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## **Socio-cultural influences on vehicle defects in the Omani heavy vehicle industry**

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### **Abstract**

With recent economic growth in Oman there is increased use of heavy vehicles, presenting an increase in heavy vehicle crashes, associated fatalities and injuries. Vehicle defects cause a significant number of heavy vehicle crashes in Oman and increase the likelihood of fatalities. The aim of this study is to explore factors contributing to driving with vehicle defects in the Omani heavy vehicle industry. A series of qualitative participants observations were conducted in Oman with 49 drivers. These observations also involved discussion and interviews with drivers. The observations occurred at two road-side locations where heavy vehicle drivers gather for eating, resting, vehicle check-up, etc. Data collection was conducted over a three week period. The data was analysed using thematic analysis. A broad number of factors were identified as contributing to the driving of vehicles with defects. Participants indicated that tyres and vehicle mechanical faults were a common issue in the heavy vehicle industry. Participants regularly reported that their companies use cheap, poor quality standards parts and conducted minimal maintenance. Drivers also indicated that they felt powerless to resist company pressure to drive vehicles with known faults. In addition, drivers reported that traffic police were generally ineffective and lacked skill to appropriately conduct roadside inspection on trucks. Further, participants stated that it was possible for companies to avoid being fined during annual or roadside vehicle inspections if members of the company knew the traffic police officer conducting the inspection. Moreover, fines issued by police are generally directed to the individual driver rather than being applied to the company, thus providing no incentive for companies to address vehicle faults. The implications of the findings are discussed.

**Keywords:** Road traffic crashes; vehicle defects; Bronfenbrenner Ecological Development Model; Deterrence Theory; Safety; Oman.

### **Introduction**

The United Nations General Assembly (2003) identified five main areas for road safety improvement; these are the road infrastructure, road users' behaviours, emergency services, leading agency and vehicle characteristics. Rechnitzer (2002) stated that to improve road safety, controls on vehicle safety factors such as break inspection and maintenance standards must be addressed to reduce the prevalence of vehicle defects and number of associated crashes. In addition, Blower and Woodrooffe (2012) reported that vehicle defects and inappropriate maintenance are a common cause of crashes. The issue of vehicle defects remains a common problem within heavy vehicle transport industries. Rechnitzer, Haworth, & Kowadlo, (2000) reported that even though vehicle defects contributed to approximately 6% of crashes in Victoria, Australia, an even greater number of vehicles on roads could be classified as un-roadworthy despite annual technical inspections. Moreover, Mohan and Bawa (1985) found that, buses and trucks accounted for 65% of brake failure caused road traffic crashes in Delhi. Cuerden, Edwards and Pittman, (2011) reported that the most common vehicle faults that contributed to crash occurrence and severity of injury in UK during (2009) were found to be illegal tyres and break failures.

In the Omani context, Al Bulushi, Edwards, Davey, Armstrong, et al. (2015) examined heavy vehicle crash data that was obtained from the Royal Oman Police (ROP) for the period from 2009-2011. They reported that vehicle defects were the primary cause of 10% of fatal crashes and that crashes caused by vehicle defects were three times more likely to result in a fatality. The ROP reported that 243 crashes (light and heavy vehicles) occurred because of vehicle defects (mostly tyre defects) in 2013, compared to 178 in 2009. These vehicle defect-related crashes in 2013 led to at least 61 deaths and 243 injuries (ROP, 2013). The number of crashes due to vehicle defects are increasing in Oman, and further investigation is required to understand and examine the magnitude and characteristics of the problem, particularly in the heavy vehicle industry.

Heavy vehicle defects and their contribution to road traffic crashes and fatalities may also be influenced by factors which are not controlled by the driver. Company factors, customers, government departments, and road and working environments can all influence heavy vehicle safety (Edwards, Davey, & Armstrong, 2014). When exploring the factors which influence vehicle defects in Oman, it is important to explore the cultural context of heavy vehicle operations. In the Oman context, governments polices and legislations, trucking industry operations, police enforcement, road environment and heavy vehicle driver characteristics should all be considered. To explore these factors and how they related vehicle defects within the industry, the current research applied the ecological development model. This model originated from research into human development (Bronfenbrenner, 1977). In this model there are four systems (micro, meso, exo and macro) which help formulate behaviours. These four systems and their relevance to the research are briefly discussed below. This framework has been used in multiple different research settings to understand the variety of influences on health and safety outcomes.

For the purpose of this study, the micro-system referred to the immediate physical environment including heavy vehicle gathering and rest areas, and heavy vehicle characteristics. The meso-system included the environment surrounding the microsystem (road infrastructure and surrounding facilities). The exo-system included the heavy vehicle industry workplace environment, government legislation and policies as well as traffic law and enforcement (in this paper, to provide better clarity, this system is further divided into two sub-systems representing the organisation and policing). The macro-system here was used to understand the legal and political context, general overarching culture and international influences on heavy vehicle safety. These headings were used in the results and discussion below.

In the absence of sufficient research within Oman, there is limited current knowledge of factors which influence heavy vehicle safety. The aim of this study is to provide greater knowledge of the key influences on heavy vehicle defects and to explore how these influences lead to safety outcomes and safety-related behaviour within the trucking industry in Oman.

## **Method**

A series of observations were conducted of heavy vehicles and their drivers within Oman as part of a larger study examining safety broadly. During these observations the researcher travelled to two major roadside locations where heavy vehicle drivers gather, took notes on the level of maintenance of heavy vehicles that were parked at these locations (e.g. tyre tread, and visible aspects of the vehicle), observed the interactions between drivers and conducted informal interviews with heavy vehicle drivers at these sites. Additionally, a number of ride along observations were conducted, where the researcher joined drivers on their journey to deliver goods, taking notes of observed interactions and ongoing informal discussions with the drivers.

While no participant information was provided to the drivers of vehicles that were not present when their vehicle was any time a driver was approached for discussion, or questioned the researcher as to why they were present, the researcher introduced themselves and the purpose of the study as well

as relevant participant information. This study received ethical clearance from the Queensland University of Technology Human Research Ethics Committee.

Prior to undertaking the study the researcher undertook training at a police inspection depot for heavy vehicles, observed a full day of inspections and was instructed by the officers as to what to look for whilst casually observing a heavy vehicle. Almost all drivers who were approached agreed to be involved to varying depth of conversation and levels of vehicle observations. At the end of each day notes and discussion were transcribed in Arabic language and then translated into English for reporting. The transcripts were entered into NVivo 10 for analyses. Thematic analysis was conducted, guided by the ecological development model. That is, data was coded according to levels of the model, and subthemes were identified within. For the purpose of reporting, the participants quotes are identified in the result section as 'Obs##'. A total of forty nine participants were involved in interviews from which quotes were drawn. Not all participants discussed vehicle defects, however, of those that did there was a high level of congruence in themes discussed.

## **Results and Discussion**

The observations identified two common areas where vehicle defects occur. These were bald or re-treaded tyres and general mechanical faults, and for the purpose of this research are considered to form the microsystem (as the final behaviour that influences safety is the decision to drive with a vehicle with these defects). Each of these issues was influenced by the other three systems. Each of these is discussed below within the relevant ecological systems levels.

### ***The Micro-system***

Poor quality standards of re-treaded tyres were almost universally present in the heavy vehicle industry regardless of the company.

*Whether it is a small company or a large one, every single truck would have 3-7 defected tyres (Obs6).*

In addition, many participants reported the frequent occurrence of hydraulic brake system failure, drum wheel cracking and breakage while driving, as well as failures in tie rods, steering rods and air balloon valves. Participants stated that these defects were associated with crash involvement in many instances. In many cases, participants stated the main cause of these faults and breakages to be the usage of substandard spare parts. Substandard or low quality spare parts were frequently used to replace genuine manufacturer parts as they were significantly cheaper. Within Oman, this practice is popularly referred to a "duplicate parts".

*In general, the fundamental problems that we face are the failure of hydraulic braking system and broken drum wheel. This can cause a serious crash, because we lose the main means of truck control. Some of the reasons for this were due to the use of duplicate (poor quality standard) or commercial spare parts (Obs8).*

The majority of the observed heavy vehicles in both study sites were fitted with multiple bald, cracked or poor quality re-treaded tyres. The risk in using these poor quality tyres is significantly increased when one observes the distance between two poor quality tyres paired on the same axle. When combined with commonly overloaded vehicles the gap between tyres becomes very narrow. This becomes critical when the gap closes and generates heat resulting in tyre explosion.

With regard to general mechanical faults, the most common heavy vehicle mechanical faults that were reported were associated with brake failure. In the event of a brake malfunction, the inability to control the truck significantly increases crash likelihood.

Overall, it was clear that poor levels of vehicle maintenance was common. Further, drivers appear to be willing to drive these vehicles. As such, it is important to understand the factors which lead to the occurrence of these defects, and encourage drivers to operate these vehicles.

### ***The Meso-system***

In general, road infrastructure can play a significance role in safety and this is particularly the case within the Omani heavy vehicle industry. In Oman, the police traffic law requires truck drivers' to drive on the far right lane of the roads. The heavy usage of this lane by trucks, especially when they were overloaded, results in rapid destruction the road surface. As a result, the road surface causes continuous vibrations to the vehicle and drivers while on the road. These vibrations can structurally affect the mechanics of the truck.

*The truck lane surface that most of the trucks must drive on (far right lane) in some location were worn out due to the heavy usage of this lane by trucks. This lane surface causes vibrations of the truck body leading to eclectic failure to lights and hydraulic break wire connections disruption (Obs23).*

This issue can be argued to indicate failures at a transport authority level. There appears to be an absence of road monitoring, supervision and evaluation programs within the transportation authorities. Further, there is an absence of measures to monitor and enforce truck weights. These issues need to be addressed to reduce the problem of vehicle defects within the Omani heavy vehicle industry.

### ***The Exo-System***

There were two main influences that were categorised as part of the exosystem. These were transport companies and road safety policing. For clarity, the exo-system has been separated into two separate systems reflecting these two influences.

#### ***Exo-police system***

Road policing forms one of the strongest influences on road safety internationally. The primary means by which police in Oman can influence vehicle defects in the heavy vehicle industry is through heavy vehicle technical inspections. The responsible authority for the technical inspection within Oman is the ROP. The ROP traffic law requires every heavy vehicle registered in Oman to undergo annual technical inspection, and police also conduct occasional road side inspections. It became evident very early in the research that legislations, enforcement and monitoring system with regards to technical inspection needs to be strengthened. However, to maintain high quality of vehicle inspection and meeting international standards, participants acknowledged that in companies such as the Petroleum Development of Oman (PDO) and Occidental Oman (Oxy) conduct their own vehicle maintenance inspections.

*Like you have the PDO and Oxy, they have strong inspection guidelines and will not allow passing any vehicle if not fulfilling all requirements without any mediation. While in the police, social influence can play a big role in passing some of trucks where defects were highlighted in breaching some of the requirements (what I mean by social influence is that, the company owner knows some police officers, they may be relatives or friends) (Obs48).*

Many of the participants reported that traffic police lack sufficient knowledge with regards to on-road heavy vehicle inspections. They reported that police commonly issue tickets for tyres defect and lights, yet fail to inspect for, or detect, other defects such as hydraulic brake system failure and

drum wheel cracking. This indicates a need to improve traffic police knowledge and training with respect to on road heavy vehicle inspection.

*At the time of being stopped for inspection, they only practice the normal procedures of checking such as tyres, lights, flash (yellow lights) at the forefront and the rear of the truck (Obs10).*

Driving a truck with bald tyres and known mechanical faults is an offence by traffic law. While drivers were accepting of this, they criticised the current police ticketing in terms of how, and to whom, tickets were issued. Traffic police generally issue vehicle and maintenance related tickets to the driver's licence. Once tickets are issued to a driver's license, the driver is responsible to pay the fine. However, under Omani law the ticket can also be issued to the registered owner of the vehicle. To our knowledge, this approach is rarely if ever used, even though under the law vehicle maintenance is considered the responsibility of the owning company. Thus there is no punitive incentive for transport companies to improve vehicle maintenance. While driver's would ideally refuse to drive vehicles with defects, they do not own the vehicle and thus cannot ensure proper maintenance. As such, it would be beneficial for police to direct their efforts toward fining vehicle owners, rather than drivers of heavy vehicles.

*In some cases, if you have been stopped by the police for tyre offences, the ticket issued on the driver license and supposed to be ticketed on the company or the owner of the truck (Obs9)*

According to deterrence theory, individuals are deterred from a behaviour as a function of their perception of the severity, swiftness and certainty of punishment (Elvik & Christensen, 2007; Watson & Freeman, 2007). The interviews and field observations identified a range of deterrence weaknesses in the current police sanctions for vehicle defects. To use an example, when a driver is ticketed for tyre defects they are fined an equivalent to approximately AU \$115. This fine is to be payed at the end of the year, or at the vehicle annual technical inspection. More importantly the vehicle is still allowed to operate with the defective or damage part. When this is combined with the relatively low likelihood of detection, there is a lack of certainty, severity or swiftness. While annual inspections can result in seized vehicles, drivers frequently reported that when a heavy vehicle does not pass an annual inspection, punishments can be completely avoided "if they knew someone in the police", resulting in a passed inspection. Whilst issues related to knowing police officers are likely cultural issues that may be difficult to overcome, the findings overall highlight the need to review the current police operations and practices related to vehicle defect offences.

*If the police seize the vehicle for these types of offences, the factory managers will run to rid the truck. In addition, the fine is not enough, that is why you see the same offence repeated so many times, but "if you give them a strong nip they will not repeat it" (Obs43).*

### ***Exo-company system***

Within Oman legislation, the majority of companies are required by law to have a health and safety policy statement, and larger companies must also employ a health and safety officer (Ministry of Manpower, 2008). However, it does not automatically follow that companies apply and adhere to their own health and safety policies. The interviews and field observations identified two broad levels of health and safety standards within the industry. Some companies facilitated a high standard of workplace health and safety, while other companies paid little attention to workplace safety.

There were a small number of companies that appeared to be highly focused on safety. These companies were exclusively large Omani oil and gas organisations, such as the Petroleum

Development Oman, which follow international standards of best practice. However, the majority of companies that drivers in the observations were employed by had relatively low operational levels of workplace health and safety. With respect to these organisations, if drivers did report that their company had workplace safety policies, these policies were almost never followed or supported by management. As such, drivers highlighted that health and safety policy requirements were ineffective in promoting safe practices among companies employees. In addition, participants stated that these companies produce routine reports to the Ministry of Manpower inspectors that enforce company compliance, yet that these reports were completed solely to appease inspectors and did not reflect actual health and safety performance.

*When you talk about safety, believe me most of the companies that have a fleet of heavy vehicles do not have the true meaning of safety or road safety, safety of trucks and their drivers. With the exception of oil and gas companies such as PDO and National Gas Company, other than these companies, they claim to be having safety system in their companies but that is only to show to government organisation that they have a safety system for their employees, but in fact this is not true (Obs30).*

Researchers around the world highlight the importance of the organisation safety culture in formulating employee behaviours (Guldenmund, 2010). With specific regard to vehicle defects, these less safety-focussed companies would ignore driver reports about mechanical faults. Additionally, participants emphasised the pressure to work in unsafe conditions from company management. Most drivers reported that they were forced to drive their trucks with known faults or defects, or face punishment. For expatriate drivers, this can even include a loss of work visa and requirement to leave the country.

*There is air leakage from rear brake pipe, I have told the company in-charges about the problem but no action taken yet, I am a driver and I follow orders from my supervisors to drive the truck with this fault (Obs7).*

*These tyres pose a major threat in crash involvement and public safety, we have no any hand to change the company decision in what type of tyres to be used, we are drivers and we accept what they offer (Obs22).*

In Oman, there is a need for government intervention targeting transport organisations. Without sufficient motivation to ensure companies promote safe behaviour, it is unlikely that heavy vehicle safety can be significantly improved.

### ***Macro-System***

As was noted in the previous section, a small selection of companies had high standards of workplace health and safety. These companies included oil, gas and chemical companies. These companies were involved in maintaining a high standard of safety and safety culture in all aspects of their activities whether at the depot or on the road. One of the key reasons for these activities was that these companies engaged in trading with the international market, in which the implementation of a high standard of safety is a general requirement. Hence, continuation and maintenance of this safety standard in Oman or any place where these companies located is crucial for these companies. While it is difficult to see how this could be used to improve safety in companies that have no international market, it is important to recognise that this does indicate the power of customers to influence transport companies. While drivers did not highlight the role of customers, it is evident that customers can have an influence on health and safety practices, if they have a reason to do so.

*For the presence of regulations and documents concerned with road safety and safety in the facility, only large companies have such regulations such as PDO. These companies have*

*their own company field inspectors to monitor the drivers and issue tickets for the offenders and apply the company's penalties on them (Obs4).*

## Conclusions

This study aimed to explore the key influences on heavy vehicle safety defects in Oman. Two major areas of vehicle defects were identified in this study, driving a truck with bald or poor quality re-treaded tyres and general mechanical faults. There were a number of influences on driving with these defects. Through using the ecological systems model, these influences were separated into a number of systems. It should be noted that each of these systems may have effects on one another. Within the present study, such interactions were not found to have a major effect on driving with vehicle defects, nonetheless it should be noted that these systems do not exist in isolation.

The mechanical faults identified in this study included hydraulic break failure, steering and tie rods breakdown and balloon air valve failure. While there were examples of strong workplace health and safety operations and environments, the majority of employing companies appeared not to value workplace health and safety policies and held little fear of government inspectors. Due to the many influences on the industry, drivers were found to be powerless and forced to engage in driving unsafe vehicles. Many drivers felt unable to refuse their company managers and supervisor's requests or directives. This could be further explained by the fact that many drivers are expatriates and the company has the ability to cancel their work visa. When this issue is combined with weaknesses in enforcement as well as the effects of road infrastructure on the vehicles, it highlights the need for system wide initiatives. It is evident that the problem of vehicle defects cannot be addressed with a sole emphasis on attempting to change driver behaviour.

Importantly this research highlighted the overall importance of the employing companies influence on operational road safety. In comparison the operational focus of introduction activities appears to be on the driver. However within this unique Oman context the singular focus on the driver as a point of intervention will yield little overall improvement in road safety outcomes. In fact it will only continue to reinforce a status quo where industry continues in exploiting cultural and legislative weaknesses to their financial benefit for the sake of drivers and the communities' safety.

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