DRIVING ON THE HARD SHOULDER
A SAFETY ASSESSMENT

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ABSTRACT

This paper assesses the risks associated with driving on the hard shoulder, in the context of the Western Cape. Driving on the hard shoulder is an activity legitimized by SA legislation, yet is exceptional internationally. It is a potentially dangerous activity, particularly when the shoulder is also used by non-motorized (NMT) road users. The aim of the research was to investigate the laws, safety aspects of hard shoulder driving and the identification of potential risks, focusing on single carriageways with paved hard shoulders. Observations were carried out on two specific sites in the Cape Winelands District of South Africa. These enabled the patterns of driver, pedestrian and cyclist behavior to be monitored on the hard shoulder of the roadway, and to quantify and document their interactions. Crash data was examined to quantify the risks associated with hard shoulder use to road users of all three categories. Questionnaires were distributed to drivers, pedestrians and cyclists to determine the extent of their knowledge about hard shoulder driving laws, how the drivers use the hard shoulder, and how the NMT road users use the hard shoulder - in particular what the experiences of many of the NMT drivers have been. The results confirmed that drivers do not fully understand the laws on hard shoulder driving, yet they regularly and indeed sometimes unlawfully utilise this area of the roadway for driving. Pedestrians and drivers both report regular experiences with dangerous situations. Pedestrians were overwhelmingly unaware of the benefits of maximizing their visibility and few cyclists were seen taking measures to increase their visibility to drivers. The research concluded that there is an urgent need for better education around hard shoulder use by drivers, pedestrians and cyclists, and that the benefits of hard shoulder driving need to be reassessed in terms of the risks posed by this activity to more vulnerable road users.

1. INTRODUCTION

The paved hard shoulder of the roadway is a reserved area that is usually slightly narrower than the other lanes of the roadway. The main purpose of the hard shoulder is to provide a safe place for a vehicle to stop in the event of an emergency. It is common practice in South Africa, and indeed permitted by legislation in SA, for slower moving vehicles to move over to the hard shoulder to let faster moving traffic pass. Chapter 10 of the National Road Traffic Regulations (2000) describes the rules of the road and the usage of hard shoulders. In section 298A the conditions for driving on the hard shoulder of a public road are explained. The driver of a vehicle is allowed to drive on the hard shoulder of single carriageway between sunrise and sunset when the vehicle is being overtaken by a faster moving vehicle. Drivers are allowed to drive on the hard shoulder only if the driver does not endanger other traffic and pedestrians. Finally a driver is allowed to drive in the hard shoulder only if the driver can clearly see obstructions in the hard shoulder at a 150 metres distance.

A different section of the National Road Traffic Regulations (regulation 16) lays out the duties of pedestrians. The law permits pedestrians to walk on the edge of a roadway which does not have any sidewalks or footpaths. Subsection (2) reads: “A pedestrian on a public road which has no sidewalk or footpath abutting on the roadway, shall walk as near as is practicable to the edge of the roadway on his or her right-hand side so as to face oncoming traffic on such roadway, except where the presence of pedestrians on the roadway is prohibited by a prescribed road traffic sign”.

The traffic regulations thus allow both pedestrians and vehicles use of the hard shoulder under specific circumstances. Other forms of Non-motorized transport, including cyclists, also utilize this space. Such shared access creates opportunity for conflicts, particularly when one considers the primary role of the hard shoulder, which is to prevent run off accidents as well drift-offs.

2. METHODOLOGY

2.1 Site selection

To date very little research has been done on the safety of using the hard shoulder to drive in. In this section the methods used to conduct a safety assessment on the use of the hard shoulder of South African roads are explained.

For the purpose of this study, two sites were identified and used to conduct the safety assessment. The two sites are the R302 (between Durbanville and Malmesbury) and the R304 (between Stellenbosch and Malmesbury, beginning at the Joostenbergvlakte area). In both cases, a two-kilometre stretch was selected. Both study sites have a speed limit of 100km and consist of two lanes, each 3.7 metres wide and a 2.4 metre wide paved hard shoulder on each side. Both are in rural areas and carry relatively high traffic volumes - particular at peak times. Both roads also carried pedestrian traffic, including adults and children (in this case primarily learners using the road to access their schools). Images of the roads are displayed in Figure 1 and Figure 2 below.

Figure 1: R302, westbound direction

Figure 2: R304, eastbound direction

2.2 Observations

The observations were conducted during morning peak time traffic, mid-day traffic and afternoon traffic. These are the times where the roads are at their busiest. It was thus the optimal time for observations as the driver behaviour during these periods can be used as representative behaviour of drivers on those particular roads.

The behaviour of drivers and pedestrians was observed in order to see how they use the hard shoulder and what effect their behaviour had on the safety of the hard shoulder. Special attention was paid during the times of the observations on how the driver behaviour complies with the law.

The observations were conducted by means of tally sheets. All the vehicles heading in one direction were counted. These vehicles were grouped into heavy vehicles and light vehicles. The number of vehicles using the hard shoulder to drive in was also counted. Pedestrians and cyclists using the hard shoulder were also counted during the observations.

2.3 Questionnaires

In order to gain some knowledge on what road users actually do in the hard shoulder and what their understanding of hard shoulder laws was, a series of questionnaires was developed and implemented.

2.3.1 Participants

Different target groups required different survey instruments. In order to reach a wide variety of drivers, an online questionnaire was used. These were distributed by email, using a cascading sampling procedure. A range of drivers were desired: drivers who frequently use a single carriageway, drivers who do not use a single carriageway frequently and drivers of heavy and light vehicles. This selection of drivers was used to see whether their approach to the use of the hard shoulder is shaped by their experience.

The other target group was pedestrians. The aim of the questionnaire for this target group was to gain knowledge on their perception on the use of the hard shoulder. The focus of this questionnaire was to determine how frequently they use the hard shoulder, how safe they feel when using it and what safety measures they take when using the hard shoulder. In this case the questionnaire was administered personally, with individual and groups on pedestrians along the two roads in question.

A third questionnaire was used with cyclists.

2.4 Casualty data analysis

Casualty data was collected for the two sites in question. Accidents related to the use of the hard shoulder were identified. The data over the past decade was used to determine whether the accidents and casualties are increasing.

3. ANALYSIS

3.1 Observations

An intensive period of observation was conducted in September 2013, over which time eighteen observations were made at the sites. The observations were conducted to gain knowledge on the usage of the paved hard shoulder, specifically who uses the paved hard shoulder, how frequently the paved shoulder is used and general driver, pedestrian and cyclist behaviour at the sites. Features that were taken into consideration included the number of heavy and light vehicles, and pedestrians and cyclists using the two roads under investigation.

Observations were conducted from 07h00 – 08h00, 12h00 – 13h00 and 17h00 – 18h00 each day.

3.2 Regional Road 302

730 pedestrians were counted over 9 hours' observation using the paved hard shoulder. Most appeared to be commuting from a low-income housing area situated on the outskirts of Durbanville. None of the observed pedestrians took any measures to improve their visibility to moving vehicles. It was observed that pedestrians would tend to walk in groups of around four people and would tend to walk next to each other. The majority of the pedestrians who walked on the shoulder, walked with their backs facing the traffic travelling in the same direction as them.

Two hundred and eight cyclists were counted travelling on the hard shoulder of the R302. Special attention were paid to determine whether the cyclist take any measures to improve their visibility to vehicles. The majority of cyclists (172 of 257) took no measures to improve their visibility to vehicles.

Due to the fact that the surrounding land uses generate and attract a high volume of heavy vehicles, attention was paid to determine whether this leads to an increase in driving on the hard shoulder by heavy vehicles. Heavy vehicles travelling on the R302 tend to be fully laden due to the nature of the products being transported. This led to heavy vehicles travelling at lower speeds.

Over the course of the three days of observations, the 07h00 – 08h00 observations and 17h00 – 18h00 road users' volumes were significantly higher than the 12h00 – 13h00 observations. Four hundred and eighty one heavy and light vehicles made use of the hard shoulder to drive in during the morning and afternoon periods of the observations. The high volumes of pedestrians and cyclists who used the shoulder during these periods had significant impacts on the safety of the road. It was noted that with high volumes of pedestrians and heavy vehicles, the number of other vehicles dangerously passing a slower moving heavy vehicle in oncoming traffic, were significantly higher. This action occurred 117 times during the observation periods. The number of heavy vehicles making use of the hard shoulder, relative to total numbers of heavy goods vehicles, is shown in Figure 3 below. On both roads, both shoulders were used to similar degrees.

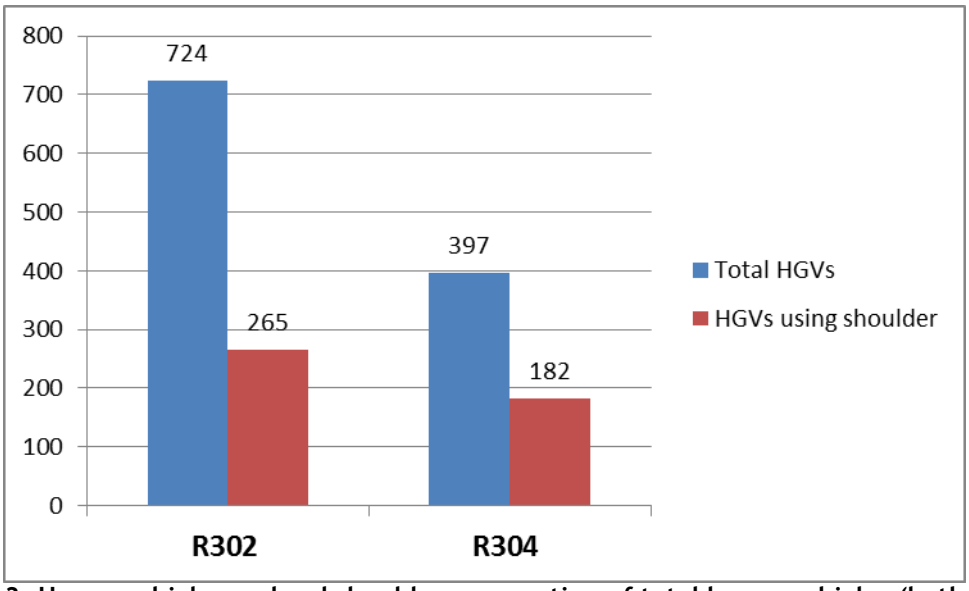

Figure 3: Heavy vehicles on hard shoulder as a portion of total heavy vehicles (both roads)

This shows that 36.6% of HGVs on the R320 made use of the hard shoulder. Similar counts were done for light vehicles – these were significantly lower. For the R302 the percentage of light vehicles using the shoulder during the observation periods was 2.5%.

3.3 Regional Road 304

High volumes of light vehicles (11939) were noted during all the observation periods and increasing volumes of heavy vehicles (183) during the 13h30 – 14h30 observation periods. Five hundred and seventy nine (579) pedestrians, including large numbers of school children, were observed during the 07h00 – 08h00 and 13h30 – 14h30 observation periods.

School children that were observed on the R304 were seen on various occasions playing on the shoulder on their way to school. Other pedestrians included farm workers on their way to work. None of the pedestrians that were observed took any measures to improve their visibility to oncoming traffic.

Over the three hours' observation, 449 cyclists were observed using the shoulder of the R304; split almost equally between Stellenbosch-bound cyclists (228) and Malmesbury-bound cyclists (221). During the 07h00 – 08h00 observation periods, the visibility was poor for much of the observation period. Some of cyclists (115) took some measures to improve their visibility to oncoming traffic. These measures include LED flashing lights and reflective clothes.

As with the R302 a significant number of heavy vehicles made use of the hard shoulder (see Fig 3). This equated to 46.8%. Numbers of light vehicles using the shoulder were again lower, at 3.8% of the traffic, although this amounted to 456 vehicles over the course of three hours. Eight pedestrian were observed in direct conflict with moving vehicles. A notable amount of dangerous actions (59) were caused by slow moving heavy vehicles not being able to move over to the hard shoulder due to high volumes of pedestrian activity. This led to fast moving vehicles driving in front of oncoming traffic.

4. RESULTS OF QUESTIONNAIRES

4.1 Drivers

The first objective of the driver questionnaire was to determine whether the drivers who participated know if the law permits them to drive on the hard shoulder. A total of 101 responses were received. The majority of the drivers indicated that they are aware of laws in South Africa on driving on the hard shoulder. However the majority of the participants indicated that they do not completely understand what the laws in South Africa permit. Of 17 drivers who had between 0 and 5 years legal driving experience, 13 drivers indicated that they are aware of laws and that they completely understand these laws. Of the rest of the sample, twelve drivers had received their South African driver`s licence in the last 6 – 10 years. Of these, 9 drivers were aware of laws relating to hard shoulder driving, but only 4 of them completely understand what these laws permit. The majority of the participants (72 drivers) indicated that they have a valid South African driver`s licence for more than 10 years. As indicated in the figure below, 56 of the 72 drivers are aware of laws in South Africa regarding hard shoulder driving, but only 20 drivers completely understood what the law permits them regarding hard shoulder driving (see Figure 3).

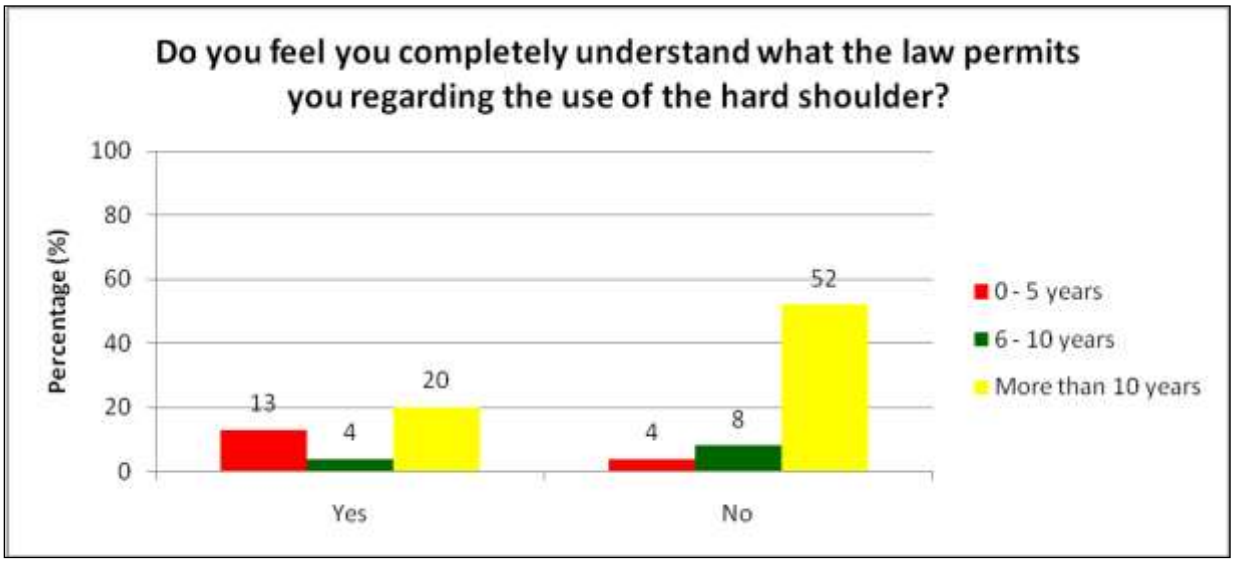

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Figure 4: Respondents level of understanding of hard shoulder legislation

Additionally, the questionnaire sought to investigate the driving habits of road users in the hard shoulder. The majority of the drivers do use the hard shoulder to drive in. Of the 17 drivers with 0 to 5 years legal driving experience, 12 regularly make use of the hard shoulder, as do eleven of the twelve drivers with between 6 and 10 years legal driving experience and the majority of the drivers with more than 10 years legal driving experience (62 of 72 drivers).

The drivers were asked to indicate how they use the hard shoulder. The majority (54 of the 100 participating drivers) indicated that they sometimes move aside to let faster moving vehicles pass them. The minority showed that they always move aside for faster vehicles. A small number of the participating drivers (6 of the 100 participating drivers) indicate that they use the hard shoulder to pass slow moving vehicles that do not move aside to the hard shoulder to let them pass. A significant number of drivers (17 of the 100 participating drivers) indicated that they use the hard shoulder to drive in when they are driving particularly slowly.

Thirty-nine of the one hundred participating drivers feel that it is sensible to make use of the hard shoulder as it maximizes the use of the available road surface. Some (14 drivers) feel that it is sensible to use the hard shoulder as it makes driving times shorter. A small number of drivers (5 drivers) indicated that they have not really thought about it. The majority of drivers (69 of the 100 participating drivers) have concerns about how safe it is to participate in hard shoulder driving.

4.2 Pedestrians

Sixty pedestrians filled out the questionnaire (30 at each site) as well as 30 cyclists. Numerous ages groups were included. See figure 4 below.

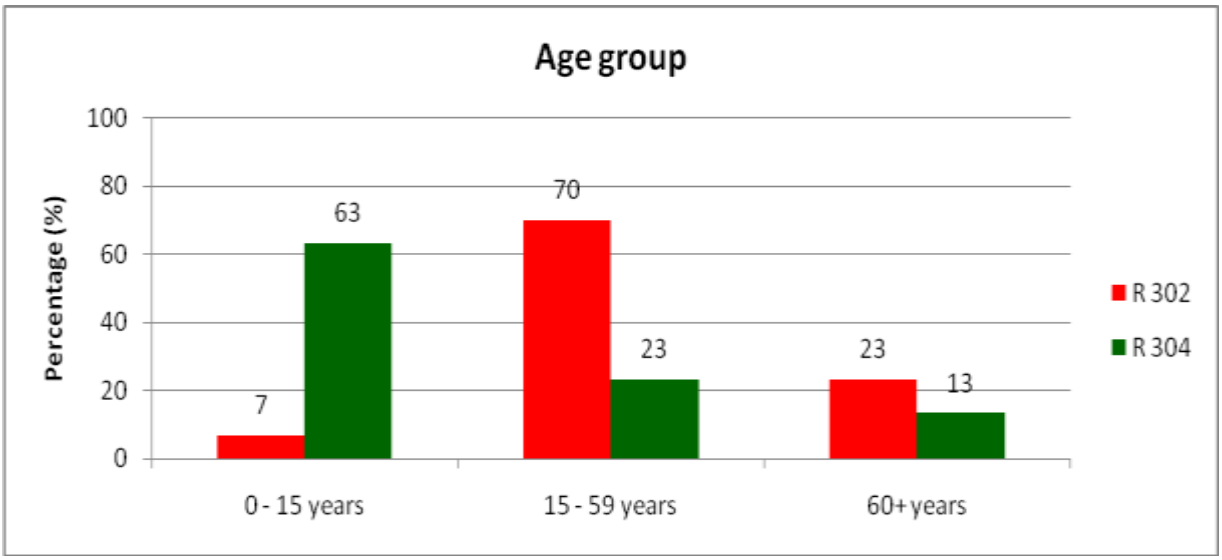

Figure 5: Age breakdown of participating pedestrians and cyclists

The vast majority of the pedestrians who participated in the questionnaires indicated that they walk on the hard shoulder more than once a day. For the R302, 24 of the pedestrians use it more than once a day, opposed to the 21 of pedestrians on the R304. A small number of pedestrians use the hard shoulder to walk in a few times a week.

The majority of the pedestrians, 16 pedestrians for R302 and 30 pedestrians for R304 feel a little unsafe when using the hard shoulder to walk in. Nine of the pedestrians walking on the hard shoulder of the R304 feel very unsafe and 3 of the pedestrians walking on the hard shoulder of the R302 feel very unsafe.

Of the pedestrians walking on the hard shoulder of the R302, none took any measures to improve their visibility to moving vehicles, compared with the 28 of the pedestrians walking on the R304 who took no measures. Only 2 of the pedestrians approached on the R304 took measures to improve their visibility by wearing reflective gear. Figure 5 below indicates if the pedestrians who were approached have any alternative methods of travelling. The majority indicated that walking is their only method of travelling.

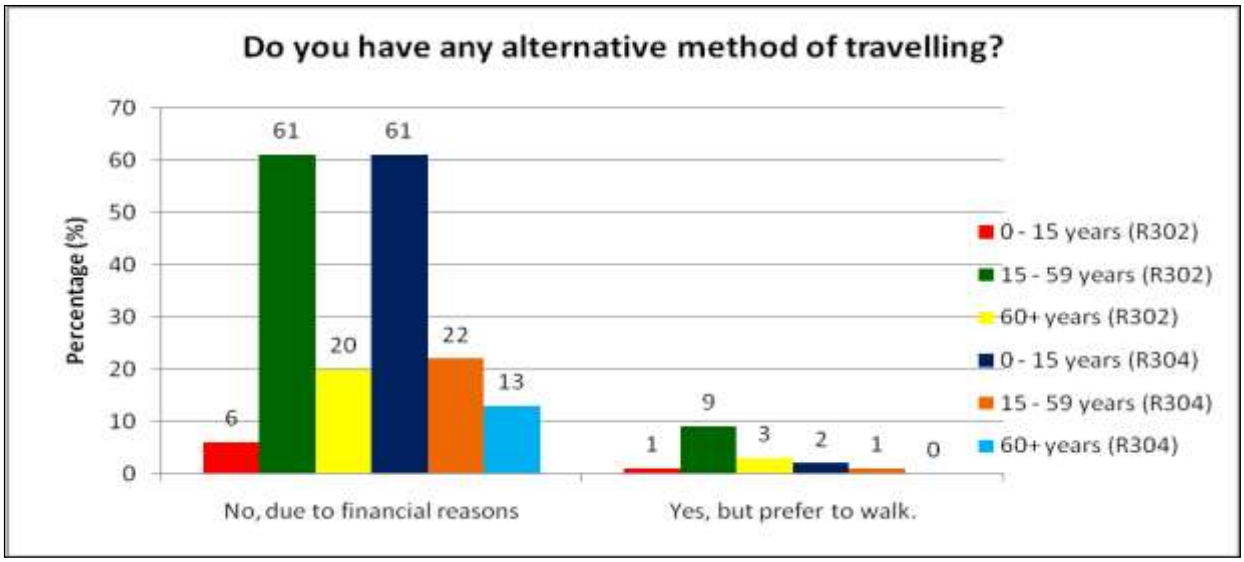

Figure 6: Dependence of pedestrians on walking as a means of access

5. COMPARISON OF QUESTIONNAIRES AND OBSERVATION RESULTS

From the drivers' questionnaire, 61 of the 100 drivers confirmed that they only utilize hard shoulders after sunrise and before sunset. Thirty-none respondents would use the hard shoulder during hours when this was forbidden. This was in fact reflected in the observations - all the observations done from 07h00 – 08h00 were before sunrise while it was still dawn. During the period 356 of the 1119 vehicles driving on the hard shoulder were recorded. This does have a significant impact on the safety of using the hard shoulder as 781 of the 1915 pedestrians and cyclists using the hard shoulder were observed during the morning observations.

As concerning is the fact that none of the observed pedestrians took any measures to improve their visibility to the moving vehicles. In the pedestrian interviews 45 of the 60 pedestrians who were approached to participate in the survey frequently use the hard shoulder to walk along. Of these 33 of the 60 felt unsafe in doing so. The fact that the pedestrians took no measures to improve their visibility could be contributing to both their real risk and their perceived risk.

6. ACCIDENT DATA

The accident data was collected for the Regional Road 302 and Regional Road 304 from the City of Cape Town. The accident data of the R304 is incomplete and could not be used in the analysis.

The available accident data was for the period between 2000 and 2013. During this period 49 pedestrian accidents occurred on the R302. In these accidents 8 pedestrians were killed, 8 pedestrians were seriously injured, 26 pedestrians were slightly injured and 42 pedestrians had no injuries. The data distribution does not support an increase in pedestrian crashes year-on-year, but it does appear fairly consistent. In 2004 the peak number of pedestrian accidents occurred with only 1 pedestrian slightly injured and 9 pedestrians with no injuries.

7. DISCUSSION

It was apparent from the results of the pedestrian questionnaires that 54 of the 60 participating pedestrians have no other means of travelling. Therefore the pedestrians have no choice and are forced to walk to their destinations along the carriageway on the hard shoulder. In the observations it was noted that the all of the observed pedestrians walk in the same direction as the adjacent moving vehicles, thus with their back facing moving vehicles heading their way. Pedestrians therefore have a larger risk of being struck by a moving vehicle and drivers could fail to see the pedestrians.

From the questionnaires it was noted that the majority of the pedestrians feel a little unsafe when walking in the hard shoulder. The results indicated that 45 of the 60 participating pedestrians feel unsafe when walking on the hard shoulder. The big difference in pedestrians feeling safe and pedestrians feeling unsafe when walking on the hard shoulder perception can be caused by the high volumes of vehicles driving on the carriage way. During the observations 18717 moving vehicles was observed driving on the single carriageways.

From the results of the driver questionnaire it is clear that the greater part of the participants of the driver questionnaire (72 of 100 driver participants) consisted of drivers who have a driver`s licence for more than 10 years. A sensible conclusion can be drawn from the above mentioned fact, that the majority of the participants should have a clear understanding of what the traffic laws permits them to do. However the results of the questionnaire indicated that 78 of the 100 participants are aware of laws on driving on the hard shoulder, but 64 drivers do not fully understand what the law permits them to do. Eighty five of the driver participants indicated that they do make use of the hard shoulder to drive in, yet 84 of the participants feel the use of the hard shoulder is a little unsafe. This is a concerning factor that the majority of drivers do make use of the hard shoulder despite the fact that they do not entirely know what the law permits them to do and they feel that their driving on the hard shoulder is a little unsafe.

When the participating drivers were asked under what circumstances do they feel it is safe to move over to the hard shoulder to let faster moving vehicles pass, the majority unconsciously selected all the circumstances which are permitted by the South African laws. The majority indicated that they feel safe to move over to the hard shoulder after sunrise and before sunset, with a visibility of more than 150 meters of approaching traffic, in good weather conditions, driving at speeds below 100km/h and with a shoulder width of more than 0.5 meters. In spite of both locations meeting these physical criteria, on 18 occasions during the observations, drivers were observed almost striking a pedestrian walking on the side of the road. Speed of the vehicles, visibility of the pedestrian and attention of the drivers all played a role in these 'near-misses'.

8. CONCLUSION

The hard shoulder is frequently used by various types of moving and stationary vehicles combined with pedestrians and cyclist regularly using the hard shoulders. The interaction between these types of road users does have an effect on the safety of the hard shoulder and the safety of the road itself. Little is being done to educate drivers and pedestrians on what are they permitted to do and how they can improve their safety. There are several risks involved in the usage of the hard shoulder in South Africa. These include the facts that many drivers frequently use the hard shoulder without fully understanding what the law permits them to do, and pedestrians and cyclists not protecting themselves better - both with reflective clothing and (in the case of pedestrians) walking facing the oncoming traffic.

Latest accident statistics for South Africa confirm that pedestrians continue to make up around 40% of people killed on South Africa's roads. The legislation which permits the use of hard shoulders by drivers is clearly responsible for creating road space which is shared, at often times uncomfortably, by motorized and non-motorized traffic. If the legislation is to remain it is essential that more education goes into ensuring that people use this space responsibly. The better solution may, however, lie in South African drivers conforming to the rest of the world and using the hard shoulder for emergencies only.

. 9. BIBLIOGRAPHY

Cycling safety suggestions for South African conditions. 2013. [Online]. Available: www.arivealive.co.za

Aron, M., Seidowsky, R. & Cohen, S. 2013. Safety impact of using the hard shoulder during congested traffic - the case of a managed lane operation on a French urban motorway. *Transportation Research Part C: Emerging Technologies,* 28168-180.

Aron, M., Cohen, S. and Seidowsky, R. 2010. Two French Hard-Shoulder Running Operations: Some Comments on Effectiveness and Safety. Paper presented at 13th International IEEE Conference on Intelligent Transportation Systems, ITSC 2010, September 19, 2010 - September 22. 2010.

Morena, D.A. 2003. The Nature and Severity of Drift-Off Road Crashes on Michigan Freeways, and the Effectiveness of various Shoulder Rumble Strip Designs. Paper presented at Proc. TRB 2003 Annual Meeting.