, or driving as part of their work, either in their own vehicle or a vehicle provided by their employer (STAYSAFE 36, 1997; STAYSAFE 57, 2002).

This paper looks at why work-related road safety is important in Australia, and introduces the Haddon Matrix as a tool to identify and manage the distractions faced by people driving as part of their work. It is intended as a discussion paper to provoke and widen the debate on driver distraction beyond the vehicle and the driver.

Why is work-related road safety important?

There are many societal, business, legal and cost reasons why Australia should focus on work-related road safety. These reasons were considered by Murray, Newnam, Watson, Davey and Schonfeld (2002), and their findings are summarised in the following paragraphs.

Societal factors or macro level factors

At present there is only limited data on the true extent of the work-driver effect on road safety because few jurisdictions around the world maintain any 'purpose of journey information'. The best data currently available are for Queensland, where at least 16% of hospitalisation crashes and 24% of fatal crashes over the period 1998-2002 involved someone driving for work. Table 1 shows some other societal reasons—suggesting that work-related driving is one of the most high-risk activities many Australians face.

Clearly there is a range of macro, societal or government level reasons why work-related road safety is important. There are also a range of micro or organisational business, legal and cost reasons why work-related road safety should be taken seriously.

Table 1. Societal reasons to improve work-related road safety (From Murray et al., 2002)

1. Despite the media around the recent 2005 Queensland rail crash, roads are much more risky. In 1998, for example, the total number of road deaths in Australia was 1,839, while there were 42 rail deaths, 64 air deaths and 52 deaths at sea.
2. Work-related vehicles constitute about 30% of registered vehicles in Australia (including 15% of cars).
3. Work drivers travel about three times the distance of the average private motorist in Australia (30,000 compared to 10,000 kilometres per annum).
4. Business travel accounts for about a third of all travel in Australia, over half if commuting to and from work is included.
5. Over 50% of new vehicles (70% of Ford and Holden) in Australia are initially purchased for commercial purposes, most of which will be integrated into the wider Australian vehicle pool within two to three years. The safer they are the better it is for Australian society.
6. National Occupational Health and Safety Commission (NOHSC) data suggests that over half of all the work related fatalities in Australia involve vehicles (26% commuting, 23% driving for work and 8% involving vehicles on work sites).
7. Queensland Workers Compensation figures for 1997-2000, show that vehicle accident payments from 10,195 claims (5% of total claims) cost over $52.5 million (10% of total costs) and resulted in 233,013 workdays absent (9% of total days). Vehicles were involved in 99 (43%) of the fatal claims.
8. Compulsory Third Party (CTP) insurance data from Queensland shows that work vehicles including taxis, buses, trucks and hire vehicles, have the highest claims frequencies and insurance premiums.

Business factors

From a more general organisational or business perspective, there is a clear link between safety, quality, customer service, efficiency and the environment through getting things right first time, better fuel efficiency and reduced asset wear and tear. Work-related road safety offers many opportunities for effective marketing, business development, projection of corporate social responsibility, enhancement of staff wellbeing, and brand enhancement or protection. At the most simple level, it is much better for an organisation's reputational risk to have the opportunity to promote a good news safety story—such as winning a safety award—than it is to have to attempt to suppress or explain away the outcomes of a major incident.

A proactive safety program can also keep an organisation ahead of, and protected from, regulations and legal requirements. Proactive organisations shape and lead forthcoming regulations, giving them a competitive advantage by being ahead of more reactive

organisations. Many such companies have also used safety as part of their business development process and to help them diversify by promoting their safety systems to others.

Legal factors

The importance of occupational health and safety (OHS) regulations, duty of care, chain of responsibility (COR), and corporate manslaughter requirements is increasing in the transport and road safety sectors. In the heavy truck sector in particular, organisations are increasingly being forced to change their practices under the requirements of chain of responsibility regulations—which make consignors, packers, loaders and customers, in addition to drivers and transport suppliers, legally accountable for offences to which they have contributed or encouraged. Although chain of responsibility does not currently apply to light vehicle fleets, it sends a clear message to organisations requiring their staff, or those of their contractors and sub-contractors, to drive for work purposes.

Organisations operating motor vehicles have legal obligations and a duty of care under the occupational health and safety regulations to provide a safe and healthy workplace that includes the operation of all types of vehicles—trucks across the full range of combinations and configurations, buses, vans, 4WDs, uts, cars, all terrain vehicles (ATVs), motorcycles, and bicycles. Plant machinery, such as tractors, forklifts, agricultural machinery and tracked vehicles also fall within this legal framework. Legally, vehicles are considered as part of the workplace in all jurisdictions around Australia. This means that there is a requirement to ensure ways in which they are used provide a working environment that is safe and has minimal risk to health. To date, however, this has not been strongly enforced as the occupational health and safety field has not treated occupational driving as a priority. This may be about to change, however, as the focus of occupational health and safety regulators appears to be moving in the direction of transport and logistics operations, There have been increasing calls for work-related road safety to be managed under an occupational health and safety framework. This trend is also emerging in the United Kingdom, United States of America and New Zealand (Murray et al., 2002).

Cost factors

From a cost perspective, the implications of work-related road safety can be massive, with significant increases occurring in insurance costs, ambulance chasing and personal injury costs. Workplace injury costs are met 40% by the employee, 30% by the employer and 30% by the community as a whole.

One company, Interactive Driving Systems, recently had damage costs of $3 million per year associated with its staff involvement in the operation of motor vehicles. Its hidden costs were approximately as much again and its return on sales figure was 8%. This meant that just to pay for the $3 million of ‘metal bashing costs’ it had to generate $75 million in revenues. Over four years this equates to $12 million in bent metal, $24 million in total costs and $300 million in revenues required to pay for it.

There are clearly some strong societal, business, legal and financial arguments in favour of government and industry takeing proactive steps to improve work-related road safety—which has led to some very positive initiatives in Australia and around the world.

Driver distraction and work-related driving

In the United Kingdom, several recent studies have focused on fleet driver distraction. Broughton, Baughan, Pearce, Smith & Buckle (2003) suggested that work drivers are susceptible to distractions such as fatigue, time pressures causing the need to speed and mobile phone use. In a recent investigation for an online journal Fleet NewsNet, Burton (2005) reported that some of the simplest tasks drivers carry out in cars, including tuning the radio, could be the difference between keeping safe and crashing, She listed the main distractions for fleet drivers as:

- Adjusting controls.
- Mobile phone calls.
- Texting.
- Eating.
- Looking in bag.

She observed that these driver distractions can have a significant impact on driving reaction times and braking distances. (We note that a similar point about driver distractions was made by Cadogan (2004) in comments critiquing a current Australian road safety advertisement—featuring Professor Ian Johnston of Monash University Accident Research Centre and depicting differences in reaction times, braking distances and crash consequences of a 5 km/h difference in initial speed at the time of recognition of a road hazard. Cadogan remarked that the advertisement was, in his view, misleading as far greater risks were associated with interference to the driving task through driver inattentiveness or distraction and the resultant delay in reaction or response to a hazard, or through a failure by the driver to ensure that the tyres and mechanical systems of a vehicle—brakes, suspension, etc.—were in top line condition).

The studies by Broughton et al. (2003) and Burton (2005) are good and interesting, but in many ways the studies have too narrow a focus by concentrating on driver factors alone. In a work setting, a focus on the driver may miss the identification of a large chunk of the risk.

Australian research by Watson, Wills and Biggs (2004) found that a work-related road safety setting the key drivers of risk can be seen to be:

- societal/situational factors (15.5%);
- organisational factors (8.2%);
- driver factors (7.8); and
- vehicle factors (2.5%).

This confirms that although important, driver-based initiatives are only one element of a wider work-related road safety program—and goes some way to explaining why focusing on in-vehicle activities alone can easily be open to criticism.

For one of us (Murray) on-going research and commercial experience over 15 years in the United Kingdom, Europe, United States of America, South Africa, the Middle East and Australia supports these findings.

Answering a set of questions such as those shown in Table 2 will, in our view, clearly identify that in the work-related driving context driver distraction is a much wider issue than just driving and what goes on in the vehicle. There are significant organisational and management distractions that are also involved.

This means that to identify and manage issues of driver distraction in a work context, it is necessary to look much more widely. The Haddon Matrix is an excellent tool for undertaking this process.

Table 2. Management considerations regarding ‘at work’ drivers

1. Who (manager or driver) recruits the driver /writes their job specifications?
2. Who implements the change management processes?
3. Who sets the schedule?
4. Who tells the driver what to do?
5. Who gives last instructions to drivers when they go off-site?
6. Who sets the sets the safety budget and manager's bonus scheme?
7. Who is responsible for assessing/training the driver?
8. Who sets and supervises the policies for such matters as: vehicle reversing; cash for car arrangements; use of agency drivers; vehicle use by family member; etc.?
9. Who sets the policy for health, eyesight and drugs/alcohol?
10. Who collects and analyses the crash data?
11. Who undertakes risk assessments at frequently visited sites?
12. Who negotiates with suppliers and customers to improve sites?
13. Who manages the safety and risk management work group?
14. Who defines the specifications for vehicle selection and on-board equipment fit out?
15. Who audits aftermarket or in-use installation of equipment during period of vehicle fleet operation?
16. Who is responsible for identifying best practice, monitoring current research and legislation, etc.?
17. Who establishes and reports on benchmarks for ‘at work’ driver safety performance?
18. Who is responsible for incorporation of ‘at work’ driver safety into corporate governance mechanisms, including ensuring concordance between strategic plans, business planning cycles, action plans and annual reports?

Using the Haddon Matrix to identify and manage driver distractions

William Haddon is an American epidemiologist who specialized in the study of road traffic injuries and who was a prominent advocate in the 1960s and 1970s for road safety policy and program development (see, e.g., Haddon, 1963, 1967, 1968, 1972, 1980). Haddon was instrumental in applying scientific methods to the study of injuries, particularly motor vehicle injuries. The Haddon Matrix, a conceptual model for the systematic exploration of countermeasures, provides an integrated approach to injury control. The model specifies a two-dimensional matrix: a temporal dimension of pre-event, event, and post-event phases, and an epidemiological dimension organised into human, agent/vehicle, and environmental factors (Williams, 1999).

His original focus on the road, vehicle and driver has been extended by several theorists, for example, Murray et al., (2002) have described how several writers have shown a renewed interest in the value of the Haddon Matrix in recent times. In the area of work-related road safety, Faulks and Irwin (2002) posed the question: 'Can Haddon's Matrix be extended to better account for work-related road use?' They noted that there had been an accepted development of the original Haddon matrix to include consideration of the wider social-cultural-legal environment—legislation, standards, and group norms, attitudes, and beliefs. In an extension of this development, they proposed that the Haddon Matrix be adapted to include explicit reference to, and consideration of, travel purpose—the reason why a person chooses to use the road transport system. Faulks and Irwin argued that if:

> "… you can incorporate a mechanism for trip purpose (or the general purpose for travel, the primary reason why you are seeking to use the road) within the Haddon matrix, you may get a better marriage of a variety of disciplines—travel planning, traffic management, transport logistics, and road trauma prevention. A whole variety of disciplines might better integrate back into occupational health and safety concerns and road safety concerns."

As well, such an approach might allow better use of approaches such as the Theory of Planned Behaviour (see, e.g., Azjen, 1988, 1991) in modelling and analyses of road behaviour.

Faulks and Irwin proposed an extension of the Haddon Matrix to create a three-dimensional matrix with three orthogonal axes, incorporating the two dimensional Haddon Matrix (the well known 'temporality', and 'epidemiological' axes), and third dimension with a 'purpose of road use' axis—a dimension that deals with the purpose of a trip and the reason for going on the road. They identified three categories of road use within the purpose of road use dimension:

- work-related activities (e.g., commuting, travel for work, commercial or business purposes)
- tourism and recreational activities (travel for social, holiday or tourism purposes)
- home and life maintenance-related activities (e.g., shopping trips, the school run, and the personal or family runs to go to the doctor, hairdresser, etc.)

They noted that the work-related road use category provided explicit recognition that if you are on the road because you are engaged in some business or work-related activity then there are significant and consistent differences relating to temporal factors, including what you do before commencing the trip, the characteristics of the trip itself (such as when you travel, for what time, the distances involved, etc., and the consequences that flow if a crash occurs). There are significant and consistent differences relating to epidemiological factors, including the types of vehicle used, the types of roads used, and a variety of specific road user characteristics (e.g., training and licensing requirements). Work-related road users include such obvious users as truck drivers, courier and parcel delivery drivers, armoured vehicle crews, police officers, parking patrol officers and council rangers, tradesmen travelling to and from work sites, retail and wholesale transport staff, business executives travelling to meetings—the list is extensive. They also noted that we modify our roads to deal with work-related road use, with special roadways for commuters (bus-only lanes for commuters, transit lanes for drivers and two or three passengers), and special roadway rules for 'peak hour' commuting and common working hours (clearways, parking restrictions for certain times of the day, S-lanes, tidal flow traffic arrangements, etc.). Some vehicles are exclusively used for work—trucks, many light trucks and vans—and most vehicles are used for work-related purposes at least some of the time.

Table 3. Some elements of a Haddon Matrix extended and applied to work-related road safety

	Management culture	*Journey*	*Road/site environment*	*Drivers and managers*	*Vehicle*	*Society/community*
Pre-crash	Policy and procedures Organisational climate tools Management structure Board level champion OHS or quality-led Safety committee Safety pledge	Travel surveys Purpose Need to travel Modal choice Journey planning and route selection Shifts/working time	Risk assessments Guidelines Site layouts Road improvement	Select Recruit Induct Handbook Risk assess Train Driving pledge Use of communications technologies (mobile phones, radio, fax) Use of navigation technologies	Selection Maintenance Checking Installed communications technologies (mobile phones, radio, fax) Installed navigation technologies Intelligent Transport Systems (ITS) and telematics to monitor	Marketing program Community involvement Safety groups Road Safety Week Conference circuit Media and public relations (PR) Safety awards External benchmarking Regulator briefings and involvement
At scene	Emergency support to driver	–	Manage scene	Known process to manage scene	Crashworthy ITS to capture data	Escalation process
Post-crash	Report, record, investigate and evaluate Change management	Debrief and review	Investigate and improve	Driver debrief Counselling & support Reassess/train	Investigate ITS data Vehicle inspection & repair	Manage reputation and community learning process

A very important element that is recognised by Faulks and Irwin's conceptualisation is that many pedestrian movements are work-related or business-related activities. Typically, that is not recognised within a fleet management approach which focuses on 'work-related driving' alone. Accordingly, driver distraction issues are seen under the Faulks and Irwin conceptualisation as a subset of road user distraction (pedestrians can be distracted too, with often particularly injurious consequences).

Another important element that can be derived from the Faulks and Irwin conceptualisation is that the agency involved in occupational health and safety regulation and promotion (in New South Wales, this is the WorkCover Authority; in the United Kingdom it is the Health

and Safety Executive) has a major role in work-related road safety, and must be viewed as a significant stakeholder within the road safety community.

In Table 3, we provide an example of the application of the Haddon Matrix extended and applied to work-related driver road safety. This includes elements such as journey planning, management culture, and societal issues.

Table 4. Examples of some successful case studies in work-related driving.

23% claims reduction *
Claims halved over 12 months
Crashes increased due to better reporting, $s fell, fuel saved 5%, manager got promoted
Months per crash increased 12 to 24, temps went from 4 times the risk to 1.5, substantial fuel savings, PR *
Proactive participants cut $s, reactive stood still or increased $s *
Risk manager used data to target key risks, rate fell 1.6 to 0.8 *
OHS and evidence-led approach, cost per claim falling *
Worst drivers 3-17 times more likely to crash than best, fleet reduced by 16% claims by 8% *
Claims reduced by 30% over 4 years of program *
Claims reduced by 10% over 12 months and costs by 10% *; over 5 years fatalities fell 6 to 1 per year
High risk drivers on RoadRISK averaged 0.3 accidents in past 3 years, low risk 0.2 *
Kilometres per blameworthy incident increased from 50,000 to 200,000 *

In relation to at-work driver distraction, the Haddon Matrix elements described in Table 3 can be a very useful audit tool. By asking questions about the matrix elements of the form: ‘Do work policies and practices and/or installed equipment allow for driver distraction?’, researchers and practitioners can begin to understand the impact that issues such as the company culture, journey planning, or business needs have on the drivers’ level of distraction.

Finally, it is legitimate to ask if an approach such as has been described is worthwhile. One of us (Murray) has documented his experience. As a general rule the ‘successful’ organisations he has worked with over the past 15 years have been ‘safe’, and the ‘safe’ organisations have been ‘successful’ (as shown in Table 4; note that those marked with an asterisk [*] have won some type of award as a result of the program, and gained substantial

brand-related benefits as well as the safety outcomes). The 'bottom line' financial benefits have been significant.

Conclusions and recommendations

Overall, work-related road safety is an important issue for government and industry for a range of societal, business, legal and cost reasons. Organisational and management pressures mean that at-work drivers do face many distractions.

In a work setting, just focusing on drivers, and in-vehicle on-road distractions is probably too narrow—because there are a range of organisational factors at work often beyond the control of the driver. Given the scale of the work-related road safety problem described above, a wider organisational culture based approach—based on applying the modifications to the Haddon Matrix that have been discussed—could offer opportunities to improve road safety.

A holistic safety culture-based risk assessment-led approach has to be the way forward for reducing the wide range of distractions that effect work-related drivers.

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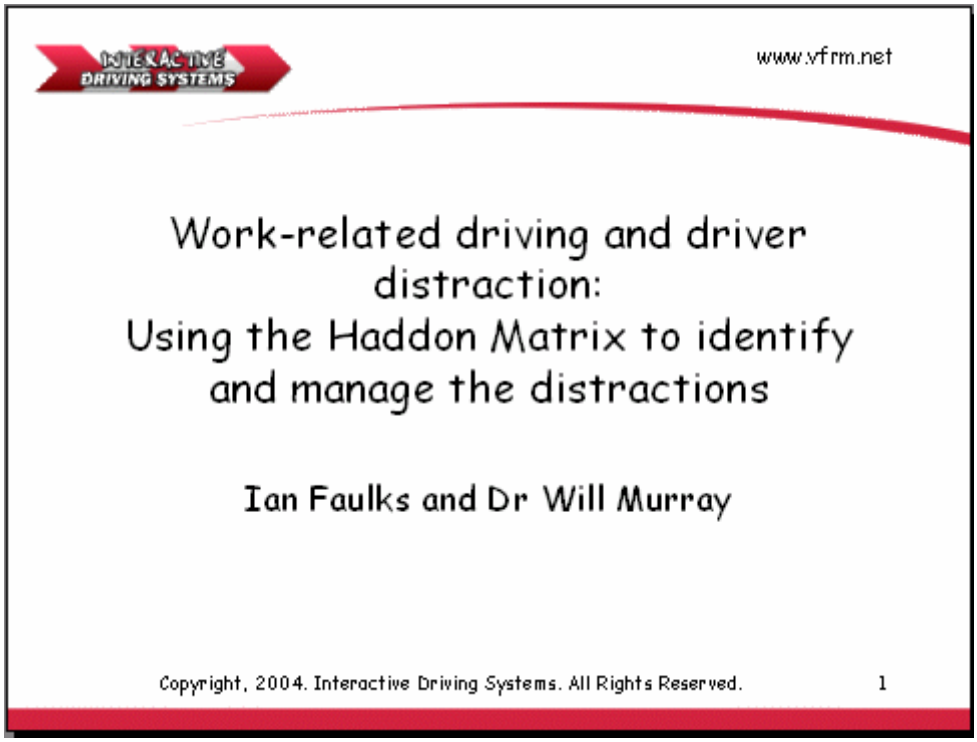
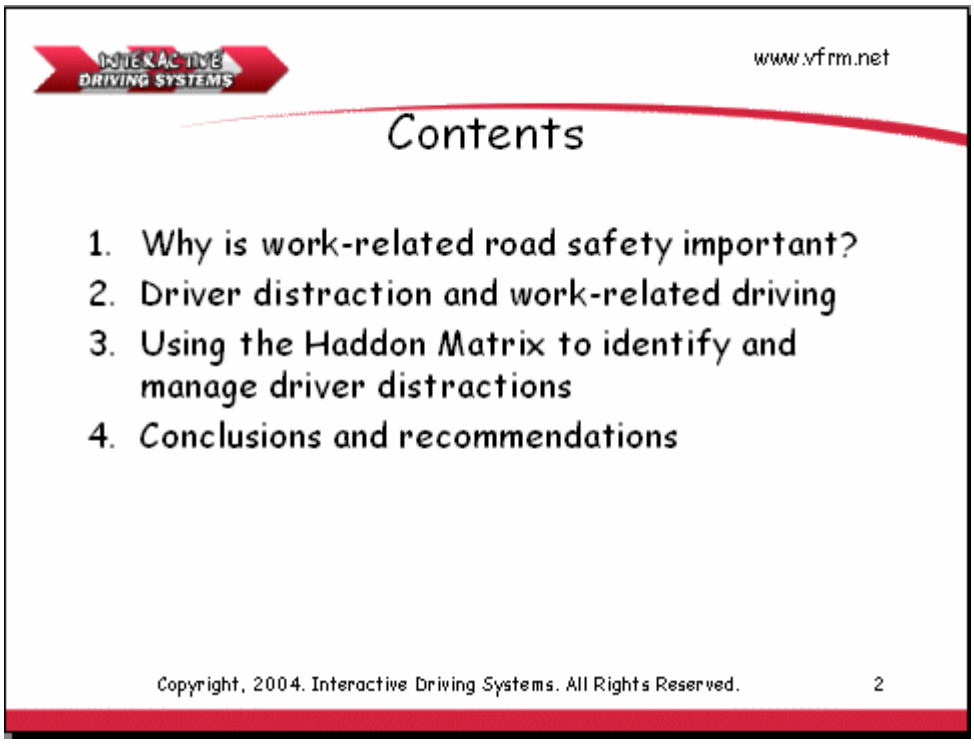
PRESENTATION SLIDES



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Why?
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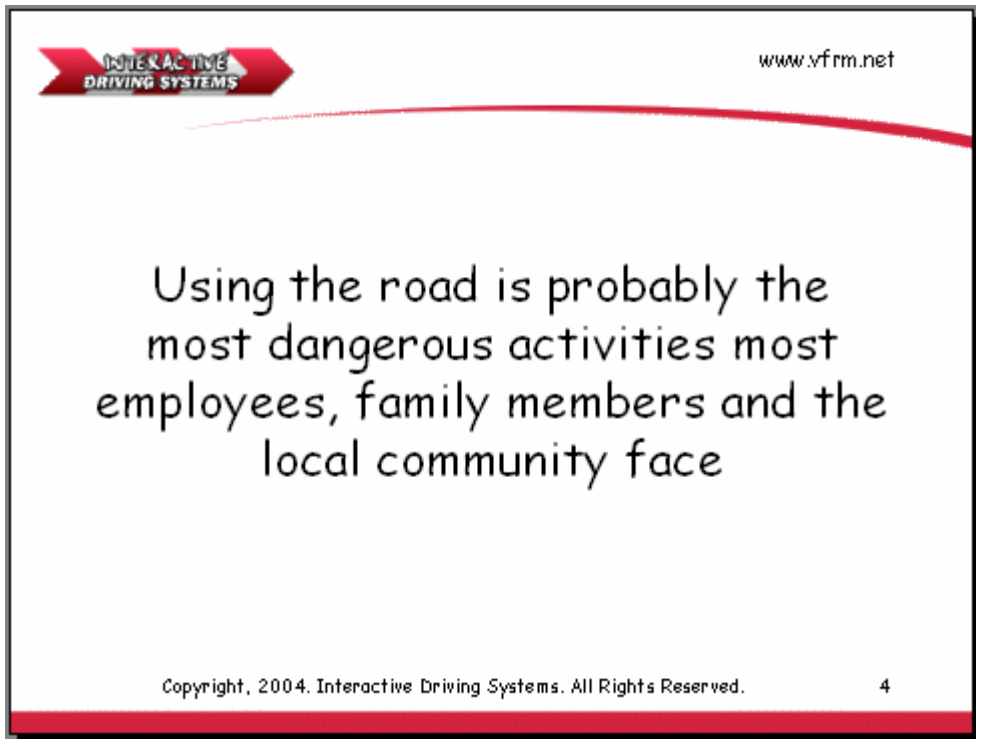
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Using the road is probably the most dangerous activities most employees, family members and the local community face
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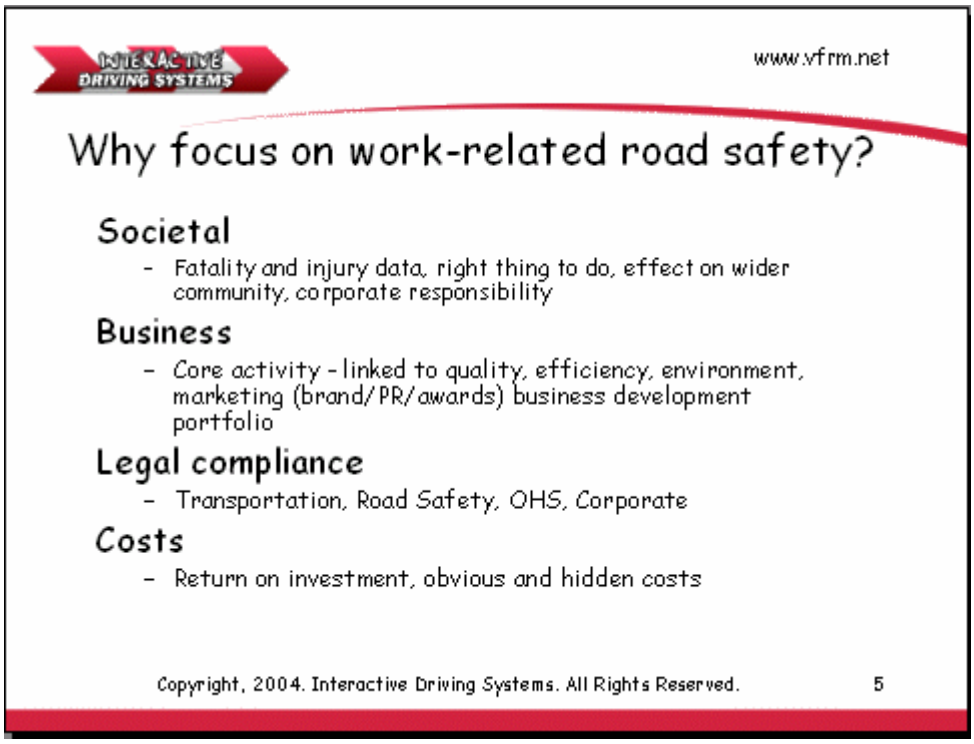
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Why focus on work-related road safety?
Societal
- Fatality and injury data, right thing to do, effect on wider community, corporate responsibility
Business
- Core activity - linked to quality, efficiency, environment, marketing (brand/PR/awards) business development portfolio
Legal compliance
- Transportation, Road Safety, OHS, Corporate
Costs
- Return on investment, obvious and hidden costs
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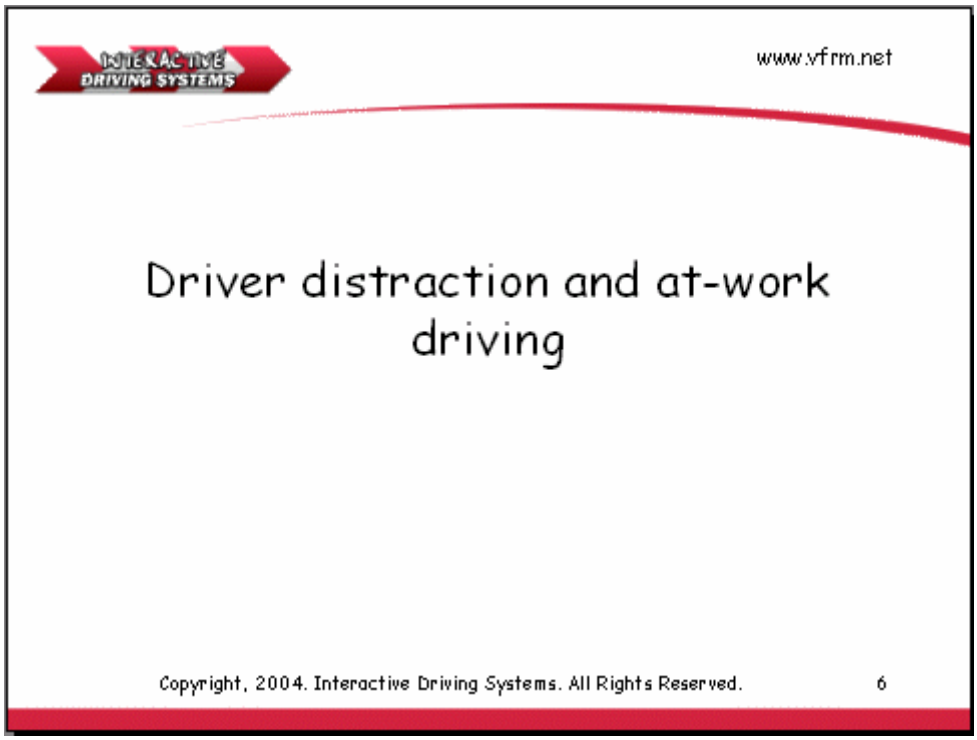
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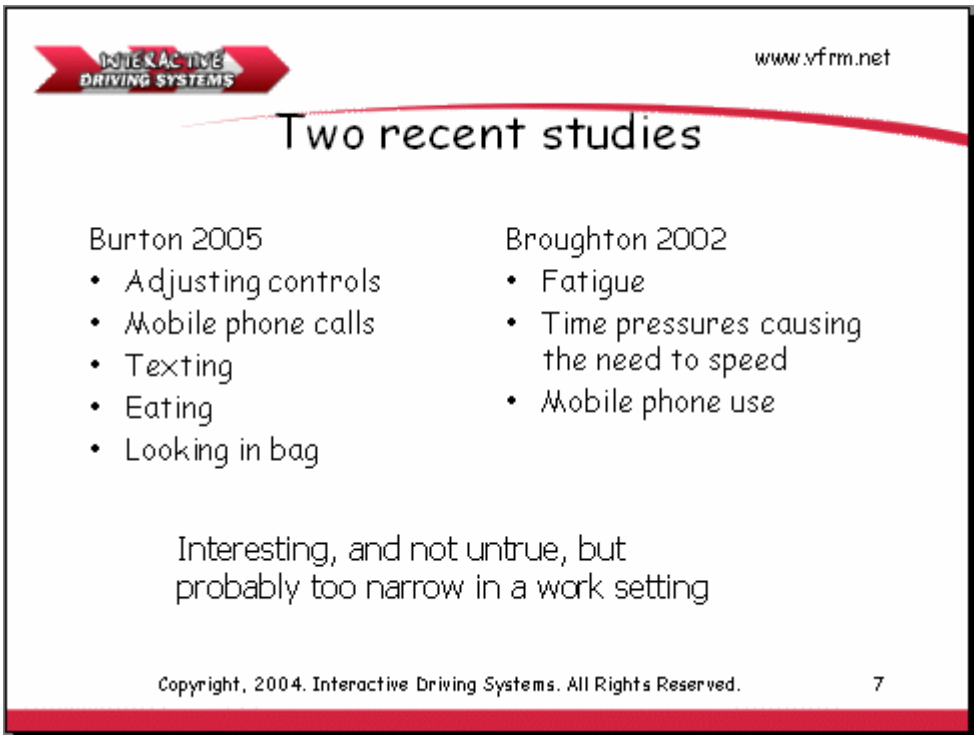
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Two recent studies
Burton 2005
• Adjusting controls
• Mobile phone calls
• Texting
• Eating
• Looking in bag
Broughton 2002
• Fatigue
• Time pressures causing the need to speed
• Mobile phone use
Interesting, and not untrue, but probably too narrow in a work setting
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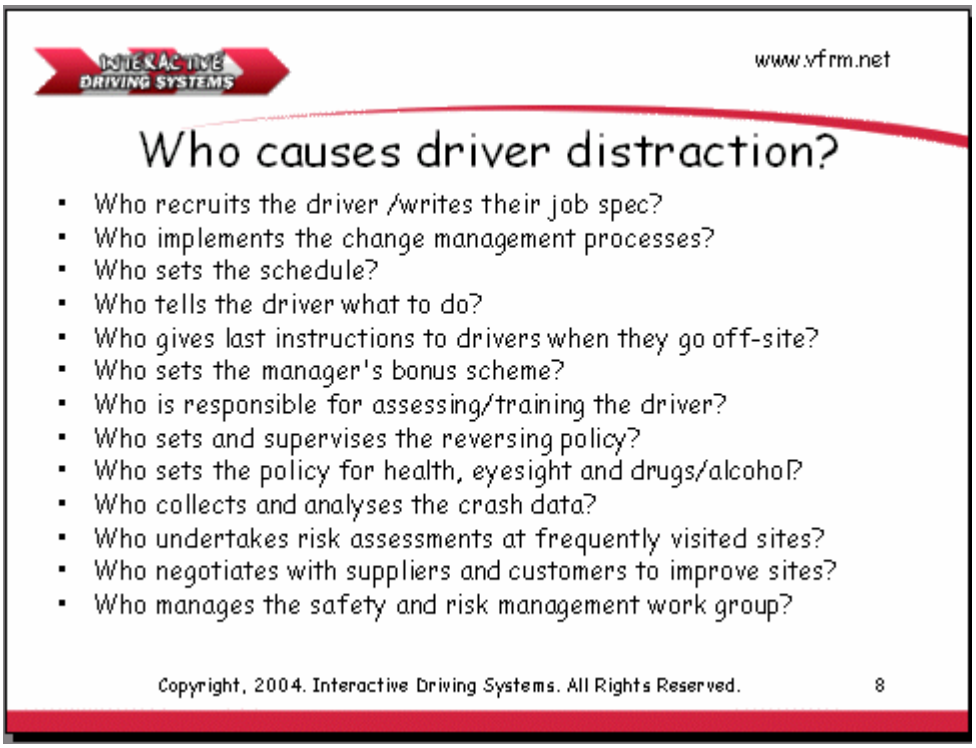
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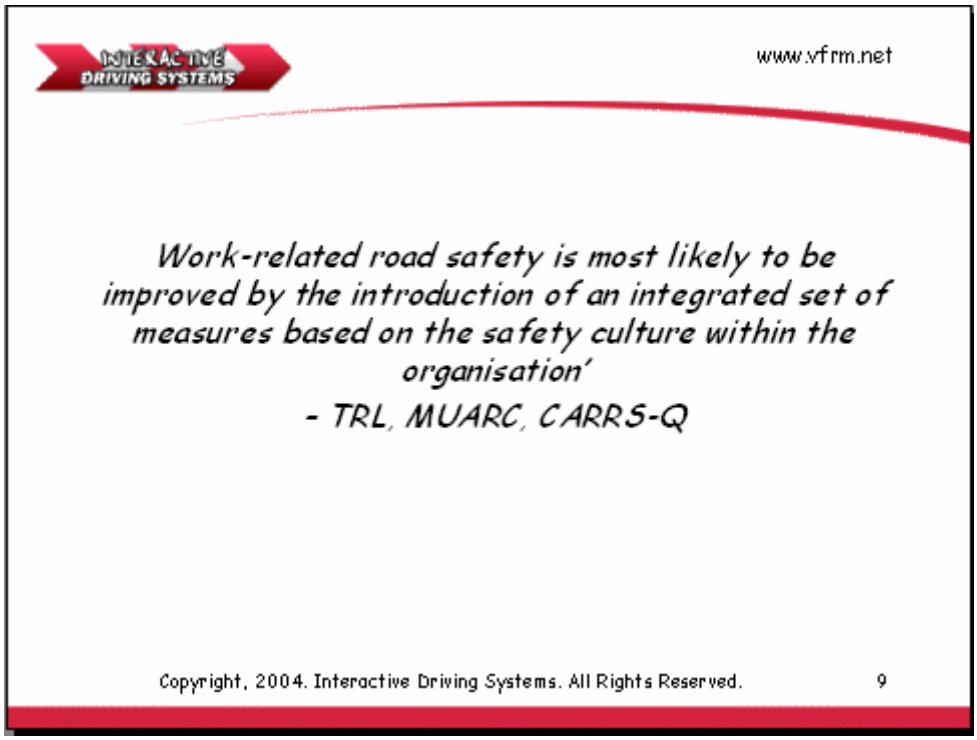
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Work-related road safety is most likely to be improved by the introduction of an integrated set of measures based on the safety culture within the organisation'
- TRL, MUARC, CARRS-Q
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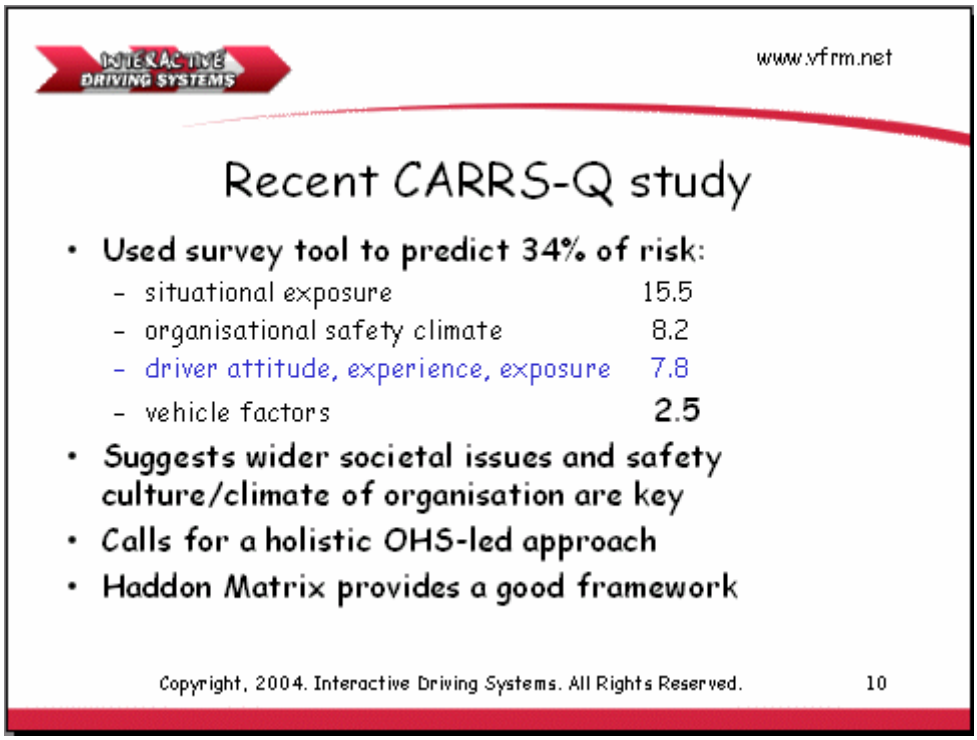
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Recent CARRS-Q study
Used survey tool to predict 34% of risk:
situational exposure 15.5
organisational safety climate 8.2
driver attitude, experience, exposure 7.8
vehicle factors 2.5
Suggests wider societal issues and safety culture/climate of organisation are key
Calls for a holistic OHS-led approach
Haddon Matrix provides a good framework
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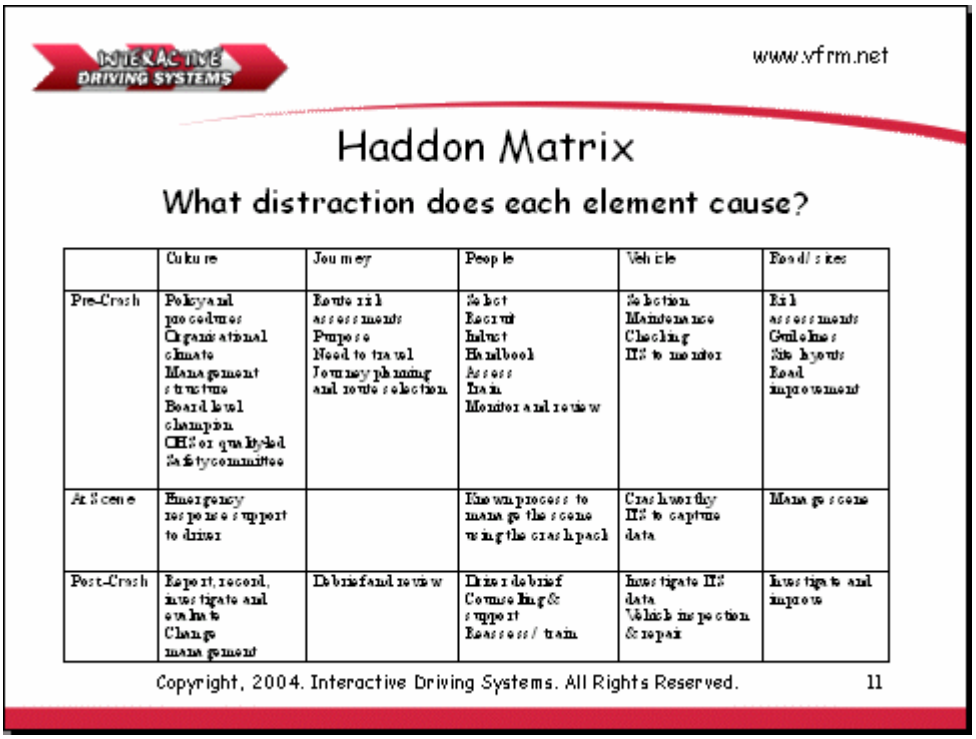
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Haddon Matrix
What distraction does each element cause?
Culture
Journey
People
Vehicle
Road / sites
Pre-Crash
Policy and procedures
Organisational climate
Management structure
Board level champion
OHS or qualified safety committee
Risk assessments
Purpose
Need to travel
Journey planning and route selection
Select
Recruit
Induct
Handbook
Assess
Train
Monitor and review
Selection
Maintenance
Checking
ITS to monitor
Risk assessments
Guidelines
Site layouts
Road improvement
At Scene
Emergency response support to driver
Known process to manage the scene using the crash pack
Crash worthy
ITS to capture data
Manage scene
Post-Crash
Report, record, investigate and evaluate
Change management
Debrief and review
Driver debrief
Counselling & support
Reassess / train
Investigate ITS data
Vehicle inspection & repair
Investigate and improve
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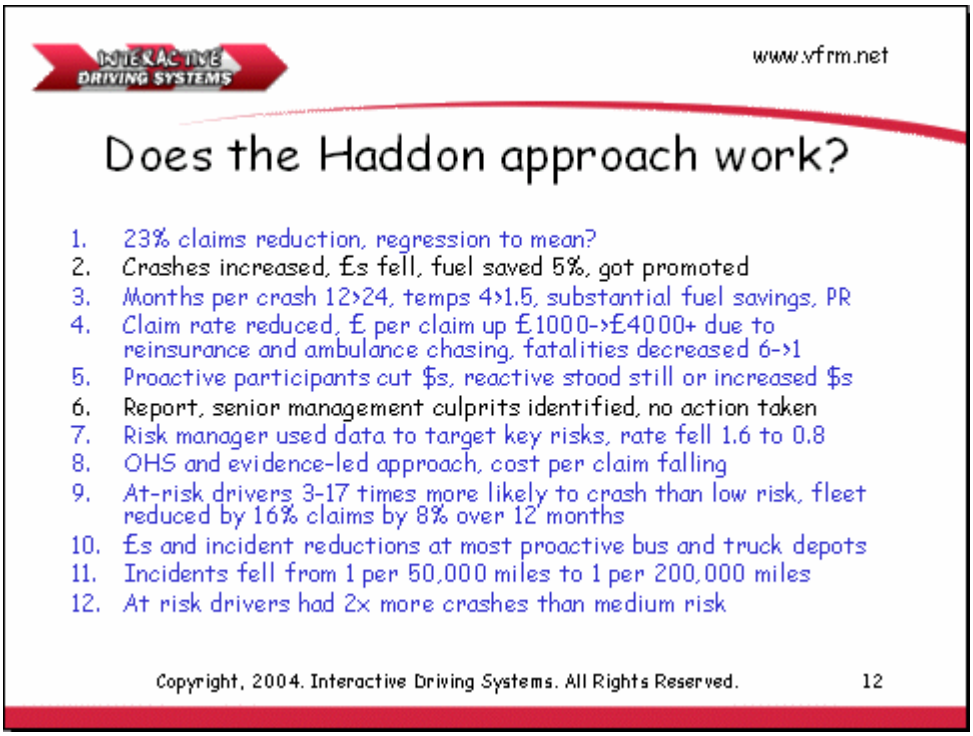
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Does the Haddon approach work?
1. 23% claims reduction, regression to mean?
2. Crashes increased, £s fell, fuel saved 5%, got promoted
3. Months per crash 12>24, temps 4>1.5, substantial fuel savings, PR
4. Claim rate reduced, £ per claim up £1000->£4000+ due to reinsurance and ambulance chasing, fatalities decreased 6->1
5. Proactive participants cut $s, reactive stood still or increased $s
6. Report, senior management culprits identified, no action taken
7. Risk manager used data to target key risks, rate fell 1.6 to 0.8
8. OHS and evidence-led approach, cost per claim falling
9. At-risk drivers 3-17 times more likely to crash than low risk, fleet reduced by 16% claims by 8% over 12 months
10. £s and incident reductions at most proactive bus and truck depots
11. Incidents fell from 1 per 50,000 miles to 1 per 200,000 miles
12. At risk drivers had 2x more crashes than medium risk
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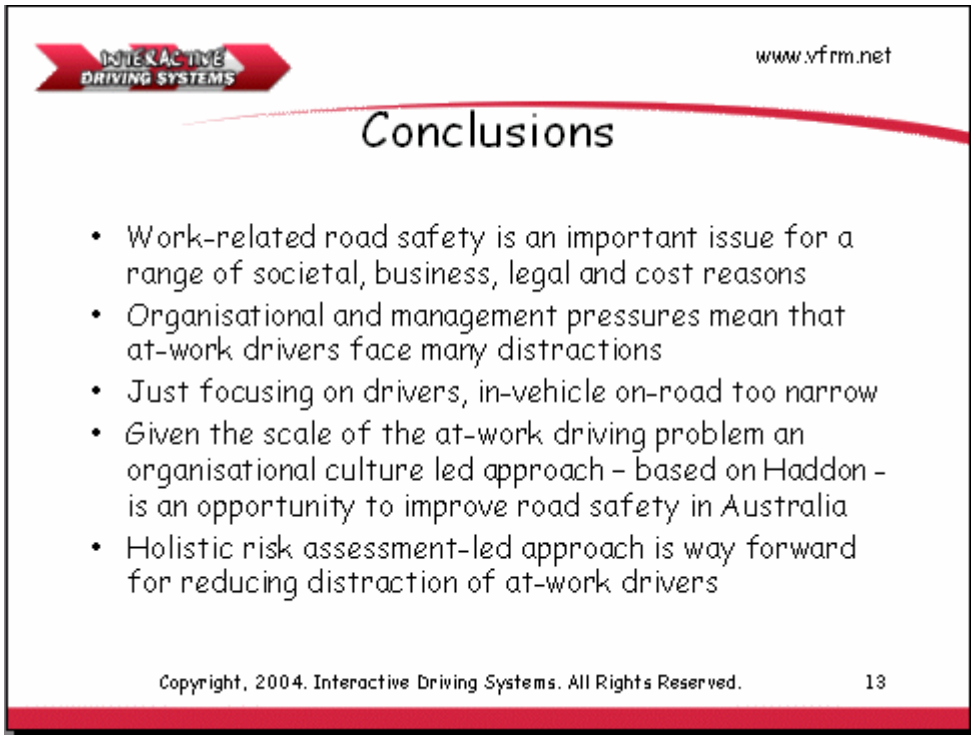
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Conclusions
• Work-related road safety is an important issue for a range of societal, business, legal and cost reasons
• Organisational and management pressures mean that at-work drivers face many distractions
• Just focusing on drivers, in-vehicle on-road too narrow
• Given the scale of the at-work driving problem an organisational culture led approach – based on Haddon - is an opportunity to improve road safety in Australia
• Holistic risk assessment-led approach is way forward for reducing distraction of at-work drivers
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