DRIVING EXCELLENCE

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ABSTRACT

A short review of the websites or annual reports of the oil majors quickly illustrates a single, dominating expectation about safety outcomes. The common expectation is easily summarized as a demand for zero fatalities. While recent years have seen steady improvement in recorded fatalities; one area continues to hold back industry progress in achieving zero.

The crisis situation is driving-related fatalities. The deaths of employees and contractors; occurring in 2003, illustrate the nature of the crisis that confronts the oil majors. BP recorded 14 vehicle-related deaths, with a further 28 fatalities involving members of the public; Shell recorded 19 road deaths.

This paper explains why the oil majors have been unable to solve the crisis of fatalities that confronts them each year. Specifically, it explains how the crisis of fatalities results from the application of a model of competency that suggests fatalities will be eliminated when drivers develop the necessary "skills" associated with vehicle operation. I explain why improving drivers' skills by commissioning advanced driver training programs is not the required solution to the fatalities crisis.

Instead, the Driving Mastery Model (DMM) suggests that fatalities can be eliminated when drivers develop competency to a level defined within the model as "mastery". Drivers achieve "mastery" by integrating three key competency elements: these being the right driving skills; as well as the necessary awareness and knowledge of the hazard management process. In that sense, the DMM is represented in summary form thus: *Mastery = Awareness of hazards + Knowledge of the hazard management process + Skills of vehicle operation*. This paper explains and defines the elements of the DMM and demonstrates how its application works to motivate positive driving outcomes.

KEYWORDS

Driving. Hazards management. Competency. Driving Mastery Model.

INTRODUCTION

We are all witnesses to a global tragedy. Jacobs, Aeron-Thomas and Astrop (2000) estimated that 1.2 million people die each year in road traffic crashes. In first world countries like the USA and Australia, road traffic accidents are the leading cause of death for people aged one to 34 years. Up to 50 Million more people are injured or disabled in road accidents (Peden and Sminkey, 2004). The economic cost of these accidents is enormous. Jacobs et al (2000) estimated the global cost at US $518 billion per year.

While the cost of road accidents to global society is huge, the economic, emotional and social costs of fatalities in the oil and gas sector are also large. What is tragic about the road toll and specifically for the impact within our industry is the reality that so much of this suffering is easily preventable. So, why has a zero fatality rate failed to materialize despite the desire of society as a whole for this to happen, and the clear expectation for achievement of this goal within the oil majors? More importantly, how can road we prevent road accidents so that recorded fatalities fall to zero?

Dealing with the first question: it is unfair to suggest that progress in preventing road accidents has not occurred; and recent data demonstrates this (Anonymous Author, 2002). In the 30 years since 1971, road fatalities *have* declined by 50 per cent in Canada, 46 percent in Britain, 48 percent in Australia and 16 per cent in the United States. These reductions have occurred despite an increased number of vehicles, drivers, kilometers traveled, and population (Binder and Runge, 2004). The general reduction in fatalities that is seen at the level of societies has been mirrored by reductions in fatalities in the oil industry.

The improved situation has occurred for several reasons. These include: improved standards for engineered roads and the materials used in road construction; improvements in the technical design of vehicles and safety-related equipment installed in vehicles; improvements in emergency response capability to accidents, and improved emergency trauma care; increased surveillance of driving offences and enforcement of the law by authorities; improved technology for monitoring traffic movement; and increased spending on road-safety awareness campaigns (National Occupational Health and Safety Commission 2003; and Anonymous Author, 2002). Yet statistics also show that improvements in recorded fatalities have largely stalled; both in society at large and in the oil industry.

This paper suggests that the enforcement of the law, traffic surveillance, design and engineering of the roads, improved vehicle equipment, and improved trauma care have reached the thresholds of their applicable benefits to reducing road accidents. Improvements stemming from future developments in these areas are now likely to be both smaller than in the past, and occurring at greater financial cost than has previously been the case. In effect, the cost to benefit ratio of improvements in the engineering, technical, health and law enforcement sectors will be smaller than we have previously seen. One area that remains under-exploited in the drive for zero fatalities and with the potential for significant improvement is the “human factor” relating to safe and unsafe behavior and competency (Anonymous Author, 2002). In simple terms, the human factor addresses the person-relevant variables that the driver brings to the driving situation. These variables include such psychologically-derived elements as values, attitudes, beliefs, knowledge, capability, disposition, age, gender and state of mind; as well as observable behavior.

Unfortunately, however; the exploitation by the oil industry of the potential benefits of human factors in reducing fatalities to zero has been undermined by a too-narrow focus and the use of an ill-conceived model of competency. In particular, I suggest that the narrow focus of effort has been on developing a single competency element that I characterize as driver "skill". The assumption seems to be that developing the competency termed "skill" within drivers will assist them to drive safely, and hence, eliminate accidents. But is that assumption correct?

For the purpose of this paper, "skill" is defined as the competency of the driver to physically and technically operate the vehicle and its systems (Western Australian Department for Planning and Infrastructure (WADPI) Licensing Services, 2004). In that sense, "skill" in operating the vehicle involves such actions as using the brake pedal, clutch and accelerator to move the vehicle forwards and backwards and to hold it stationary or to stop it. It also involves the ability to apply the handbrake, use the indicators and mirrors, and to turn the steering wheel to change direction. "Skill" also involves combining all the previously mentioned activities and behaviors into a smooth-flowing simultaneous operation that makes the vehicle move through the environment under the control of the driver.

In order to develop competency to "skill" level, companies have routinely turned to one form or another of advanced driver training (ADT). Taken at face value, such ADT typically claims to develop the "skill" of drivers to operate a vehicle to a high-level. That may be so. But, its application is not enough to eliminate fatalities. That is because developing drivers "skills" in vehicle operation does not necessarily develop the required "awareness" and "knowledge" for hazard management; nor does ADT specifically motivate drivers to use their awareness and knowledge of hazard management and their driving skills to appropriately control hazards. I suggest that enabling people to control the hazards associated with their road transport-related activities and motivating them to apply what they know are additional prerequisites to eliminating fatalities.

So far, I have suggested that the focus of the oil majors on developing the "skill" of drivers to safely operate a vehicle is not the solution to the fatalities crisis. Furthermore, I have indicated that the required solution to the fatalities crisis must also involve developing the awareness and knowledge competency of drivers for managing hazards and motivating them to apply the hazard management process, plus their skills whilst executing driving-related activities. As such, the solution I offer is to suggest that drivers must develop competency to a level that I define as “mastery”. Mastery entails having the right driving skills; together with the awareness and knowledge to manage driving-related hazards; and the motivation to apply the right behaviors and other controls. As such the Driving Mastery Model (DMM) suggests that Mastery = Awareness + Knowledge (of hazard management) + Skills (in vehicle operation).

The appropriate management of hazards requires the use of a recognizable step-by-step process that has clearly defined competencies for each step and which is articulated by organizations like Shell International (2003) and Woodside Energy (2004). Although there is some disagreement about the required number of steps in the hazard management process, the steps generally involve the following:

1. Identifying and understanding the sources of hazardous energy present in an activity;

2. Identifying and understanding the threats present in an activity that could lead to an uncontrolled release of the hazardous energy;

3. Identifying and understanding the events or incidents that could occur if an uncontrolled release of hazardous energy should occur;

4. Identifying and understanding the consequences of an uncontrolled release of hazardous energy;

5. Identifying, understanding and implementing threat barrier controls that minimize the potential for a release of hazardous energy; and

6. Identifying, understanding and implementing escalation barrier controls that minimize the consequences of an event should hazardous energy be uncontrollably released.

A person who is a “master” of driving will be aware and knowledgeable in using the six-step hazard management process within the context of an overall qualitative risk assessment. They will also be able to choose and then be psychologically motivated to apply the right behaviors, including deploying various driving skills during actual operation of a vehicle. Using suitable examples, I will now provide an overview and definitions of the concepts related to the six-step hazard management process.

Mastery over driving competency requires people to be able to identify and understand the hazards they face as they control a vehicle. A lay definition of a hazard is that it is *something* that can course harm. But what is the *something*? A hazard is typically any source of energy that people face in the tasks and activities that they perform at work or play (Sim and Marshall, 2004; and Anonymous Author, 2003). Amongst others, hazardous energy sources include electricity; chemicals like petrol and diesel; physical energy such as motion and acceleration; biological sources of energy like dogs and cows; psychological energy like anger and frustration; and others (Marshall, 2004). In order to manage hazards, it is self-evident that people need to have full awareness of the types of hazards present in the environments in which they live and work. If we consider car-driving as a typical example of a hazardous activity, the major source of hazardous energy is located in the forward (or reversing) motion of the vehicle.

Threats are the *things* that could release the hazardous energy in an uncontrolled fashion (Marshall, 2004). To drive safely, people need to be able to identify and understand the full range of threats associated with their driving activity. With regard to driving, examples of threats may include: poor visibility due to darkness, fog or smoke haze; poor road conditions or surfaces due to snow, ice, oil or lack of road maintenance; use of a poorly maintained vehicles; and a range of “at risk” behaviors like inattention, aggressive acceleration and braking, and high speed.

Once people have identified the sources of hazardous energy and the possible threats that could release them; they then need to identify the events that could occur if such a release were to happen. An event is a negative incident that has the potential to result in some type of harm (Marshall, 2004). Typical events associated with car driving include skids, roll-overs and collisions.

The next element of the hazard management process is for people to consider the consequences if hazardous energy is released during an uncontrolled event (Anonymous Author, 2003). Consequences are the harm done when energy is uncontrollably-released. Consequences typically take the form of harm to people, finances, the environment, production, reputation or legal status (Anonymous Author, 2003). Consequences of a vehicle colliding with another vehicle or something else in the environment range from minor property damage through injury to multiple fatalities.

Only when people have developed the necessary awareness and knowledge competency to identify hazards, threats, events and consequences can they move on to consider, select and apply the full-range of threat barriers – including driving “skills” and practices – that should be implemented to eliminate the threats and control the hazards. Threat barriers are *things* we put in place or use that help us to control or eliminate the threats that may lead to the release of hazardous energy. Threat barrier controls can take several forms and these have previously been classified into five types (Sim and Marshall, 2004). These types are:

1. Elimination controls that remove the hazard completely;

2. Substitution controls that replace one source of hazard for something less hazardous;

3. Engineering controls that are designed to control the hazards;

4. Administrative controls that provide procedures, guidelines and standards that help to control the hazards; and

5. The use of personal protective equipment (PPE).

These five types are often considered in terms of a “hierarchy of control” (Sim and Marshall, 2004). The hierarchy of control suggests that higher levels of control involving elimination or substitution are always better at minimizing risk than are lower levels of controls involving administration or use of PPE. The purpose of this paper is not to describe the hierarchy of control in detail, but it is important that employees do have competency in selecting and implementing threat barrier controls based on awareness and knowledge that some controls are better at controlling threats and minimizing risk than are others.

For example, if we accept that driving a car is a relatively high-risk activity involving hazardous physical energy in the form of vehicle motion; then a simple elimination control is to not drive. This may not always be practical so turning to a substitution control, our driver may decide to take the train or bus. That decision substitutes a higher-risk transport option (driving) for ones with (statistically) lower-risks (public transport). Again, if using public transport is not a practical option; then our driver may look to engineering controls such as choice of route (.e.g., grade separated freeways as opposed to single lane highways) or choosing a car with “built-in” safety features like ABS, airbags, crumple zones, roll-cages, cargo barriers and the like. Our driver could also then bring in administrative controls that limit alcohol intake, promote frequent breaks and rest periods, or promote driving skill through ADT. The lowest level of control is the use of PPE such as a seat belt.

Having identified, selected and implemented a wide range of threat barrier controls, employees are then ready to consider and implement the further controls they may require in the event that their threat barriers fail to control the threats involved in the activity. Such a failure may result in an uncontrolled release of energy and a negative event that generates unwanted consequences. These types of additional controls have previously been referred to as “escalation” barriers (Marshall, 2004). In summary, escalation barriers are *things* we need to have in place to help us regain control, minimize harm and recover from events and the consequences of an uncontrolled release of hazardous energy.

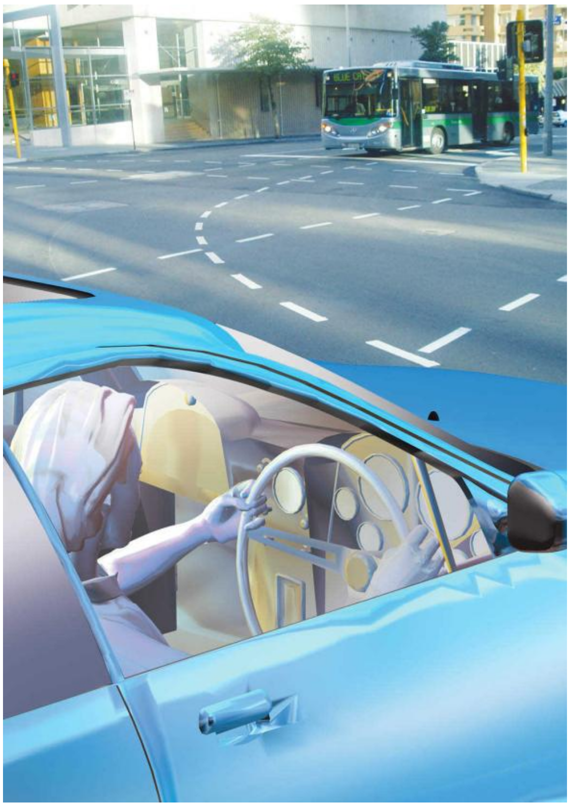
In our driving example outlined above: it may be the case that our driver is traveling in a well designed vehicle with inherent safety features; has completed a route planning activity to identify safer roads and the safest time to travel; has avoided consuming alcohol and is well-rested and alert; is applying defensive driving skills to their driving behavior; and is wearing a seatbelt. Despite the implementation of these threat barrier controls, however; it is still possible for the driver to be involved in a negative event such as a crash (e.g., collision), and for negative consequences to result from the event. Consequences may include damage to the vehicles involved; injuries to persons involved; or fatalities.

In the moments directly following the occurrence of the negative event to our driver, few of the threat barriers which were working to prevent the collision are now of further use. Our driver now requires escalation barriers to help them regain control and prevent consequences from becoming worse. This is commonly called “recovery”. For example, a fire extinguisher may help to control a small fire resulting from the crash and prevent it becoming a larger fire; first aid training may help the driver to assist injured passengers who could otherwise die; and a mobile phone may assist in summoning an ambulance or doctor. Note, however; none of those escalation barriers will help to prevent the negative event and its immediate consequences from occurring. Their role is to assist once an event has occurred. The identification and implementation of these controls is critical to the complete process of risk management.

As already stated, mastery over driving involves properly applying the six-steps of the hazard management process together with the right driving skills to a range of driving activities. Advanced Driver training will equip drivers with the skills; and various types of ADT are routinely used. Drivers need practice, however; in also developing the awareness and knowledge competencies required for the hazard management process. There are far fewer options to help the oil majors to equip their drivers with these hazard management competencies.

A suggested solution that operationalizes the hazard management process during training uses picture-based simulation in conjunction with a simple questioning approach that forces employees to develop hazard management solutions for themselves (Sim and Marshall, 2004). The suggested solution integrates the psychologically-derived approaches known as Q-Methodology and projective technique (Stephenson, 1953; Ellenberger, 1970; Brown, 1980; and Arbisi, 1998). It deploys an image-based card-sorting process on a sorting board; requiring participants to psychologically "project" themselves into the images using projective technique. That is, participants place the image-cards on the sorting board in line with the risks that they perceive the images to depict, and relative to the risks posed by the other images. The use of projective technique and Q-Methodology card sorting makes the uptake of hazard management information and buy-in much greater than passive delivery of information during more traditional approaches like video presentations, lectures or other "talking head" experiences.

For example; by presenting drivers with suitable images, we can have them consider a range of typical driving related activities. Such activities include: driving in low visibility situations at night, in fog, haze, or during bush-fires; driving on snow, ice or wet roads; driving off-road; driving on freeways or highways; urban driving, driving while towing a trailer; driving in unfamiliar environments; driving an unfamiliar vehicle; driving with heavy loads; driving in remote regions; crossing creeks; loading and unloading vehicles; and the like. Two examples of driving-related pictures are shown in Figure 1. Individual drivers can then select types of driving activities that they typically confront. By concentrating on those activities, they can then work through the six-step hazard management process; answering relevant questions as they go; until they have demonstrated the necessary awareness and knowledge competency for identifying hazards, threats, events and consequences; and the competency to identify, select and implement appropriate threat and escalation barriers.



Urban driving

Loading/unloading vehicles

Figure 1. Examples of vehicle-related activities.

Using the "loading/unloading vehicles" image shown in Figure 1 as an example; it is possible to demonstrate the type of hazard management competency that is required to perform the activity safely, and without damaging the environment (Marshall, 2004). A further example is illustrated in summary form in Figure 2. Within the six-step hazard management process outlined earlier, consideration of the hazards is our first concern. Using a simple and structured questioning approach in which employees are asked to identify relevant information is the key to having them "internalize" what they learn (Sim and Marshall, 2004).

Starting with hazards, we would want employees to be able to identify that the hazards associated with vehicle loading and unloading typically involve one kind or another of physical energy; with ergonomic energy, solar radiation (if outdoors), biological sources, and chemicals (if loading chemicals) also possibly presenting a hazard. These sources of energy can include the potential for the vehicle to move; falls from height; dropped objects; pinching and crushing; overexertion or repetitive movement; exposure to harmful sunlight; potential for contact with, or misuse of chemicals; and contact with harmful biological toxins or biting/stinging insects.

Employees should also be able to identify that the threats that could lead to the release of those sources of hazardous energy are varied. They include: poorly maintained or inappropriately used brakes on the vehicle; poor housekeeping; unsecured loads; poor manual handling technique; lack of personal protective equipment (PPE) like gloves, long-sleeved shirt and trousers, wide-brimmed hat, safety glasses or goggles, sun-block cream, or specific PPE required for handling chemicals or biological toxins; uncontrolled access to the job location; lack of use of insect repellent spray; and fatigue, day-dreaming and lack of task planning.

Haz & Zard industry Version

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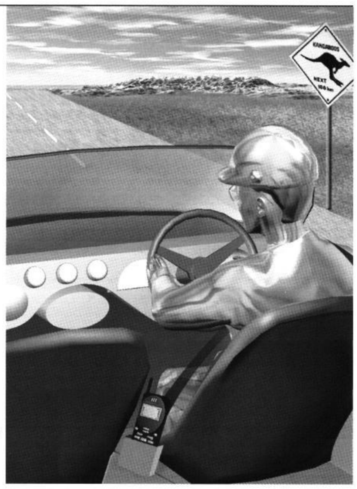

1 What are the hazards?

- ◯ Physical.
- ◯ Psychological.
- ◯ Ergonomic.

2 What are the threats?

1. Faulty equipment.
2. Fatique/alcohol consumption.
3. Excessive speed.
4. Lack of ability (skill).

3,4 What potential events or incidents could lead to injury or harm, and what are the consequences?

1. Collision.
2. Crushing.
3. Roll over.
4. Injury.
5. Fatality.
6. Vehicle damage.

5 What is the risk?

6 What behaviours or practices will you adopt / avoid for health and safety?

(1) Correct license for vehicle type.

(2) Seat belt.

(3) Don't drive while fatigued.

(4) Take frequent short breaks.

(5) Don't use mobile phone or o ther distracting equipment.

(6) Make pre-journey vehicle inspection (tyre pressure, oil level, etc).

(7) Plan journey to arrive in daylight. Avoid night driving.

(8) Be aware of wildlife or livestock on road.

(9) Never drink alcohol and drive, or when using certain medications.

(10) Maintain vehicle to manufacturers recommended specifications.

(11) Don't exceed safe or recommended speed limits.

7 What behaviours or practices will you adopt / avoid to protect the environment?

Other comments about the picture:

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Figure 2. Driving example illustrating hazards, threats, events, consequences and controls.

Unwanted events associated with loading and unloading vehicles are also variable. Employees should be able to identify that they include: slips, trips and falls; pinching and crushing; uncontrolled vehicle movements; dropped or falling objects; loss of containment and chemical splash; explosion; insect bites; sun burn; inhalation or ingestion of toxic chemicals or biological toxins; and cuts and piercing. The consequences of those events range from the trivial to the catastrophic and include: injuries of carious types, including crushed or broken fingers, amputations, broken bones and heat or chemical burns; chemical poisoning; property and equipment damage; reputation loss; environmental damage; and death.

In order to prevent the uncontrolled release of hazardous energy that leads to unwanted events and their consequences; the next competency requirement is for employees to identify, understand and implement the threat barrier controls that will help to manage the hazard. Once again; when we consider the activity of loading and unloading vehicles, there are many threat barrier controls required. These include: preparing a job-specific plan; completing a job hazard assessment (JHA) prior to starting the job; holding a "tool-box talk" immediately prior to starting the job to ensure all people involved are clear about the job plan and HSE requirements; not starting a task if the hazards are uncontrolled; stopping a task if the hazards become uncontrolled; speaking out about safety concerns; maintaining the vehicle; applying the park-brake; "chocking" the wheels, switching off the engine; wearing and using the right PPE; following the workplace procedures; barricading and signing the workspace in order to control access to the site; checking Materials Safety Data Sheets (MSDS) for handling, storage and transportation requirements of chemicals; using the right manual handling and lifting techniques; using mechanical lifting aids; asking for and/or offering assistance with lifting; taking regular breaks as required; and housekeeping as the job progresses.

While those threat barriers will certainly assist employees to manage the hazards involved with vehicle loading; competency in their implementation is not enough. Employees must also be competent to identify, understand and implement the escalation barriers that are required in the event that their preventative threat barriers fail to control the hazards. In that event, employees need to be able to respond appropriately to minimize harm and regain control (Sim and Marshall, 2004). That may involve them selecting and implementing the following examples of controls: spill response equipment and clean-up equipment; chemical antidote available and emergency wash-down or eye-bath stations available; working within a bund to contain spills; first aid kit and first aid trained people available to assist with medical emergencies; fire fighting equipment available; emergency communication equipment available; emergency response planning and drills up to date; and safe disposal of chemical residues, contaminated PPE and the like.

A key issue then arises in relation to drivers taking away what they have learned in the simulated training session and being sufficiently motivated to apply it to their actual driving activities. An integrated solution within the approach outlined above is for drivers to make public commitments to implement high-priority threat and escalation barriers. The training approach uses a “psychological contracting” technique whereby drivers openly commit to adopt and apply actions that they have developed for themselves earlier in the process. Using a workbook (as illustrated in Figure 2), they then write down their top ten key commitments.

In conclusion; the DMM suggests that elimination of fatalities will occur when drivers are able to demonstrate awareness and knowledge competency in terms of the six-steps of the hazard management process; and they can apply their driving skills in an appropriate manner. As such, drivers must be able to identify the hazards, threats, events, and consequences that relate to a variety of driving situations. They then need to be able to identify, select and be motivated to implement a range of controls – including driving skills – that can either assist them in managing driving-related hazards and or in recovering from negative events should they occur. To develop the competency to mastery level, oil majors need to continue to offer ADT for the skills component; but they need to seek out new approaches that assist with promotion of competency over the hazards management process. I have suggested that one way to operationalize the required awareness and knowledge competency for managing hazards is to use a picture-based simulation exercise with appropriate questioning that drives home learning about the key concepts involved.

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BIOGRAPHY

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