Non-natural deaths in the Republic of South Africa with specific reference to road deaths

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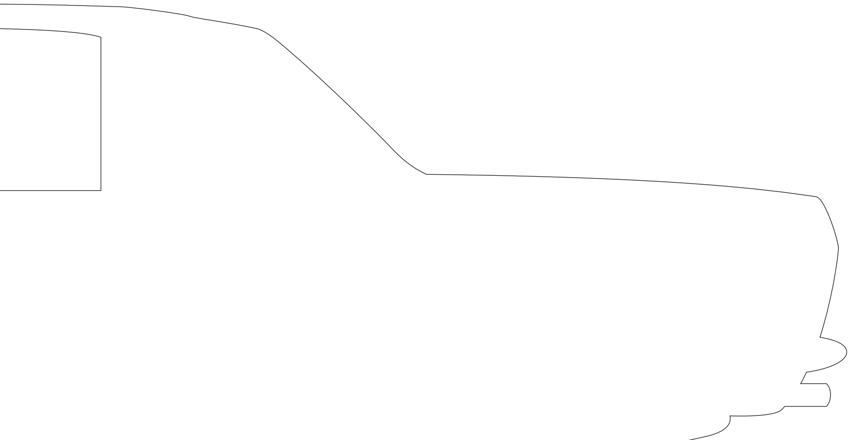
Prof Johann M Schepers
Department of Human Resource Management
University of Johannesburg



It is estimated that about 60 000 non-natural deaths occurred in the Republic of South Africa during 2004. These deaths were caused by murder and homicide (23 513), suicide (6 727) and unintentional accidents (23 812). The latter also includes road deaths. The cause of 5 793 deaths could not be determined[1]). There were 12 636 road deaths during the same period[2]).

The above figures form a frightening picture of South Africa, and the question can rightly be asked: What can be done to improve this situation? One of the areas in which we can all contribute is road safety.

Road accidents have claimed more than 400 000 lives since 1950. In fact, more than 100 000 people have been killed on our roads in the past nine years[2]). This situation can no longer be tolerated. Apart from the loss of life, our country cannot afford the cost of fatal accidents. The estimated cost of fatal accidents in 2005 was R9,99 billion. The cost for December 2005 alone was R1,05 billion[2]).

Fatal accidents affect us all. In 2004 there were 10 471 fatal road accidents involving 13 325 motor vehicles. During 2004 7 211 276 licences were issued. The chance that a driver of a motor vehicle might be involved in a fatal road accident in a *single year* is therefore 1:541.

Purpose of the study

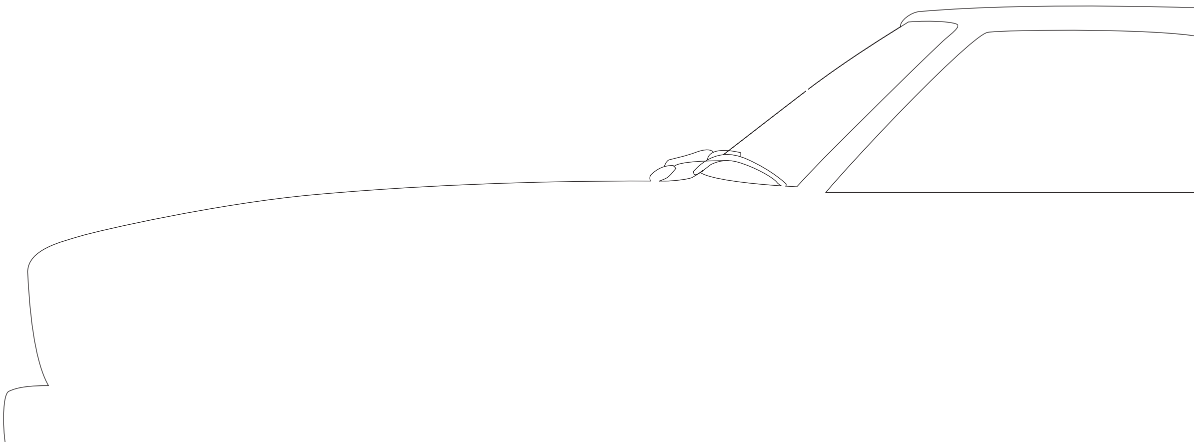
The study had three objectives:

» to indicate the influence of reduced speed limits on road deaths
» to indicate the role of speed in *serious* accidents, i.e. to illustrate the effect of kinetic energy, and
» to try and determine safer following distances

To understand what role speed plays in road accidents, it is necessary to first consider the process of information processing.

Information processing

All information from the outside reaches us via our senses. The incoming information must be processed as quickly and effectively as possible, and suitable decisions must be made, based on this information. To perform this function properly,



we humans depend on our senses and higher intellectual abilities. Depending on the nature of the information, *affective components* may also be present.

Some people appear to be able to do more than one thing at a time, whereas others have to focus on one thing to be able to do it well. In reality, no one is able to perform two tasks absolutely simultaneously. What happens is that the two tasks alternate so quickly that it seems as if they are taking place simultaneously. Whatever the case may be, performing two tasks almost simultaneously requires a high rate of information processing by the operator.

In practice, the fastest worker (regardless of the nature of the work) is about 400% faster than the slowest worker. In handling a motor vehicle or aircraft, there are major individual differences in the rate at which incoming information is processed. Some drivers can drive through heavy traffic and still conduct a complicated argument with one of the passengers, whereas others never even venture out into heavy traffic.

Rate of information processing

Space constraints do not allow an in-depth discussion of the topic here. Readers who would like more information on this can refer to Schepers (2002).

According to Hick (1952), there is a *linear relationship* between reaction time and quantity of information, measured in binary digits (bits). This should clearly indicate that the rate at which decisions are made is a direct function of the complexity of the information to be processed. The shorter the reaction time, the more decisions can be made per unit of time.

It has been empirically established that people can process about three bits of information per second without making a mistake (Cumming, 1964). If they have to process information at a higher rate, they start making mistakes. The mistakes they make are either in the form of information that is "lost" or information that is deliberately rejected. As the demand increases, they are forced to reject certain information because they can no longer handle the work load. If they are particularly experienced, or have a higher skill level, they are very *selective* in the information they reject.

Cohn, Carlson and Jensen (1985) made a comparative study of 70 above-average Grade 7 learners and 60 academically highly gifted learners. The average age of the above-average group was 13,17 years and that of the highly gifted group was 13,5 years. There was no statistically significant difference between the two groups in terms of average age. The highly gifted group represented the upper 2-3% of the public school population regarding academic aptitude, and did well in university courses in Maths and Science. The above-average group was not selected for academic aptitude, but came from a junior high school in a white middle to upper class environment.

Raven's Standard Progressive Matrices and nine different reaction time tasks were applied to all the learners. The reaction time tasks measure how quickly people can perform various elementary cognitive processes. The regression of the reaction time tasks on Raven's Standard Progressive Matrices was calculated and yielded a multiple correlation of 0,60 ($p < 0,01$) for the highly gifted group and 0,50 ($p < 0,01$) for the above-average group. These correlations are in reality much higher if restriction of range is considered.

Another interesting finding of Cohn et al. (1985) was that they could correctly classify 91,7% of the highly gifted group and 76,4% of the above-average group with the aid of discriminant analysis by using only eight of the reaction time tasks. The highly gifted and above-average groups differed by an average of 1,3σ on the different reaction time measurements and 1,9σ on the measurement of psychometric intelligence. It therefore appears that regardless of higher intellectual ability, the highly gifted group was also able to process information at a much faster rate than the above-average group.

To examine the importance of information processing in flying, Barkhuizen, Schepers and Coetzee (2002) applied the Computerised Information Processing Test Battery of Schepers (2002) to 58 military and commercial pilots and 20 non-pilots. The pilots and non-pilots were of comparable age and educational status.

With the aid of discriminant analysis, 93,1% of the pilots and 90,0% of the non-pilots could be correctly classified by using only four of the information processing measures.

In view of the above findings, the question that could involuntarily be asked is: Would there be similar differences if accident-prone drivers were compared with accident-free drivers?

Reserve capacity

Reserve capacity can be *defined* as the *difference* between the maximum rate of information processing (bits per second) of persons, and the demand a task places on them (bits per second). If the difference is positive, it means that they have considerable reserve capacity in which to perform tasks if necessary. If the difference is negative, it means that the workload is greater than the persons' capacity. They will therefore have to reject certain information to be able to perform the task at all. If persons have a large reserve capacity, they can be expected to perform the task easily and to experience it as less stressful (Brown, 1966).

Tension and alertness

There is an inverse U-shaped relationship between tension and alertness. If a task can be carried out with little or no tension, the alertness of the person is fairly low. Alertness increases as the tension in the person increases, but only within certain limits. Optimal alertness is reached at a particular tension level. Thereafter, it decreases consistently because the *excess tension immobilises* the person.

The less the reserve capacity of the person, the more tension-filled the task is for him/her. Excess tension leads to fatigue and at the same time reduces the person's capacity to process information effectively. It therefore forms a type of vicious circle (Brown, 1966).

As information processing is also a function of *time*, drivers have to adjust their load by regulating their speed accordingly.

Flow of information

The flow of information in traffic varies mainly as a function of traffic density, points of choice on the road, view and the speed at which a person is travelling.

In daylight, drivers can see long ahead of time whether the road curves; they know that the intersection ahead must join the main road at some stage; they expect a bridge in the vicinity of the stream they see and are aware that the cattle grazing along the road could walk out in front of them at any time. The fact that this information reaches drivers ahead of time enables them to make the right decisions.

At night time, their view is extremely limited. For long periods they do not get any new information and then again too much to process it in time and make appropriate decisions.

The amount of information that reaches drivers increases as a function of the speed at which they are travelling. At a high speed they may receive more information than what they can process meaningfully. The first reaction of the drivers is then to reject the information that is not absolutely essential. However, essential information could quickly be "lost" and drivers could get into trouble. It would be sensible of them to adjust their speed so that they still have enough time to process all important information. This implies a slower speed during the night than in the day.

From the above it should be evident that the amount of information (in bits per second) that reaches drivers increases as a function of the *speed* at which they are travelling. If the load exceeds their capacity, they will start making mistakes, which could lead directly to accidents.

The following example could serve to illustrate the above principle in practical terms:

A driver drives at 20 km/h through city traffic. He is alert and notices that an elderly man is crossing the street. He sees a child that has just got off a bus moving in front of the bus to run across the street. He notices that a woman is moving out of a parking bay without considering the oncoming traffic. He sees a lapdog running bewilderedly in the middle of the road.

How much of this information would reach him in time if he is driving 50 km/h or talking on his *cellphone*?

Legislation on cellphones is somewhat distorted. The emphasis is on holding the cellphone to your ear with your *hand*, whereas the crux of the matter is actually about processing information coming from the cellphone.

Business transactions are concluded via cellphone, interpersonal conflict in the workplace is resolved via cellphone, household arguments and crises are discussed over the cellphone and messages of illness and death are conveyed by cellphone. Holding a cellphone to your ear in your hand is analogous to holding an apple to your mouth in your hand. In itself it is not recommended, but it cannot be compared to having a conversation on a cellphone.

From the above it should be clear that the issue of cellphones in cars deserves further research.

Speed and road deaths

The number of road deaths, vehicles and distances travelled during 1950 - 2005 are given in Table 1. This information was obtained from the Road Traffic Management Corporation and is the basis of all the comparisons made.

[See Table 1 on page 31]

Table 1 shows that there was a consistent *rise* in road deaths from 1950 to 2005; in fact the road death toll was 14,8 times higher in 2005 than in 1950. Similarly, the number of motor vehicles in 2005 was 12,6 times more than in 1950.

The number of road deaths for 1950 to 2005 is illustrated in Figure 1.

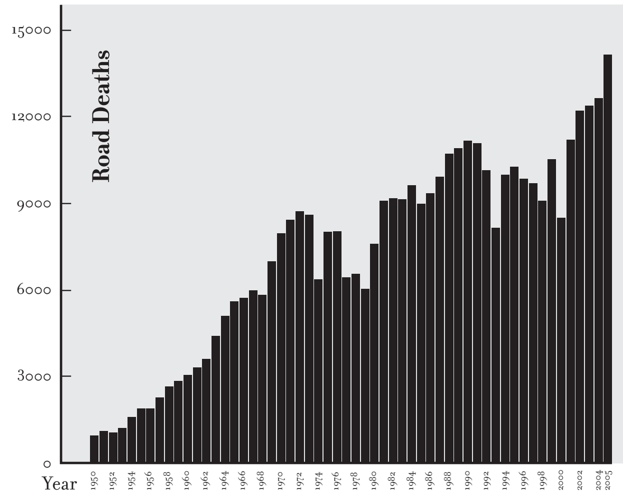


Figure 1: Road deaths in the RSA: 1950-2005

Figure 1 shows that there was a significant decrease in road deaths in 1974, 1977, 1978, 1979 and 1980. This decrease is directly related to the speed limits that applied at the time.

From 1950 to 1966 there were no speed limits on our national and provincial roads, but there were limits in urban areas. The normal speed limit in urban areas was 35 miles per hour (56 km/h). From 1967 to 1970 the general speed limit on highways and provincial roads was 113 km/h, and from 1971 to 1973 it was 120 km/h, with 60 km/h being the limit in urban areas. With the *energy crisis*, the speed limit on peri-urban roads was reduced to 80 km/h and to 50 km/h in urban areas at the end of 1973. However, the urban speed limit was raised again to 60 km/h in early 1974. From 1975 to 1980 the rural and urban speed limits were 90 and 60 km/h, respectively. In 1979 the speed limit on certain metropolitan peri-urban roads was 70 km/h for a brief period, after which it was raised to 90 km/h again. On 1 April 1981 the speed limit on peri-urban highways and national roads was raised to 100 km/h. Later this was extended to the rest of the rural road network. On 1 August 1984 the speed limit on rural highways was raised from 100 to 120 km/h, and in 1985 this was further extended to certain non-highways.

There were also two definite decreases in road deaths in 1992 and 2000, but these were not associated with lower speed limits.

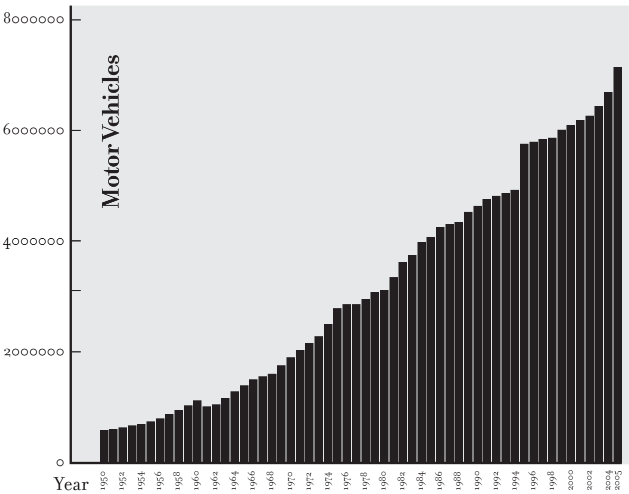


Figure 2: Motor vehicles population of the RSA: 1950-2005

Table 1: Number of road deaths, motor vehicle population and distances travelled by motor vehicles in South Africa

Year	Road Deaths	Motor Vehicles	Distance million km*	Deaths per 10,000 vehicles*	Deaths per 100 mvk**
1950	952	564,864	10,842.40	16.85	8.78
1951	1,116	587,519	12,604.79	19.00	8.85
1952	1,065	611,427	13,212.45	17.42	8.06
1953	1,195	645,700	14,057.83	18.51	8.50
1954	1,596	670,919	15,385.52	23.79	10.37
1955	1,876	718,535	17,288.37	26.11	10.85
1956	1,896	772,558	18,620.23	24.54	10.18
1957	2,260	853,604	19,246.76	26.48	11.74
1958	2,633	931,438	20,353.70	28.27	12.94
1959	2,842	1,006,713	20,461.77	28.23	13.89
1960	3,051	1,097,756	21,184.50	27.79	14.40
1961	3,306	982,599	25,830.12	33.65	12.80
1962	3,591	1,031,035	27,387.85	34.83	13.11
1963	4,394	1,143,472	28,429.21	38.43	15.46
1964	5,104	1,255,910	32,166.26	40.64	15.87
1965	5,602	1,368,347	36,537.30	40.94	15.33
1966	5,728	1,480,785	39,496.39	38.68	14.50
1967	5,975	1,529,110	44,636.79	39.08	13.39
1968	5,810	1,577,434	51,292.94	36.83	11.33
1969	6,987	1,730,269	55,714.90	40.38	12.54
1970	7,948	1,883,104	67,818.11	42.21	11.72
1971	8,417	2,011,024	71,496.04	41.85	11.77
1972	8,713	2,138,944	78,205.99	40.74	11.14
1973	8,580	2,248,348	90,730.46	38.16	9.46
1974	6,346	2,473,584	79,663.90	25.66	7.97
1975	8,001	2,768,781	85,110.85	28.90	9.40
1976	8,030	2,842,302	87,682.70	28.25	9.16
1977	6,420	2,844,176	85,129.76	22.57	7.54
1978	6,550	2,943,154	90,669.11	22.26	7.22
1978	6,550	2,943,154	90,669.11	22.26	7.22
1979	6,037	3,069,432	71,247.35	19.67	8.47
1980	7,572	3,102,437	74,887.15	24.41	10.11
1981	9,087	3,319,453	83,939.17	27.37	10.83
1982	9,154	3,600,560	75,783.91	25.42	12.08
1983	9,121	3,732,021	74,687.60	24.44	12.21
1984	9,621	3,968,228	81,798.26	24.25	11.76
1985	8,972	4,056,558	75,202.25	22.12	11.93
1986	9,343	4,228,523	71,033.79	22.10	13.15
1987	9,905	4,285,333	80,727.05	23.11	12.27
1988	10,691	4,317,082	99,736.69	24.76	10.72
1989	10,877	4,511,088	99,308.67	24.11	10.95
1990	11,157	4,616,398	94,091.57	24.17	11.86
1991	11,069	4,727,007	95,908.38	23.42	11.54
1992	10,142	4,786,079	97,676.87	21.19	10.38
1993	8,140	4,845,151	97,866.18	16.80	8.32
1994	9,981	4,904,223	102,256.04	20.35	9.76
1995	10,256	5,733,497	109,240.69	17.89	9.39
1996	9,848	5,776,424	113,376.26	17.05	8.69
1997	9,691	5,819,351	115,017.25	16.65	8.43
1998	9,068	5,850,566	117,025.48	15.50	7.75
1999	10,523	5,992,057	116,911.36	17.56	9.00
2000	8,494	6,074,201	111,937.67	13.98	7.59
2001	11,201	6,159,679	112,549.71	18.18	9.95
2002	12,198	6,245,392	113,494.15	19.53	10.75
2003	12,353	6,417,484	117,874.80	19.25	10.48
2004	12,636	6,677,239	121,666.18	18.92	10.39
2005	14,126	7,128,790	124,645.68	19.82	11.33

* = motor vehicles / ** = million vehicle kilometres

The number of registered vehicles for the period 1950 to 2005 is shown in Figure 2. [See Figure 2 on page 30]

Figure 2 clearly shows that there was a consistent *increase* in the number of motor vehicles from 1950 to 2005. This includes *motorised* vehicles only. However, what is alarming is that in December 2005, there were 595 135 unroadworthy and unlicensed vehicles on the roads.

To test the hypothesis that there is a strong relationship between the number of road deaths (Y) and the number of motor vehicles (X), the regression of number of road deaths on number of motor vehicles was calculated. The following formula was used:

$$\hat{Y} = r_{xy} \frac{S_y}{S_x} (X_i - \overline{X}) + \overline{Y},$$

where $\hat{Y}$ = estimated number of road deaths

r_{xy} = correlation between variables X and Y

$\overline{X}$ = average number of motor vehicles

$\overline{Y}$ = average number of road deaths

S_x = standard deviation of X

S_y = standard deviation of Y

Two regression lines were used: The first for the period 1950 to 1973 and the second for the period 1981 to 2005. The regression equation for the first period is $\hat{Y}$ = 0,00499X_i - 1802,683 and $\hat{Y}$ = 0,00082 X_i + 6126,979 for the second. The regression lines are illustrated in Figure 3.

Figure 3 shows that there is a strong relationship between the number of road deaths and the number of motor vehicles on our roads for the period 1950 to 1973. The correlation obtained is 0,991 (p < 0,001) and it explains 98,1% of the *variance* of road deaths. However, it is noticeable that the points for 1974 to 1980 broke away from the regression line completely. If 1973 is taken as baseline, 11 104 lives were saved during the period 1974 to 1980. After 1981, the speed limit was again systematically increased, first to 100 km/h and from 1 August 1984 to 120 km/h.

The correlation between road deaths and the number of vehicles for the period 1981 to 2005 is considerably lower,

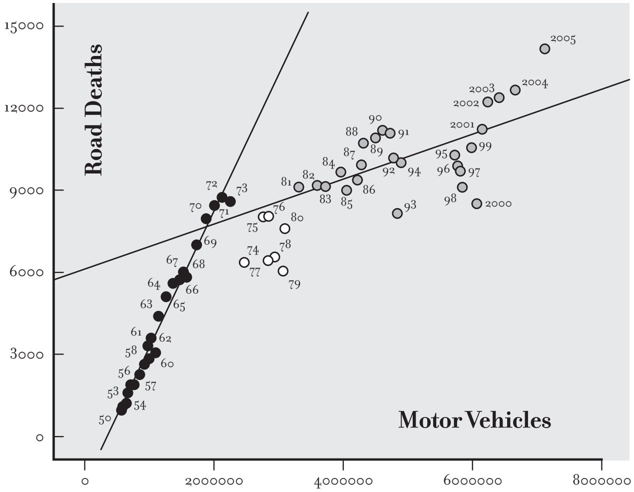


Figure 3: Regression of number of road deaths on number of motor vehicles

namely 0,613 (p = 0,001). It explains only 34,8% of the variance of road deaths in the second period. The stated hypothesis is therefore largely supported. However, it is not very clear why the correlation for the second period is so much lower. A possible explanation may be that our current road systems are not able to carry the increase in traffic. It may also be that many drivers now far exceed the set speed limits. The number of people wearing seat belts has also reached a low. Urgent research on all these aspects will have to be conducted.

The *types of vehicles* involved in road accidents may also have changed considerably over the years. In December 2005 there were 1 462 fatal road accidents. Of this number 647 were cars, 86 minibuses, 75 minibus taxis, 33 buses, 36 motorcycles, 260 light delivery vans and 111 trucks.

If we compare the road deaths in South Africa with those in the USA, there is a noticeable difference. The number of road deaths in the USA for the period 1950 to 1991 is illustrated in Figure 4.

According to figure 4, the number of road deaths in the USA in 1991 was essentially the same as in 1950 – a remarkable achievement indeed. In addition to good roads and good law enforcement, lower speed limits (55 mph) contributed to this.

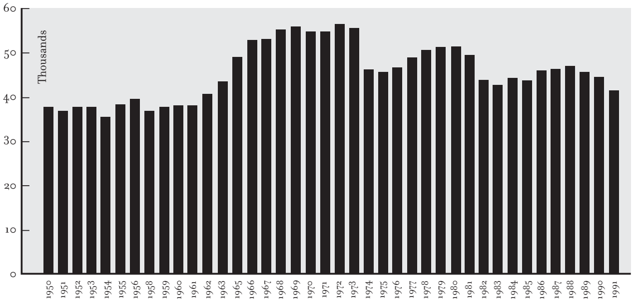


Figure 4: Road deaths in the USA: 1950-1991

From a report on speed and road deaths by Danny Hakin of the *New York Times* (2001), it appears that there is a close link between speed and road deaths. He states that the consensus of opinion of road safety researchers is that increasing the speed limits is harmful. He quotes Leonard Evans, a safety researcher at General Motors: "Speed is central to safety. The largest yearly traffic fatality decline ever recorded in peacetime in the US was in 1974, the first year of the nationwide 55 mph speed limit."

Evans acknowledges that other factors were also involved, but that "a major portion of the 16 percent decline, from 54 052 in 1973 to 45 196 in 1974, is related directly or indirectly to the speed limit change".[3])

This clearly shows that it is actually possible to stop the upward trend of road deaths if the right measures are taken and carried out consistently.

Kinetic energy

If there are many accidents involving pedestrians, cyclists and motorcyclists, the number of deaths would be expected to be high, even at relatively low speeds because these people are unprotected.

According to a report of the Slower Speeds Initiative of the United Kingdom (March 1998), a pedestrian has the following chances of survival if he/she is hit by a car:

» At 40 mph (64,3 km/h) the chance of survival is only 15%; at 30 mph (48,3 km/h) it is 55% and at 20 mph (32,2 km/h) it is 95%.[2])

In December 2005 pedestrians were involved in 50,01% of all road accidents. About 42,55% of all the people who died during this period were pedestrians.[2]) They were therefore killed by motor vehicles travelling at a high speed.

The extent of damage to motor vehicles involved in collisions is a direct function of the speed at which they have collided. In fact, the amount of *kinetic energy* generated increases with the square of the velocity at which the motor vehicle is travelling.

Kinetic energy can be calculated by using the following formula:

$E = \frac{1}{2}mv^2$, where

m = mass (kg), and

v = velocity (m/s)

For head-on collisions, the two sources of kinetic energy combine and the extent of damage is that much greater.

Seat belts and airbags

The severity of injuries in road collisions can be reduced considerably if the occupants of the motor vehicle wear their seat belts. Airbags in motor vehicles can also help to prevent serious injury. However, the number of people that wear seat belts leaves much to be desired. The following information was obtained during *roadblocks* in 2005:

» 17,2% of drivers did not wear their seat belts
» 35,7% of front-seat passengers did not wear their seat belts
» 97,3% of rear-seat passengers did not wear their seat belts

However, it appears from unobtrusive surveys that as many as 42% of drivers do not wear their safety belts.[2])

Braking and stopping distances

To prevent pile-ups, drivers must know exactly what the braking distance of their motor vehicles are for different velocities if they want to stop immediately. It would be useful to calculate the braking and stopping distances of light motor vehicles for different velocities.

If, for theoretical reasons, we were to postulate that the brakes of the motor vehicle are perfect, then the braking distance is determined by the *friction* of the tyres on the road surface. A friction coefficient of about -0,8 can be obtained with good tyres on a good tarred surface, under fine weather conditions. If the road surface is wet, this coefficient will decrease to about -0,5.

Using this information as the point of departure, the braking distance for both fine and rainy weather conditions can be calculated using the formula below:

$$v^2 = u^2 + 2\mu g s,$$

where v = end velocity (m/s)

u = terminal velocity (m/s)

μ = friction coefficient (negative)

g = gravitational acceleration (9,81 m/s)

s = braking distance in metres

If $v = 0$, then

$$s = \frac{u^2}{2\mu g}$$

$$s = \frac{u^2}{15{,}696}$$

Braking and stopping distances for different velocities during fine weather conditions are given in Table 2.

Table 2: Braking and stopping distances as a function of velocity (fine weather)

Velocity km/h	Velocity m/s	Breaking Distance (m)	Stopping Distance (m)	Following Time (s)
50 km/h	13,8889 m/s	12,290 m	26,179 m	1,88 s
60 km/h	16,6667 m/s	17,697 m	34,364 m	2,06 s
70 km/h	19,4444 m/s	24,088 m	43,533 m	2,24 s
80 km/h	22,2222 m/s	31,462 m	53,684 m	2,42 s
90 km/h	25,0000 m/s	39,819 m	64,819 m	2,59 s
100 km/h	27,7778 m/s	49,159 m	76,937 m	2,77 s
110 km/h	30,5556 m/s	59,483 m	90,038 m	2,95 s
120 km/h	33,3333 m/s	70,789 m	104,123 m	3,12 s
130 km/h	36,1111 m/s	83,079 m	119,190 m	3,30 s
140 km/h	38,8889 m/s	96,352 m	135,241 m	3,48 s

$$v^2 = u^2 + 2\mu g s,$$

$$= u^2 + 2(-0{,}8 \times 9{,}81)s$$

$$\therefore s = \frac{u^2}{15{,}696} \quad (v^2 = 0)$$

where v = terminal velocity (m/s)

u = initial velocity (m/s)

g = gravitational acceleration (9,81 m/s)

s = distance in metres

μ = friction coefficient (-0,8)

From Table 2, columns 2 and 3 are added together for the *stopping distance*. Column 2 represents the distance that the vehicle travels in *one second* at the particular velocity at which it is being driven. The underlying assumption here is that it takes an average of one second to decide to make a *crash stop*. If the driver is driving at 60 km/h, the stopping *distance* is therefore (16,6667 + 17,6974) m or 34,364 m. At 110 km/h it is about 90 m and at 120 km/h it is 104 m.

Braking and stopping distances for different velocities during rainy weather are given in Table 3.

Table 3: Braking and stopping times as a function of velocity (rainy weather)

Velocity km/h	Velocity m/s	Breaking Distance (m)	Stopping Distance (m)	Following Time (s)
50 km/h	13,8889 m/s	19,664 m	33,553 m	2,42 s
60 km/h	16,6667 m/s	28,316 m	44,983 m	2,70 s
70 km/h	19,4444 m/s	38,541 m	57,985 m	2,98 s
80 km/h	22,2222 m/s	50,339 m	72,561 m	3,27 s
90 km/h	25,0000 m/s	63,711 m	88,711 m	3,55 s
100 km/h	27,7778 m/s	78,655 m	106,433 m	3,83 s
110 km/h	30,5556 m/s	95,173 m	125,728 m	4,11 s
120 km/h	33,3333 m/s	113,263 m	146,596 m	4,40 s
130 km/h	36,1111 m/s	132,927 m	169,038 m	4,68 s
140 km/h	38,8889 m/s	154,164 m	193,053 m	4,96 s

$$v^2 = u^2 + 2\mu gs,$$
$$= u^2 + 2(-0{,}5 \times 9{,}81)s$$
$$\therefore s = \frac{u^2}{9{,}81} \quad (v^2 = 0)$$

where v = terminal velocity (m/s)

u = initial velocity (m/s)

g = gravitational acceleration (9,81 m/s)

s = distance in metres

μ = friction coefficient (-0,5)

If a driver is driving at 60 km/h and the road is wet, the stopping distance is about 45 m. At 110 km/h the stopping distance is about 126 m and at 120 km/h it is about 147 m. Drivers must therefore adapt their speed according to the weather conditions. This also applies to driving during the day and night.

In terms of the National Road Traffic Act (Act Z93 of 1996), a car's lights must be set so that when the lights are *dipped*, the beam touches the road surface at 45 m, and if they are on brights, they must reach at least 100 m (regulations 160 and 161). The implications of this are critical: If a driver is driving at night, the reaching distance of the vehicle lights must be at least as far as the stopping distance of the vehicle if a crash stop has to be made. If the vehicle's lights are set at 100 m, it will already be too late if a stationary vehicle is spotted while driving 120 km/h or more.

Braking and stopping times

Braking and stopping times can be calculated by using the following formula:

$$v = u + \mu gt,$$

where v = terminal velocity (m/s)

u = initial velocity (m/s)

g = gravitational acceleration (9,81 m/s)

t = braking time

μ = friction coefficient (-0,8)

If v = 0, then

$$t = \frac{u}{7{,}848}$$

Braking and stopping times for different velocities under fine weather conditions are given in Table 4.

Table 4: Braking and stopping times as a function of velocity (fine weather)

Velocity km/h	Decision time (s)	Braking time (s)	Stopping time (s)
50 km/h	1sek	1,770 s	2,770 s
60 km/h	1sek	2,124 s	3,124 s
70 km/h	1sek	2,478 s	3,478 s
80 km/h	1sek	2,832 s	3,832 s
90 km/h	1sek	3,186 s	4,186 s
100 km/h	1sek	3,540 s	4,540 s
110 km/h	1sek	3,893 s	4,893 s
120 km/h	1sek	4,247 s	5,247 s
130 km/h	1sek	4,601 s	5,601 s
140 km/h	1sek	4,955 s	5,955 s

$$v = u + \mu gt,$$
$$0 = u + (-0{,}8 \times 9{,}81)t$$
$$\therefore t = \frac{u}{7{,}848} \quad (v = 0)$$

where v = terminal velocity (m/s)

u = initial velocity (m/s)

g = gravitational acceleration (9,81 m/s)

t = braking time

μ = friction coefficient (-0,8)

Table 4 shows that one needs 4,25 seconds to come to a *dead stop* if one is travelling at 120 km/h. At least *one second* must be added to this for *decision time*. The stopping time is therefore 5,25 seconds.

Corresponding braking and stopping times for rainy conditions can be obtained if μ is equal to -0,5. The formula is then

$$t = \frac{u}{4{,}905}$$

Night vision

Poor night vision is a problem that is easily overlooked. Structural deficiencies of the eye, vitamin A deficiency and certain psychoneurotic conditions may cause defective night vision. In the latter case there is no nutritional deficiency – the night blindness is simply a symptom of the person's psychical state. The *glare* of an oncoming vehicle's lights is one of the main causes of head-on collisions, particularly if the driver has been drinking. The following quote from Rochester University (UHS Health Topics, 3 March 2006) summarises the issue concisely:

> The ability to adjust to sudden darkness, called dark adaptation, begins to deteriorate *at relatively low BACs*. The greater the concentration of alcohol in the blood, the longer the glare recovery time. This refers to the period during which a person is partially blinded when exposed briefly to bright lights and then to darkness. This happens each time the headlights of an oncoming vehicle pass you.

Alcohol and road deaths

A Survey of Traffic Offences (2003)[2] indicates that 46,5% of all drivers killed in road accidents were under the influence of alcohol. The blood-alcohol concentration (BAC) of all these drivers was over the legal limit of 0,05 g/ml. The BAC of 9,5% of drivers was five times higher than the legal limit. The BAC of 57,1% of the pedestrians killed in road collisions was higher than the legal limit (> 0,05 g/ml). Clearly, drivers must not drink and drive. The same applies to the use of drugs.

Mr Christo Mynhardt (2002) of the CSIR conducted a well-planned study for the Department of Transport on the use of alcohol and drugs by *professional drivers*. His sample consisted of 400 professional drivers (truck, bus and minibus taxi drivers). The ethnical composition of the group was 280 blacks, 51 whites, 45 coloureds and 24 Asians. It was found that 22,3% of the tested drivers had driven under the influence of at least *one* drug. It was evident that alcohol was not the primary substance abused among professional drivers. A total of 55 truck drivers, 29 minibus taxi drivers and 5 bus drivers drove under the influence of at least one drug. About 21,0% of the tested professional drivers drove under the influence of a drug during the day and 25,0% during the night. Altogether 182 (45,5%) of the drivers who participated in the study drove for more than four hours uninterrupted without rest or sleep. Of this group, 43,8% tested positive for and were under the influence of at least one drug. Cannabis, Mandrax and morphine were their drugs of choice.

This information is extremely alarming because they are *professional drivers*, and if they are involved in road collisions, a considerable number of people are killed at one time.

Alcohol and violence

According to the Medical Research Council, 79,9% of the deaths as a result of violence in 2004 were men and 20,1% were women. Most of the deaths were among *young people*.

The main reason for death according to age group was as follows:
» 15 - 24 year group: violence (51,7%)
» 25 - 34 year group: violence (47,7%)
» 35 - 44 year group: violence (40,2%)

The weapon of choice used to commit the violence was firearms. This was true for all the age groups. The age of the sample ranged from 0 to 65+ years[1]). Violence committed with firearms is extremely high. According to a survey done by the Medical Research Council in Cape Town in 2001, the rate was 40 per 100 000 of the population. For the sake of comparison, it can be mentioned that Hong Kong's is 0,01 and Singapore's 0,07.

The average BAC of 9 405 people, killed as a result of violence, was 0,17 g/ml. The BAC of 2 690 suicide cases was 0,15 g/ml.[1]) These BACs are far above the legal limit of 0,05 g/ml. Socio-economic factors contribute to high stress levels among South Africans, and this is expressed in violence, road accidents, suicide and road rage. The question is therefore: What can be done to improve this situation?"

Poverty, unemployment, criminality and a lack of respect for life appear to be some of the most important causes that deserve urgent attention. Increased law enforcement in all areas is absolutely essential. The following road safety measures should receive priority:

1. All the roads in South Africa should be upgraded to accommodate the increase in road traffic. The maintenance of our road networks leaves much to be desired. Urgent attention must be given to road markings, cat eyes and signposts, especially in areas where there is *thick mist* at night. It is also risky to put signs indicating that the road is going to narrow on the *right* side of the road rather than on the left.
2. Serious attention must be given to ways of getting all unroadworthy and unregistered vehicles off the road.
3. All learners should undergo psychometric and psychomotor tests to evaluate their ability.
4. The training given to learners and the testing of learners must be of a high standard. Their ability to drive at night should also be tested.
5. Drivers must be strongly encouraged to pull off the road if they receive a cellphone call.
6. Seat belts must be worn consistently.
7. Vehicle lights must be set so that stationary vehicles are visible at least 200 metres ahead at night.
8. Reducing the speed limit should be seriously considered.
9. Strong penalties must be instituted against people who drive under the influence of alcohol or drugs, especially *professional drivers*.
10. Rigorous action should be taken against owners of heavy vehicles who overload their vehicles.
11. Drivers should be encouraged to rest every three hours, particularly if they are driving long distances.
12. Law enforcement must be increased radically. Traffic officers should be visible everywhere.
13. Drivers should be educated regularly. The right values should be inculcated in them, particularly respect for life and love for one another. Technical information should be provided by experts. The Minister of Transport should be regularly seen and heard.

References

Barkhuizen, W., Schepers, J.M. & Coetzee, J. 2002. Rate of information processing and reaction time of aircraft pilots and non-pilots. *SA Journal of Industrial Psychology*, 28(2), 67-76.

Brown, I.D. 1966. "Effects of prolonged driving upon driving skill and performance of a subsidiary task". *Industrial Medicine and Surgery*, 35, 760-765.

Cohn, S.J., Carlson, J.S. & Jensen, A.R. 1985. Speed of information processing in academically gifted youths. *Personality and Individual Differences*, 6(5), 621-629.

Cumming, R.W. 1964. "The analysis of skills in driving", Australian Road Research. *Journal of the Australian Road Research Board*, 1, 4-14.

Hakin, D. 2001. Study links higher speed limits to deaths. *New York Times*, USA, 2001.

Hick, W. 1952. On the rate of gain of information. *Quarterly Journal of Experimental Psychology*, 4, 11-26.

Mynhardt, D.C. 2002. Alcohol drinking rate and the use of other substances amongst professional drivers. *Technical Report*, CSIR, Pretoria.

Schepers, J.M. 2002. Construction of a computerised information-processing test battery. *SA Journal of Industrial Psychology*, 28(2), 55-66.

1. Information provided by Medical Research Council/UNISA.

2. Information provided by Road Traffic Management Corporation.

3. Information provided by UHS Health Promotion Office, University of Rochester.