CAN DRACONIAN LAW ENFORCEMENT SOLVE THE SOUTH AFRICAN ROAD SAFETY CRISIS?

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ABSTRACT

Traffic law enforcement has been defined as the area of activity aimed at controlling road user behaviour by preventative, persuasive and punitive measures in order to effect the safe and efficient movement of traffic. The Department of Transport launched the Road to Safety Strategy in 2001 aimed at addressing serious policy and implementation issues linked to bad road safety conditions. A major part of the Road to Safety Strategy involves dealing with attitudes such as those that entail behaviour personified in risky / dangerous / bad behaviour. The perceived acceptable behaviour of traffic violation by society (rather than a punishable act) magnifies the road safety problem in South Africa. Severe punishment and draconian legislations have been pin-pointed in some studies as a crucial factor in behavioural change towards safer roads.

The focus of this paper is to present a literature review on effects of draconian traffic policies and legal sanctions on road traffic safety and analyse those measures that are easy, affordable and outcome driven to overcome the South African road safety crisis. The current road safety situation in South Africa will be reviewed in terms of the traffic legislations, traffic policing and the legal sanctions. The role of different road safety agencies and offices within the national, provincial and local governments will also be outlined. The study will point to some lessons learned from some countries in their ongoing road safety programmes. The effect of licence loss and imprisonment of convicted drunk drivers on the Australian road safety situation and the effect of a demerit point system in countries where it is implemented are some of the cases that the study will present. Some technical details such as the human and technological resources needed for such traffic safety measures will also be part of the paper.

1. INTRODUCTION

1.1 State of road safety in South Africa

South Africa has a population of just over 47 million people, and is a mixture of first and third world economies. As of November 2007, the country had a total vehicle population of 9,066,370 of which 5,165,606 are motorcars, 274,709 minibuses, 1,821,514, light delivery vehicles, 39,686 buses, 302,113 trucks and the rest heavy vehicles, trailers and motorcycles, all travelling along the country's approximately 754,600 km of roads network. (eNatis, 2008). More than 18,000 people die, around 7000 people are permanently disabled, and 40,000 seriously injured annually on its roads. International comparisons for 2005 indicate that South Africa falls far outside world's best practice, with a rate of 19.83 fatalities per 10,000 vehicles and 30.15 fatalities per 100,000 human population (See Figure 1 below).

According to the Road Safety Strategy, the African Ministers of Transport in Africa committed themselves to delivering the Millennium Development Goals for the transport sector, in which, among other targets, they adopted a 50% reduction of accident fatalities arising from road and other transport by 2014, i.e., 10% reduction per annum. In terms of the undertaking, this is the target which the South African Road Safety Strategy aims to achieve. Moreover, South Africa is in an even more demanding position to reduce accident fatalities due to the fact that it will be hosting the FIFA 2010 World Cup tournament. Accordingly, South Africa should fulfil undertakings specified in the bid process pertaining to safe environment for the tournament. (RSS, 2006)

It is therefore imperative that South Africa takes drastic steps to improve the levels of road safety in order to achieve the Millennium Development Goals, and to deliver improved road safety during and after the FIFA 2010 World Cup.

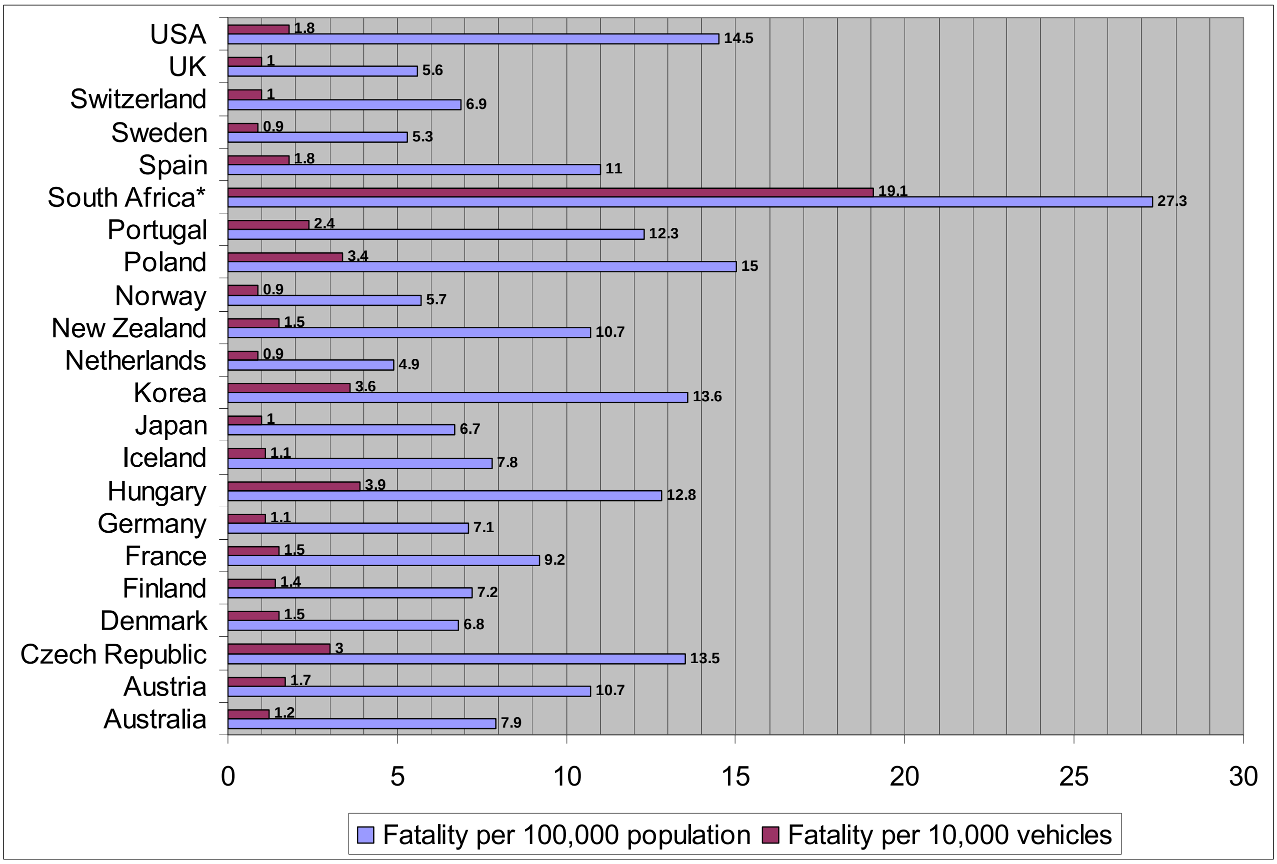

Figure 1 2005 Road Safety Comparison (Source: International Road Safety Comparisons 2005 Report, Australian Transport Safety Bureau)

* Source: Road Traffic and Fatal Crash Report 2005, RTMC

1.2 Cause of High Fatality

According to the Road Safety Strategy, in the order of 95% of road traffic accidents happen as a result of one or more traffic offences committed (RSS, 2006). Traffic offence surveys conducted over the past few years showed the general level of lawlessness with regard to the most critical offences. The results of the 2005 survey of traffic offences are as shown in Table 1, together with the target rates to be achieved by 2010 (RSS, 2006).

Table 1 Traffic offences rate (Source: Road Safety Strategy, 2006)

Offence	Current Rate	Target Rate by 2010
Speed % of drivers exceeding the speed limit	17	5
Alcohol % of drivers exceeding the legal limit	4.3	0.4
Barrier Line % of offences per hour per barrier line	0.9	0.1
Traffic Signals % of red phase offences	28	5
Seat Belts % of vehicle occupants not wearing seatbelts Drivers: Front Passengers: Rear Passengers:	 17 36 97	 5 5 10
Driving Licence % of drivers not holding legal licence	2.3	1
Professional driving permit % of drivers not holding valid permit	15.6	1
Vehicle Tyres % of vehicles with defective tyres	21.3	2.5
Vehicle Lights % of vehicles with defective lights	3.5	1

The ever-growing number of road traffic fatalities especially as a result of the high level of traffic violations mentioned above demonstrates that the current system of traffic law enforcement is proving insufficient and ineffective. The focus of the paper will thus be on identifying some international traffic law enforcement practices against the major traffic offences and the effects they had on road accident or fatality rates.

1.2.3 South African Road Safety Agencies

Based on the 1996 Road Safety Strategy, the Road Traffic Management Corporation (RTMC) Act and Administrative Adjudication of Road Traffic Offences (AARTO) Acts were created and Arrive Alive started as a communication and enforcement campaign during 1997. The establishment of the RTMC enhanced the management of the national traffic information system (NaTIS), traffic information, traffic training, education and road safety. The DoT, in conjunction with the RTMC and the Metropolitan Traffic authorities, oversees law enforcement activities, driving licence testing centres and vehicle testing stations. The RTMC entrenches an effective partnership between national, provincial and local spheres of government in the management of road traffic matters. (RSS, 2006)

The objectives of AARTO are, amongst others, to encourage the payment of penalties imposed for infringements, to establish a procedure for the effective and expeditious adjudication of infringements; with the purpose to encourage compliance with the national and provincial laws and to alleviate the burden on the courts of trialling offenders for infringements. AARTO further aims to penalise drivers and operators who are guilty of infringements or offences through the imposition of demerit points leading to the suspension and cancellation of driving licences, professional driving permits or operator cards. (RSS, 2006)

2. GENERAL ISSUES REGARDING TRAFFIC LAW ENFORCEMENT

Traffic law enforcement has been defined “as the area of activity aimed at controlling road user behaviour by preventative, persuasive and punitive measures in order to effect the safe and efficient movement of traffic” (OECD 1974 cited in Zaal 1994). The specific stepwise components described by Rothengatter (1990, cited in Zaal 1994) to be part of the actual process of traffic law enforcement are:

- Legislation which specifies the laws and regulations governing the safe use of the traffic system by road users.
- Traffic policing which ensure compliance to the legislation by road users.
- Legal sanctions which imposes punishment on the road users who violate the legislation.

While all three components play important role in determining the impact and effectiveness of a traffic law enforcement system, it is the actual policing activities of traffic law that are of pivotal importance because of their link between the other components of the system and, due to their conspicuousness, form the basis of public opinion regarding enforcement.

Such an influence on shaping public perception is considered to be an important element in the process of moderating road user behaviour and further highlights the central role of traffic policing within a traffic enforcement system. (Zaal, 1994)

The relationship between levels of policing, on the one hand, and accident or casualty rates, on the other, is not easy to establish. One theoretical relationship mentioned in Elliot & Broughton (2005 citing Oei, 1996) is provided in Figure 2 below showing policing level in the x-axis and the accident and casualty rates on the y axis. Accordingly, the relationship is not linear with highest levels of accidents and casualties expected at zero enforcement level. In the beginning, an increase in enforcement would have no noticeable effect. However, drivers will become aware of the police presence at a certain level of enforcement and can be expected to modify their behaviour (i.e. reduce their violations), so the number of accidents and casualties would start to drop. As enforcement increases, the numbers of accidents and casualties can be expected to decrease, but only up to a certain point – after which increased enforcement would have little or no effect because of a saturation effect. Elliot & Broughton (2005) hypotheses similar relationship with respect to policing levels and violations except that it’s likely that violation rates can arguably fall to almost zero but accident or casualty rates would not fall to that extent because they are caused by multitude of factors besides violations of traffic law.

Researchers therefore need to establish the levels of policing that are required to bring about the initial decrease in the curve and to reach the saturation point. It is also vital to establish the violation, accident and casualty reductions that can be achieved with these levels of policing. The information about enforcement levels that would be needed to plot the relationship shown in Figure 2 above may differ depending on the driving violations under consideration. For example, in the case of speeding, which is a relatively easy to detect, an ideal measurement of enforcement would be the proportion of traffic or road network under police surveillance. (Elliot & Broughton, 2005)

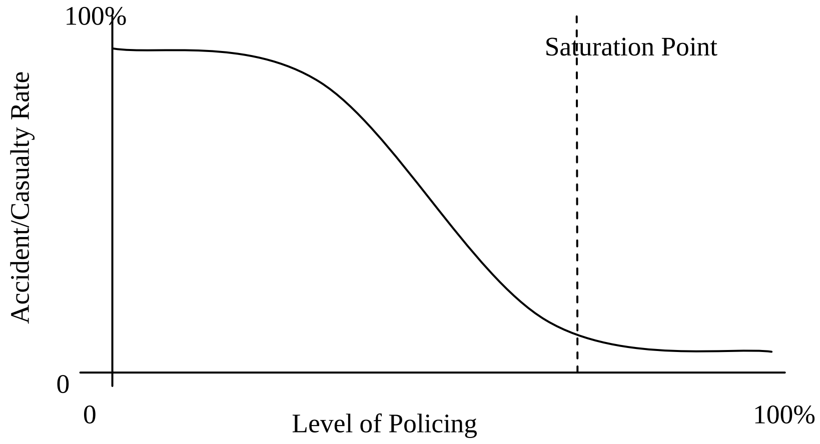

Figure 2 Theoretical relationship between level of policing and accident/casualty rate (Source: Elliot & Broughton, 2005)

2.1 Enforcement against alcohol impaired motorists

2.1.1 Traffic Policing

Homel (1984 cited in Zaal 1994) observed that deterring drunk driving behaviour is dependent upon the level of perceived risk that such behaviour is detected and results in some form of punishment which is difficult to achieve if a high proportion of alcohol impaired drivers over the legal limit remain undetected.

The deterrent effect of breath testing devices is, to a large extent, dependent on the legislation governing their use. The power of police to require a driver to undergo a test for alcohol impairment is extremely vital but varies considerably among jurisdictions and may take one of several levels, including:

- Stopping only obviously impaired drivers;
- Stopping drivers at roadblocks or sobriety checkpoints and testing only those suspected of alcohol impairment;
- Stopping drivers at random and testing all those stopped i.e. random breath testing (Zaal 1994).

Drunk driving is generally detected during roadblocks in South Africa. Furthermore, it is also mandated to test those who were involved in accidents.

Random Breath Testing (RBT) stands in marked contrast to roadblocks or sobriety checkpoint programs and other forms of less stringent testing procedures. In his work, Zaal (1994) mentions Australia's RBT which has been introduced in 1982 as the most clear and well documented evidence of the effectiveness of RBT. He stresses the importance of high visibility RBT accompanied by a concentrated publicity campaign as practiced in Australia's RBT programme.

Zaal (1994) mentions the strong evidence of a long term and sustained reduction in level of drunk driving behaviour as a result of RBT operations in Australia.. A 22% reduction in total fatal accidents (compared to the average for the previous 6 years) and a 36% reduction in alcohol related fatal accidents have been recorded in the New South Wales territory (Zaal 1994). Furthermore, Zaal (1994) suggests that the greater reduction in alcohol related fatalities as compared to overall fatalities concludes that RBT was the main cause of the decline. In Tasmania, studies indicated a 29% reduction in total road fatality accidents and a 42% reduction in alcohol related fatal accidents (Zaal 1994).

Zaal (1994) also mentions his most reliable benefit-cost studies of RBT from New South Wales, Australia. He indicates that in 1990, the estimated annual cost of the RBT program, including media publicity, was $3.5 million. At the same time the RBT program was conservatively estimated to save 200 lives per year, with savings to the community of at least $140 million. These values indicate a benefit cost ratio of over 50:1 (Zaal 1994).

One problem with RBT mentioned in Zaal (1994 citing Moloney 1993) is, due to the fact that RBT operations can be very boring and low number of offenders apprehended , problems related to police morale and professionalism. This can impact on the effectiveness of RBT operations. However, in Victoria, Australia, to solve this problem, new graduates were assigned as probationary constables for short periods (4 weeks) to undertake a large proportion of RBT operations.. For most, their task involved first contact with the public and their level of enthusiasm was made evident by a significant initial increase in both testing and detection rates as reported by Zaal (1994 citing Moloney 1993).

2.1.2 Legislation

As a result of the higher alcohol related accident risk of young drivers there have been increasing moves in some countries (particularly Australia and North America) to legislate for lower legal Blood Alcohol Content (BAC) limits for young drivers. Lower BAC limits allow the accident risk for young drivers to approximately equate to the risk of older, more experienced, drivers at existing legal BAC limits. In Australia, most States and Territories have legislated for a nominal zero BAC limit for young drivers during their first year of licensure. The impact of such legislation in the Australian state of Western Australia, which introduced a BAC limit of 0.02 for provisional licence holders, was 17% reduction in the number of drivers less than 18 years of age involved in night time casualty accidents (Zaal 1994) Drivers of heavy vehicles and public passenger vehicles, such as buses and taxis are also subjected to lower legal BAC limits in Australia because their road fatality statistics show clearly that the small minority of heavy vehicle drivers who drink and drive have a relatively high risk of causing fatal accidents (Zaal 1994). However, in the USA, Freeman (2007) recently examined the effectiveness of per se law in reducing traffic fatalities where he mentions there is no evidence that lowering the BAC limits to 0.08 reduced fatality rate either in total or in crashes.

Raising the legal drinking age has also been identified as one possible means of reducing the incidence of alcohol related fatalities among young drivers. This type of legislation is common in the United States of America where, as a result of a high proportion of accidents involving young drivers who were impaired by alcohol, 50 States, in the mid 1980s, raised the legal drinking age to 21. Evidence of the effectiveness of such law comes from the National Highway Traffic Centre which has estimated that such legislation has saved more than 12,000 lives from 1975 to 1992 (Zaal 1994). Moreover, in a recent journal, where forty nine research papers were included in the analysis, Shults et al (2001) mentions an average of 12% decrease in fatalities and fatal crashes as the effect of revising minimum legal drinking age by 5 years from 18 to 21.

Another possible strategy is the use of graduated licences, which combine a range of restrictions so that novice driving takes place in less dangerous circumstances until the young driver has had the opportunity to gain experience. Graduated licence schemes have been implemented in New Zealand, Canada and in most Australian States and Territories. The graduated licence scheme may include restrictions on the number and age of passengers a novice driver is allowed to carry (in order to reduce possible peer pressure to engage in risk taking behaviour), night-time curfews, lowered legal BAC limits, speed restrictions, compulsory seat belt use and a special licence plate for probationary drivers. Evaluation of the graduated licence program in New Zealand has shown a dramatic reduction in the number of accidents involving young drivers between the age of 15 and 17 years (the main target of the program). Whilst accidents resulting in injury have dropped by approximately 12% overall in New Zealand, accidents involving young drivers have dropped by 40% (Zaal 1994).

In South Africa, high driver fatalities were identified in the 25 to 29 year ages group from the road fatality statistics of 2005. Perhaps, after a thorough study on the main causes of fatalities among the age group, a graduated licensure for new drivers, regardless of age, may aid in overcoming the situation.

Other legislative control methods of drunk driving worth mentioning are:

- Rehabilitation Program as condition for relicensing
- Alcohol control policies (availability, taxation, advertising regulation)
- Server intervention program
- Public education program
- Public and personal breath testing devices
- Alcohol ignition interlock
- Performance interlock

2.2 Enforcement on Speeding Motorists

The literature on the effects of police enforcement on speeding behaviour, accidents and injuries has often failed to give precise descriptions of the enforcement methods used. In addition, many experiments involve the use of more than one method, which makes it difficult to attribute the effects to any specific enforcement method (Zaidel 2002)

A manual (and stationary) method generally involves a configuration that includes an observation unit, typically an unmarked police car more or less hidden at the roadside, and an apprehension unit comprising one or more marked police cars, clearly visible. The observation unit will have a measurement device such as radar or a laser device and possibly a documention device, such as a still or video camera. Speeding vehicles are detected at the first station, their description is relayed to the apprehension unit downstream, which flags them to stop and issues citations to drivers.

Zaidel (2002), in his meta-analysis study of the results from about 17 studies in the USA, England, Sweden, Australia and Norway, show an overall effect of manual speed enforcement on accidents is reduction of the number of accidents by 2%. However, the reduction in fatal and injury accidents is much higher, 14% and 6% respectively.

The Netherlands has pioneered the testing and implementation of several speed control schemes based on fixed and mobile photo-radar cameras, video cameras, automatic warnings and automated office citation processing. Automatic speed warnings coupled to photo-radar camera system operating from either an unmarked parked vehicle or from fixed poles have been evaluated and showed a 35% reduction in the total number of accidents in two-lane rural road stretches. The best estimate of the effects of automatic speed enforcement on all levels of injury accidents from nine studies is a reduction of 19%. Considering casualties only, the accident reduction is 17% (Zaidel 2002).

2.3 Enforcement of Signalized Intersections

Red light cameras (RLC) at signalised intersections have been in use for many years in EU countries and Australia. A common feature in all studies evaluating the effects of RLC is that a posted warning sign in advance of the RLC site informed drivers of the automatic surveillance of red light violations. The best estimate of the effect of RLC on all accidents is a reduction of 11% and the reduction of all injury accidents is by 12%. This is based on two reports from Australia and one from Norway (Zaidel 2002).

2.4 Effects of Warning Letters, Point Demerit Systems, Licence Revocation and Severity and Immediacy of Punishment

Eleven reports about the effects of warning letters, penalty point systems and licence revocation on accidents were considered in meta-analysis study in Zaidel (2002). The overall effect of the measures, i.e., the joined effects of all three components, is a reduction of the number of accidents by 12%. The effects of warning letters (15% decrease in number of accidents) and revocation of driving licence (17% reduction in number of accidents) are of about the same magnitude and also about three times as high as the effects of penalty point systems (5% decrease in number of accidents) (Zaidel 2002).

Currently the use of sanctions in the form of demerit point systems is widely applied e.g. in Australia, Belgium, Canada, France, Germany, Japan, New Zealand, Norway, the United Kingdom and the US. Very little is known on the effects of the demerit point system on traffic safety. However, in the light of the available evidence, it appears that when demerit points start to accumulate, the numbers of subsequent violations tend to decrease. Thus, as might be expected, the effects seem to be at least driver specific. However, it is not known whether the demerit point system has any general deterrent effect. It could be assumed that for drivers with a low number of points who know the system and are willing to gamble with it, the demerit system gives an opportunity for more reckless driving than drivers with accumulated penalty points. It is not known whether this is the case. In France, a licence demerit point system was introduced in 1992 to reduce recidivism rates in traffic violations. Associated with this, driver improvement courses are conducted by which convicted drivers can recover their lost licence points. State authorities are responsible for the accreditation of course centres and their staff. This traffic management system can be regarded as an important support system for the police in reducing the number of traffic offences on the road. The French example presents the substitution of traditional punishment by fine or imprisonment by the alternative of participating in a driver improvement course (Zaal 1994).

Introduction of severe penalties for traffic offences, as a primary means of reducing the level of unbecoming road user behaviour, has been questioned. Studies show that if the probability of detection is perceived by the majority of road users as being low then the existence of severe penalties would be negligible as a deterrent. This is supported by other studies that found that enforcement policies which emphasised the severity of punishment rather than the perceived probability of detection had a less significant impact on road user behaviour. Sweden can be mentioned as a good example. In a study examining the impact of increases in the severity of speeding fines in Sweden in 1982, studies found no change in subsequent driving behaviour even though a significant proportion of drivers knew about the fine increases. Again, when the speeding fines were increased in Sweden in 1987, no evidence was found of a change in the number of offences (Zaal 1994).

Immediacy of punishment has been pin-pointed in both laboratory and field experiments as a crucial factor in behavioural change. However, there continues to be considerable debate in the research literature regarding just how immediate punitive measures must be in order to provide an effective deterrent effect (Zaal 1994).

3. HUMAN AND TECHOLOGICAL ENFORCEMENT RESOURCES

3.1 Human Resources

The resources allocated to traffic policing in EU countries are considerable. They include personnel, a highly motorised and mobile force and a whole range of dedicated enforcement equipment such as cameras, speed detecting radar and laser units, alcohol meters and other analysis tools. Accurate and complete data are difficult to obtain, primarily because most countries do not have such data. However, in public organisations such as the police, the number of personnel is a leading measure of size, which determines allocation of other resources. Based on personnel estimates, it appears that 7% to 10% of police personnel (or a corresponding proportion of person-years) in a country are dedicated to traffic control – patrolling and surveillance, violation handling, accident handling, and traffic directing. In the 15 EU countries, about 80,000 police persons are dealing primarily with traffic. Material resources and the legal infrastructure supporting enforcement are also substantial (Zaidal et al, 2003).

An examination of police force size in relation to either population size or total annual kilometreage (which is a measure of traffic activity, or the need for traffic law enforcement, influenced by population size, motorization, size of country and the roadway network) suggested that small countries have, proportionally, larger police forces compared to large and populous countries. For example, Finland with a population of 5.2 million allocates one traffic police man-year to every 3,000 inhabitants, or one per 25 million km exposure, whereas in the UK, with a 60 million population, police allocation to traffic is one per 5,300 inhabitants or one per 40 million km exposure (Zaidal et al, 2003). In South Africa, a survey on the number of traffic and municipal officers undertaken amongst the provinces at the end of 2004 indicate that there were about 9,773 officers, which means police allocation to traffic was one per about 4,770 inhabitants or one per 13 million km exposure (Botha 2008). This suggests that South Africa has fairly adequate traffic officers as compared to European countries. However, the apparent inadequacy of traffic policing in South African roads could be due to significant difference in advanced policing structure, management and level of automated policing between South Africa and the European countries. Also the high level of non-compliant society in South Africa as compared to European societies further adds workloads to the policing system, requiring more resources.

It is not simple to interpret national differences in police resources. They may reflect priorities, efficiency, and other policing tasks of varying nature and size. The fact that countries with different road safety rankings can be found in each police force size category suggests that absolute size of a police force in general, and that allocated to traffic in particular, may not be a determining factor in managing traffic safety successfully (Zaidal et al, 2003).

3.2 Technological Resources

The following is a list of violations that have been reported to be enforced by some automated system (Sagberg 2000).

- speed
- red light running
- headway violations
- toll payment violations
- illegal use of bus lanes

- violation of vehicle weight restrictions

When discussing the technologies, a distinction between technologies for detecting violations on one hand, and technologies for identifying the vehicle on the other hand is usually made.

3.2.1 Technologies for detecting violations

The basic technologies that have been used for detecting violations are (Sagberg 2000):

- radar
- laser
- inductive loops in pavement
- pneumatic tubes across road
- piezoelectric cables
- infrared detectors, and other optical sensors
- video image processing
- electronic detection based on in-car electronic tags

Some technologies are common to systems for detecting different violations, whereas others are particularly tailored to the detection of specific kinds of violations.

Several different systems have been used for speed enforcement. Radar is still commonly used. A photo-radar can be easily moved from site to site, in case mobile enforcement is considered desirable. For manual speed enforcement, laser technology seems to have replaced the radar to some extent. For automated enforcement, however, laser systems have not yet been considered suitable, partly due to their small target angle. Recently, however, a new application of laser, called scanning laser, has been tried out. In contrast with the traditional use of a laser gun, the scanning laser is focussed vertically down on the roadway, and scans with a high frequency across one or two lanes, detecting vehicles breaking the laser beam. On the basis of the reflected laser beam, the system computes speeds and following distances (as well as width and breadth of vehicles if needed). For enforcement purposes it is combined with a video system for vehicle identification (Sagberg 2000).

For mobile automatic enforcement of speed, some systems use pneumatic tubes (rubber tubes) across the road, for example the Speed Guard system by the South-African company Trans-Atlantic Equipment. For stationary automatic enforcement of speed, on the other hand, cables in the pavement, either inductive loops or piezoelectric ("weigh-in-motion – WIM") cables, are used. Sagberg (2000) mentions the advantage of WIM cables is that they can be used for detecting both speed, following distance, and weight, whereas the inductive loops, although well suited for speed measurements, cannot measure weight, and they are less accurate than WIM cables for the measurement of following distance.

Optical sensors are used to some extent as well. A system that is used extensively in Israel for automated speeding and headway enforcement is based on the reflection of infrared beams from special reflectors in the road bed (Sagberg 2000). A detector records when a passing vehicle crosses the beam, and records speed and headway. A video image is used for identifying the vehicle.

Video systems, in addition to identifying vehicles for which violations have been detected by some other means, can be used alone for the detection of violations. Image processing systems for identifying and tracking vehicles for some distance have also been developed. From the video image violations regarding both speed, following distance and lane changes can be determined, and possibly also other violations. Concerning speed, it is possible to extend the enforcement from spot speeds to average speed over the whole distance covered by the camera. The large potential of such systems lies in their double function of both detecting the violation and identifying the vehicle. A number of fully automated video-based systems were developed and tested in Australia in the early 1990s. The systems were based on digital imaging technology for identifying the vehicles and transmitting the picture to a central processing cite (Sagberg 2000).

According to Sagberg (200), in the Netherlands, a video system is being applied for the automated enforcement of *average speeds.* This enforcement system is based on the average travel time of an individual vehicle over a predefined stretch of road. The system is designed to operate stand-alone for 7 days a week, 24 hrs a day. The system monitors traffic at 3 different locations on a 3- km section of a busy highway (70,000 cars per day average) between Utrecht and Amsterdam. At each of the three locations, a picture is taken of the rear of each passing vehicle by digital video cameras which are mounted on gantries above the roadway, and a Vehicle Definition Tag (VDT) - a 'digital fingerprint' - is generated. From all three locations a dedicated 'digital fingerprint' of the vehicles are sent to a central location which matches exit with entry vehicles, calculates average speeds over the sections, detects violations and prepares evidence information for ticketing. When a violation over a section is detected the exit and entry pictures are retrieved from the road systems and a licence plate reading is done to generate the needed visual evidence. When there is no violation the images are deleted from the temporary storage. The central processing office sends the processed violation protocols either directly to the national centre of citation issuing of the Ministry of Justice (violation < 30 km/h) or to the public prosecutor's office in Utrecht (violation > 30 km/h). At the citation centre, the vehicle plate number is linked to its owner and tickets are generated automatically from the data files provided by the police. Within one week the ticket is in the mailbox of the offender.

A similar double function may also be ascribed to the use of in-car transponders (electronic tags), which in principle and theory can be used for identifying a vehicle's position at any time, with unlimited possibilities of automatic surveillance. Currently, it is only used for identifying vehicles in toll payment systems (see Table 2).

Table 2 Automatic Enforcement Applications. Source: Sagberg (2000)

	Speeding	Red Light running	Shot headway	Toll payment violation	Lane occupancy	Excessive vehicle weight
Radar	√					
Inductive loops	√	√	√	√	√	
Pneumatic tubes	√	√	√		√	
Piezoelectric cables	√	√	√	√	√	√
Infrared detector	√		√			
Video imaging processing	√	√	√	√	√	
Laser	√		√			
Electronic detector (tags)				√		

3.2.2 Systems for Identifying the Vehicle

Once a violation has been committed and subsequently detected with some of the mentioned systems, the next step is to identify the vehicle. The most common technology includes taking a photograph of the vehicle, with a camera triggered automatically by the violation. The film is then manually recovered from the camera, and the licence-plate of the vehicle is identified by visual inspection of the picture. A comprehensive review and description of technical and operational aspects of various photo-based automated enforcement systems in use world-wide by the early 1990s has been presented by Blackburn and Gilbert (1995) (cited in Sagberg 2000). Their report also contains a discussion of issues related to the processing of citations as well as the legal and acceptability problems involved. Sagberg (2000) identifies one drawback with the conventional still picture wet film camera as being laborious processing.

The use of digital cameras (either for still pictures or video) has simplified the process of retrieving the pictures. The pictures could be transmitted electronically from the camera to the authority responsible for further action. Another important advantage of the digital camera is that it facilitates the process of automatic identification of the vehicle by image processing technology. Several systems exist for this, alternatively termed "Automatic Number Plate Recognition – ANPR" "Licence Plate Recognition - LPR", or "Automatic Vehicle Identification – AVI" (Sagberg 2000).

Electronic identification assumes some transponder or electronic tag in the vehicle, which can be read by a roadside detector. Such systems are in use for automatic toll payment (road pricing). The system may detect admissions without payment, but only for those vehicles that have the tag. The use of such systems for general enforcement would require that all vehicles were equipped with the tag, and the lack of a tag would be a violation. In that case, violating vehicles having a tag could be identified by the tag alone, whereas vehicles without the tag could be photographed (Sagberg 2000).

4. CONCLUSIONS AND RECOMMENDATIONS

The success of traffic enforcement is dependent on its ability to create a meaningful detection threat to road users. To achieve this, the primary focus should be on increasing surveillance levels to ensure that perceived apprehension risk is high. Once this has been achieved, increasing penalty severity and quick and efficient administration of punishment can further enhance the deterrent effect and ultimately contribute to alleviating the road safety crisis.

The answer to the title of the paper is not a simple yes or no. Much systematic research is still needed to establish the relations between the different levels of police enforcement, deployment schemes, applied tactics, etc. and the safety effects observed. Similarly, background studies are required to constitute measurable links between the characteristics of non-compliance in driver behaviour and accident occurrences. In both cases, specific inputs for enforcement strategies and tactics are expected. It is believed that an improved reporting system on traffic police enforcement and a system for regular monitoring of traffic behaviour, co-ordinated with accident data and driver surveys, and supported by relevant evaluation methods, will provide background for developing solutions to current problems. This will promote more effective enforcement activity and will contribute to introducing other and more efficient safety measures.

Recommended research questions include:

- What are the verifiable factors contributing to road traffic crashes?
- How do levels of policing affect road accidents and casualties in South African cities?

- What fundamental South African research on road safety has been done in the past two decades?
- Which deterrence measures works best in South Africa?
- What is the expected effect of the proposed point demerit system on road safety?

Finally, it is recommended that the data of the proposed point systems and administrative legal systems should, as standard, be made available for scientific research, provided privacy rights are protected. Provisions should be made for the research needs that are necessary to evaluate the effect of the system.

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