

# PERCEPTIONS AND REALITIES OF VEHICLE SPEED AROUND SCHOOLS IN STELLENBOSCH

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## ABSTRACT

The paper explores the issue of perceived high speeds of vehicles around two rural schools and one urban school in the Western Cape and investigates whether those perceptions are based on fact. The two rural schools chosen for the study were identified by Cape Winelands' District Municipality as schools where local residents regularly raise concerns around the speeds of vehicles. The study examines actual speeds but looks also at the safety issues of speed more generally, particularly as it relates to the perceptions of and risks facing children as a consequence of their physiological limitations. The findings suggest that while levels of speed compliance may fall within an acceptable range, the speed limits themselves may be inappropriate for child-dominated road space, given the challenges that children have regarding perceiving and responding to moving vehicles.

## 1. INTRODUCTION

The safety of child pedestrians in the vicinity of rural schools is a matter of concern in the Cape Winelands' District. Many child pedestrians in rural areas are obliged to walk long distances in order to reach their rurally situated schools. The routes to their schools are not always pedestrian friendly and on higher level roads the speed limit itself can be problematic. While the standard speed limit around urban schools in the Cape Winelands' area is 60km/h, in rural environments these limits vary between 80km/h and 100km/h. As a consequence traffic officials are often asked to enforce speed limits in the vicinity of the schools in order to minimise risk to learners. In many cases, local residents voice fears about the safety of speed limits and particular concerns about the high speeds that they perceive to be a problem. Our first objective in this study was to assess these concerns by determining the speed profile for each area at times of the day when child pedestrians were most likely to be present.

This project was based on a combination of quantitative and qualitative data, including the actual speeds of vehicles in the vicinity of three schools in the Cape Winelands' District, an assessment of drivers perceptions of their own speeds and speeds of other drivers, and observations of child pedestrian behaviour on the three roads, to better understand the challenge of combining vehicles and child pedestrians in these particular environments. These data enabled us to work towards our second objective which was to determine whether the existing speed limits were in fact appropriate for the context.

The overriding concern in this research is the safety of children, and while the focus is on vehicle speed, this is importantly insofar as it has a potential impact on child pedestrian safety. International literature tells us conclusively that speeding vehicles – or indeed any environment when the 90<sup>th</sup> percentile speed is above 30 km/h (Leden, Garder and

Johannson, 2006) - pose serious risks to children's safety. This is because the child is physically more vulnerable to severe injury should an impact occur, but also perceptually and behaviourally, more likely to put themselves into a risky position than adults in a similar context. The enhanced risk comes largely from limited perceptual development, which results in the inability to safely judge speeds and safe crossing distances. This often results in child pedestrians making poor crossing decisions (Connelly, Conaglen, Parsonson & Isler, 1998: 443).

Children are able to distinguish hazards when they are explicitly hazardous, but not when the threat is less explicit. For example, they know that fire itself is dangerous but have trouble determining at what point a fire begins to pose a direct threat to them. The same is arguably true for traffic. In a country where many children utilise road space for recreation, the ability to determine a safe road space from an unsafe one can be a difficult call.

Added to their perceptual limitations are their physical ones. Children are not only less able to evade impact through their own strength and speed but are also challenged by their height – many children believe that because they can see a vehicle clearly, they are equally visible to the driver. The vast majority of child pedestrian crashes are caused by children running into the road from behind objects (parked cars for example). This also illustrates behavioural challenges that children pose to drivers – they can be inattentive, impulsive and unpredictable, and these characteristics can lead to dangerous behaviour and decisions on the road (Tabibi & Pfeffer, 2003).

## DESCRIPTION OF SCHOOLS

Three schools with varying locations and road characteristics were chosen in order to examine the driving behaviours of drivers in the presence of children or schools.

### 2.1 Vlotenburg Primary School

Vlotenburg Primary School is situated in a lower-income rural area adjacent Vlotenburg Road with an 80km/h speed limit. Vlotenburg Road connects Baden Powell Avenue and Polkadraai Road. Both these roads also have speed limits of 80km/h and are higher mobility provincial roads.



Figure 1: Children crossing the busy Polkadraai Rd



**Figure 2: Location, Vlotenberg Primary School**

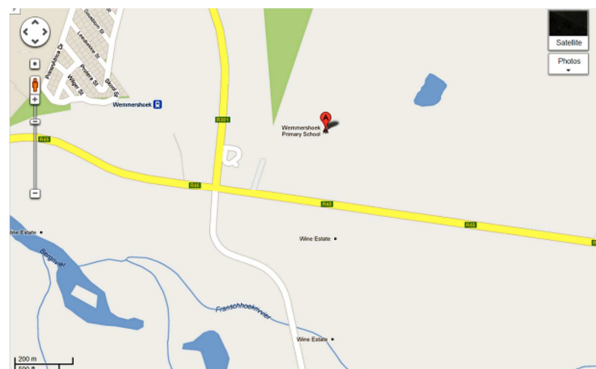
### 2.2 Wemmershoek Primary School

Wemmershoek Primary School is also situated in a lower socioeconomic setting. This school is located on the corner of two main provincial mobility routes, the R301 and the R45, both with speed limits of 100km/h.

All roads approaching the school have the appropriate child pedestrian warning signs and high visibility child pedestrian warning signs are erected on the R45 for both directions of traffic flow approaching the school. A traffic official arrives each morning and afternoon at 07: 25 and 15:45 respectively to assist children in crossing the R301.



**Figure 3: Warning sign on the R45**



**Figure 4: Location, Wemmershoek P.S.**

### 2.3 Eikestad Primary School

Eikestad Primary School represents an urban school situated in a higher socioeconomic setting. This school is accessed via Doornbosch Road which has a 60km/h speed limit. For this school, fewer children walk to school from long distances and the majority tend to be transported to school by car.

Doornbosch Road is home to four schools; two high and two primary schools. It has multiple speed bumps and two pedestrian crossings. The geometry and speed limit of this road allows for the use of a scholar patrol.



Figure 5 Doornbosch Road

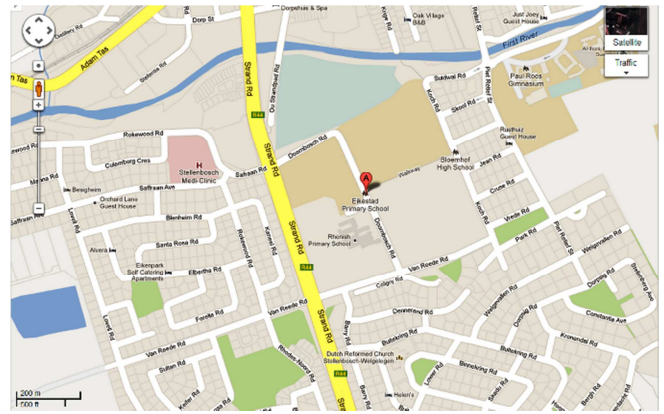


Figure 6: Location, Eikestad P.S.

## 2. SPEED PROFILES

Speed profiles were collected and compared to see whether and in what manner speed distributions differ for certain circumstances. The differing circumstances were: time of day, proximity of pedestrian warning signs, during the school term and during school holidays. Speed monitoring sessions had durations of one hour each.

On each distribution plot below the 85<sup>th</sup> percentiles are indicated.

### 3.1 Time of day effects

Vehicle speeds were measured to determine if a difference exist in their distributions depending on time of day.

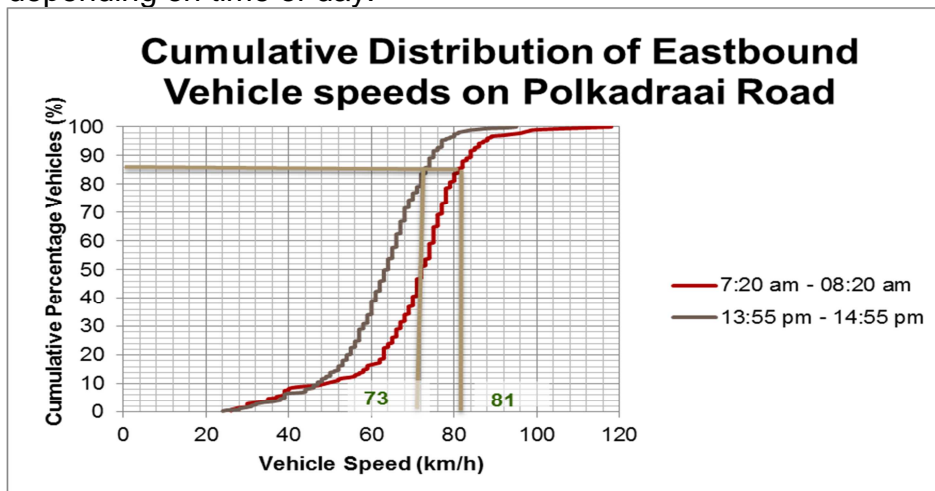
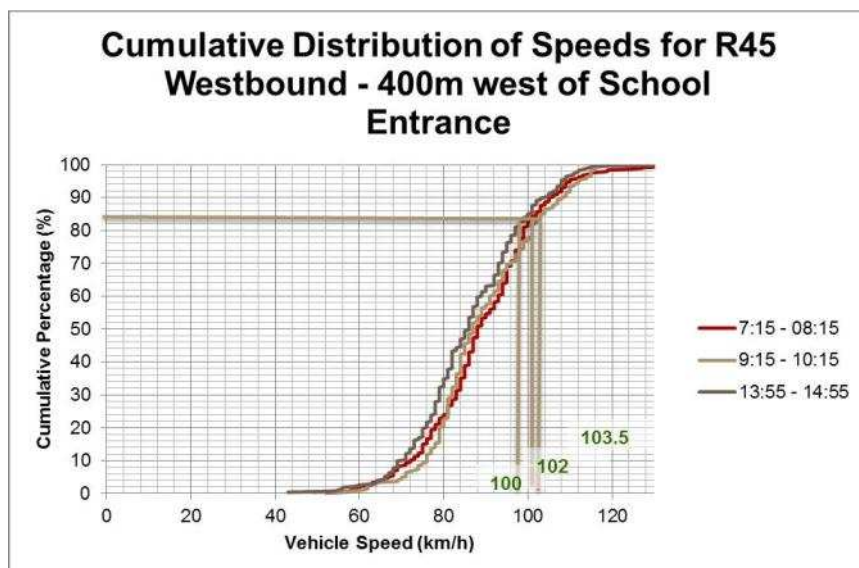


Figure 6: Speed distribution. Polkadraai Rd eastbound

	07:20 - 08:20	14:00 - 15:00
Average Speed (km/h)	65.93	60.5
Standard Deviation (km/h)	10.45	12.21
Traffic Count	810	323
Top Speed (km/h)	97	85

Table 1: Speed summary Polkadraai Rd Eastbound (100km/h limit)

For the Polkadraai Road, speeds were notably higher in the morning, as were traffic volumes. The 85<sup>th</sup> percentile speeds were 81km/h and 73km/h respectively.



**Figure 7: Speed distribution, R45 westbound.**

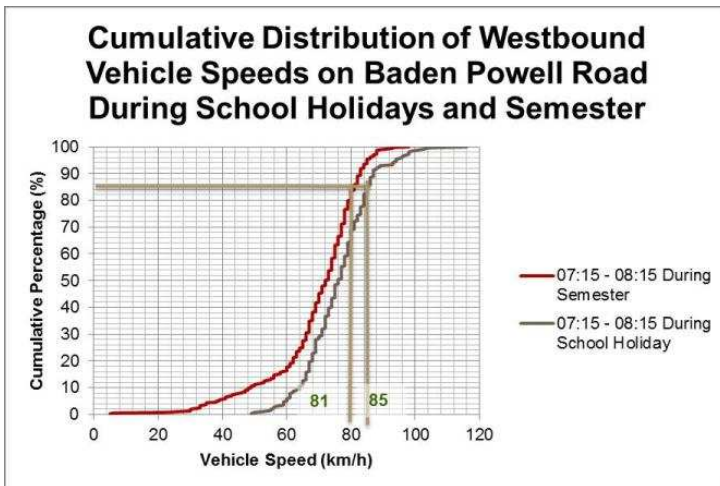
	07:20 - 08:20	09:15 -10:15	14:00 - 15:00
Average Speed (km/h)	89.27	89.43	86.31
Standard Deviation (km/h)	13.81	12.82	13.26
Traffic Count	368	273	270
Top Speed (km/h)	162	121	140

**Table 2: Speed summary R45 Westbound (100km/h limit)**

For higher volume roads, such as the R45 past Wemmershoek Primary School, the distribution for the different times of day stayed fairly constant. The 85<sup>th</sup> percentile speeds exceeded the speed limit of 100km/h for all three times recorded. Thus for all the times monitored, 15% of the drivers exceeded speeds of 100km/h.

### 3.2 School Holiday Effects

The presence of children on these roads over the school holidays period is negligible. This is a notable change for commuters accustomed to seeing child pedestrians during term time. In the study we retained the same survey times and intervals so as to determine the effect that the lack of child pedestrians might have on traffic speeds. As such speeds were recorded between 07:15am and 08:15 am as well as 14:00pm and 15:00pm.

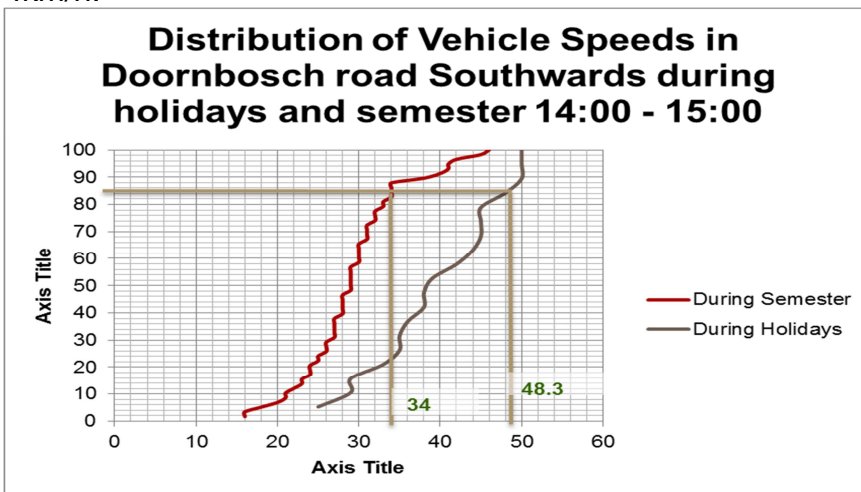


**Figure 8: Speed distribution, Baden Powell Rd, westbound**

	Mid-semester	Holidays
Average Speed (km/h)	69.15	76.10
Standard Deviation (km/h)	13.98	10.16
Traffic Count	367	254
Top Speed (km/h)	98	116

**Table 3: Speed summary Baden Powell Rd Westbound (80km/h limit)**

The average speed recorded between 07:15am and 08:15am increased by 6.95km/h during the school holiday period. In addition, the 85<sup>th</sup> percentile speeds increased by 4km/h.



**Figure 9: Speed distribution, Doornbosch Rd southbound**

**Doornbosch Road Southbound Vehicles (14:00pm - 15:00pm) - 60km/h Speed limit**

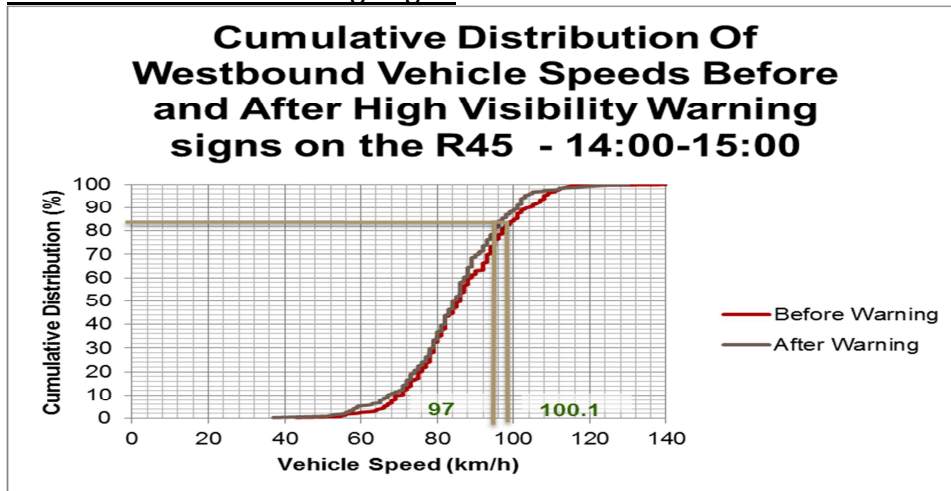
	Mid-semester	Holidays
Average Speed (km/h)	29.21	39.79
Standard Deviation (km/h)	6.39	7.63
Traffic Count	58	19
Top Speed (km/h)	46	50

**Table 4: Speed summary Doornbosch Rd Southbound (60km/h limit)**

Doornbosch road carries largely school-related traffic and during the school holidays there is almost no passing traffic to speak of. This made it impossible to collect sufficient data to enable the plotting of an accurate curve. The maximum speed recorded during the holiday was 50km/h, recorded in the absence of traffic or child pedestrians. This contrasts only

slightly with a term-time maximum speed of 46km/h. The holiday speed-profile clearly demonstrates the effectiveness of the speed bumps in Doornbosch road as no other interference affected the speeds of the drivers.

### 3.3 The effect of Warning Signs



**Figure 10: Speed distribution, R45 before and after warning signs**

R45 Westbound Vehicles (14:00pm - 15:00pm) - 100km/h Speed limit

	Before Warning	After Warning
Average Speed (km/h)	86.31	84.28
Standard Deviation (km/h)	13.26	13.26
Traffic Count	273.00	315.00
Top Speed (km/h)	140	130

**Table 5: Speed summary R45 (100km/h limit)**

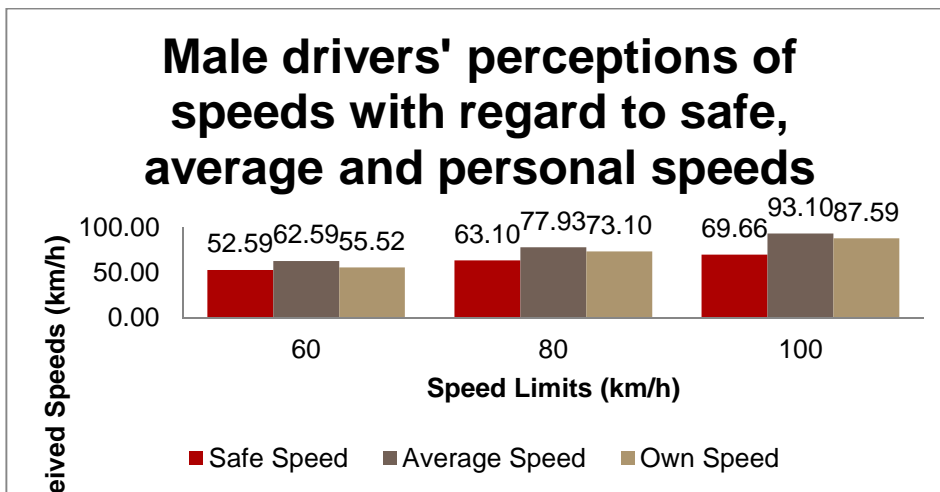
It can be seen that a decrease of 85<sup>th</sup> percentile as well as the average speeds occur after the pedestrian warning signs have been seen. These changes in speed are, however, very small. After the signs have been seen, the average speeds were still 84.28km/h. From the cumulative distribution plots it is apparent that high visibility child pedestrian warning signs appear to have little immediate or measurable effect on drivers' speeds. They may, however, improve drivers' awareness of the environment. This may not necessarily affect their speeds.

### 3. QUALITATIVE DATA

#### 3.1. Speed perception questionnaires

Driver-focused research has proven repeatedly that many drivers have a biased self-enhancement of their own driving skills. There is a trend amongst drivers to believe that they are slower, safer and more skilled than the average driver (Horswill, 2004). This pattern of belief is relevant in that it generates a false sense of safety among many drivers; not only believing that they are less vulnerable than they are, but also in underestimating the potential consequences of their driving on other road users. In this study we were interested to see whether the findings from international research were relevant in the local context. Questionnaires were developed to determine whether drivers overestimate their own speeds and driving abilities as well as to determine what they perceive to be safe speeds in the vicinities of schools to be. Twenty-nine male and 33 female drivers participated in this component of the study.

The drivers were asked their perceived speeds while driving past schools in different speed limit zones. They were asked what other 'average' drivers were doing, and also what they personally felt a 'safe' and appropriate speed to be near a school.



**Figure 11: Male drivers' responses**

Because of space constraints this report focuses only on results from male respondents. Female responses were, in fact, extremely similar to those of men.

It can be seen that for all the speed limits, men perceive safe speeds in the vicinity of schools lower than they believe their own speed to be in the vicinity of schools. They believed that hypothetical 'average' drivers exceeded both their own speeds and that of safe speeds. The same effect was seen among the female respondents. This suggests that the majority of drivers in the ample believed that their own driving and speed compliance was safer than other drivers.

Some other interesting results from the (male) surveys included:

- 28% described their driving reactions to be 'very good'.
- 55% described their driving reactions to be 'good'.
- 17% described their driving reactions to be 'average'.
- 0% described their driving reactions to be 'below average'.
- 93% said they would always decelerate when they saw a child pedestrian.
- 72% said they would decelerate upon seeing a pedestrian warning sign#17% said that a pedestrian warning sign would have no effect on their speeds.

### 3.2 Observed pedestrian behaviour

Between August 2012 and October 2012 observations of the behaviour of child and adult pedestrians on the selected roads were carried out.

Child pedestrians were observed playing on the sidewalk and the street, running in the street, pushing each other into the street, pretending to push other children in front of oncoming traffic, crossing without due care, walking on the road in the absence of formal pavements and walking in groups with other children in such a way that children were forced onto the carriageway.

Adult pedestrians in many cases avoided the use of the constructed walkways that had been provided, and crossing the road with children at locations that had not been designated formal crossings. In some cases adults encouraged children to cross the road from between parked cars.

The observed behaviour of child and adult pedestrians suggests that there is a very low level of vigilance by both groups. In particular the actions of the adults serve as poor examples for the children. In all three environments, observations clearly identified multiple opportunities for contact between children and vehicles.



## 4. DISCUSSION

This research, and many others, has highlighted some of the dangers associated with children on busy or fast-moving roads. Children are physically and perceptually unable to make appropriate decisions or display appropriate behaviour, and their behaviour itself is unpredictable and can be erratic. In light of the knowledge that children are not well suited to walking along these roads, it is necessary to question the appropriateness of the speed limits of the roads along which they are forced to walk.

In the 1987 and 1994 Reports commissioned by the UK Department for Transport, the probabilities of pedestrian fatalities for different speeds were calculated. These probabilities are tabulated as follows.

Vehicle speed	Probability of pedestrian fatality (1)	Probability of pedestrian fatality (2)
32 km/h	5%	5%
48 km/h	45%	37%
64 km/h	85%	83%

Source 1: UK Dept Transport, 1987: *Killing Speeds and Saving Lives*

Source 2: UK Dept. Transport 1994: *Killing Speeds and the Incidence of Fatal Pedestrian Collisions.*

**Table 6: Relationship between vehicle speed and the probability of a fatal pedestrian injury**

The fatality probabilities outlined in Table 6 above are not established specifically for adults or children, given the enhanced fragility of the child's body we can only assume that these may be higher for child pedestrians.

This table provides a very simple but useful way of contextualising the significance of the speeds that had been recorded at the three school locations. In Polkadraai Road, the 85<sup>th</sup> percentile speed had been recorded as 81km/h for the morning peak and 73 km/h for the afternoon period. Even though these speeds as well as the average speed of 65.93km/h are significantly lower than the prescribed speed limit of 100km/h, the probability of a pedestrian fatality with a collision is still in the range of 80%.

On the R45 past Wemmershoek primary school the 85<sup>th</sup> percentile speeds exceeded the speed limit of 100km/h for all three periods recorded. Thus for all the times monitored, 15% of the drivers exceed speeds of 100km/h. At a collision speed of 100km/h, pedestrian fatality is a certainty.

The safest location for pedestrians is obviously Doornbosch Road.. Here, during the school term, a maximum speed of 46km/h was recorded. According to the fatality probability distributions, the probability of pedestrian fatality when colliding with a vehicle of 48km/h is 37%. For the average speed of 29.21km/h during the semester, a fatality probability of less than 5% would be expected.

## 5. CONCLUSION AND RECOMMENDATIONS

Safety around schools has been a matter of much concern over the years. Children in rural areas who are required to walk to and from school are at the most risk as they are often expected to cross high volume roads.

The main focus of this research was to determine the perceptions and actions of drivers and child pedestrians with regards to speeds in the vicinity of schools.

The drivers' perceptions of their own driving skills as well as perceptions of safe driving speeds were evaluated. Their self-reported behaviour for different circumstances was

determined with the use of questionnaires. It was determined that drivers tend to overestimate their driving skills in comparison with the average driver as well as underestimate their safety while driving in comparison with their perceptions of safe speeds.

The presence of pedestrian warning signs and of child pedestrians themselves appeared to have little impact on traffic speeds. This was in spite of the qualitative surveys where almost every person surveyed claimed that they would slow down in the presence of child pedestrians. What did appear to work as a notable impact on speeds, however, was the presence of traffic officials.

As seen from the noted average traffic speeds, the current average speeds, although not always higher than the posted speed limits, pose potential threats to pedestrians with regards to fatality probability. In the case of rural schools, in spite of the fact that the speeds measured were significantly lower than the 60km/h speed limit, this limit would also have a pedestrian fatality probability of just below 83% at collision.

From the data gathered, it is recommended that traffic officials remain stationed at rural schools as their presence and visibility around lower volume roads indicated a significant decrease in vehicle speeds.

As high visibility warning signs are not an effective measure for reducing speeds, it is proposed that more research be done on how speeds in the vicinity of particularly rural schools can be reduced or regulated.

Lowering speed limits without additional interventions will not necessarily result in lower drivers' speeds. Thus, other measures need to be taken to promote lower speeds in the vicinities of schools. At urban schools it is recommended that speed bumps are used, as their presence indicates very low vehicle speeds as a result.

Children should be encouraged or obliged by parents or teachers to wear high visibility reflective bands and perform safety measures for ensuring their own safety when crossing the road.

Drivers must be educated so that they are aware of the resulting injuries that collisions of vehicles approaching even at lower speeds can have on child pedestrians.