

# RESEARCH NEEDS ON TRAFFIC MANAGEMENT AND SAFETY THE LOCAL AUTHORITY'S PERSPECTIVE

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## ABSTRACT

The City of Tshwane is actively involved in the promotion of traffic safety through engineering measures. It has also made significant efforts to integrate engineering with law enforcement, education and traffic awareness, particularly in the developing areas of the city. Various road safety improvements and action plans were developed and implemented, in both developed as well as in the developing areas. Innovative approaches to address safety issues were implemented and have been found to be successful.

A major challenge faced by traffic engineers in the City of Tshwane, is the identification of hazardous locations in both developed and developing areas. In developing areas, road safety risks are high, particularly for pedestrians, but limited accident statistics are available. In developed areas, some statistics are available, but these are often not reliable or even usable. An approach was therefore developed in Tshwane according to which safety issues were identified through community inputs and participation. This approach has proven to be successful in the reduction of fatalities and serious accidents, but further development is required.

The preferred method of identifying hazardous locations remains by means of accident data and statistics. Comprehensive and accurate accident data are required to pinpoint hazardous locations and to identify the main factors contributing to accidents. Once adequate accident data are available, it would be possible to identify factors involved in road accidents and monitor the effectiveness of road safety action plans. Of particular importance is the development and monitoring of low-cost engineering counter-measures so that immediate improvements can be made at known hazardous locations.

Due to limited resources and funding, it is not possible to implement all road safety plans and actions that may be desirable. Research is required to identify those plans and actions that can be implemented at a local authority level and which would have the greatest impact on road safety. The intention of this paper is not to list all research needs of local authorities. Although many important research topics can be identified, the paper concentrates on the following topics which are considered essential for local authorities:

- Road safety management system
- Accident (and other) data
- General contributing factors to accidents
- Road safety in communities
- Vulnerable roads users
- Traffic calming.

## 1. BACKGROUND

The City of Tshwane Metropolitan Municipality was established in 2000 from various city councils, town councils, transitional councils and regional councils. This resulted in a city with significant contrasts in terms of the provision of services, including measures to improve traffic and pedestrian safety. The safety situation in many disadvantaged areas was unsatisfactory and had led to public dissatisfaction in some of these areas. The municipality and specifically the Roads and Stormwater Division, had no other choice than to develop innovative programs to address the road safety issues.

Probably the most important challenge that is being faced by traffic professionals in the City of Tshwane is the identification of hazardous locations in particularly the disadvantaged areas. Road safety risks in these areas are high, especially for pedestrians, but very limited accident statistics are available for these areas. Where such statistics are available, they are often neither reliable nor even usable, mainly because it is not possible to trace accidents to specific locations. Proper cadastral maps with street names and street name signs are currently not available for many of these areas. Street name signs are in the process of being installed, but the process will take some time to complete.

Due to the lack of accident statistics in developing areas, it is not possible to quantify or identify safety risks in these areas. Previously, this resulted in inadequate attention being given to traffic safety in such areas, which has resulted in a situation where many of the disadvantaged communities were very dissatisfied with the safety conditions. There are many reported cases where frustrated communities obstructed the roads because people were injured or killed along some of the roads.

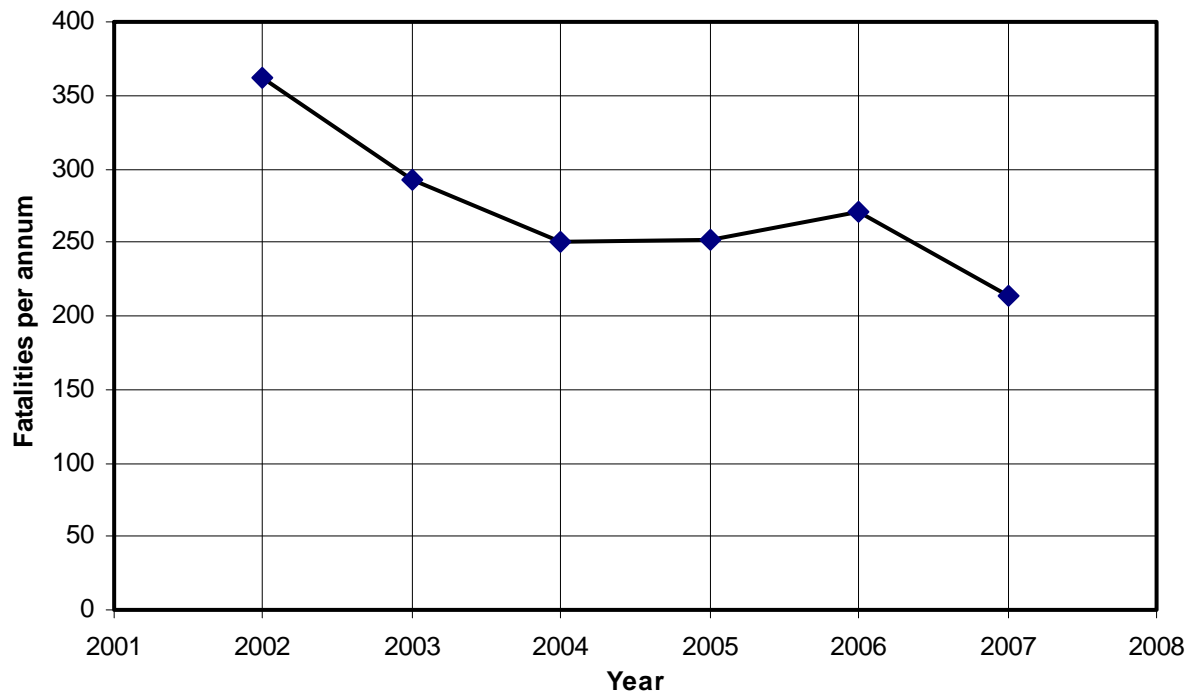
Traffic engineers had the choice of either waiting for an accident statistics database to be developed (with all its associated problems) while people were being killed or injured on a regular basis while communities were becoming very dissatisfied, or to follow a more pragmatic approach. An approach was therefore developed based on experience which is believed to be innovative and of great value to disadvantaged areas. The basic approach is to develop safety master plans in which community inputs and participation play a major role. This is primarily done through ward councillors and committees. The ward councillors and committees were requested to assist in the identification of safety issues and the selection of safety measures.

Experience has shown that community involvement and stakeholder engagement is a crucial and important step in traffic safety studies in areas where traffic information is limited. To ensure the success of a project, it is essential that community acceptance of the project be obtained before it is implemented. A community must understand why certain measures are implemented as well as the safety benefits of these measures. The need to educate people and to make them aware of the potential dangers associated with traffic is also an essential part of such a campaign.

The above process has been implemented in various areas of Tshwane with significant success. The level of community dissatisfaction has reduced significantly, although it is not always possible to immediately implement all safety measures due to a lack of funding. With continuous community involvement in the projects, however, problems could readily and quickly be addressed.

Figure 1 below shows the trend in the reduction of fatalities due to road traffic crashes in the City of Tshwane over the past five years. Fatalities decreased from 362 in 2002 to 214

in 2007, a reduction of 40%. Some of the reductions could probably be ascribed to the safety measures that have been implemented in the city.



**Figure 1 Fatalities in the City of Tshwane from 2002 to 2007**

The success of the safety programmes, however, does not necessarily imply that all problems have been solved. In fact, the programmes identified various important gaps in road safety knowledge that may have resulted in wrong decisions being made.

The purpose of this paper is to address urgent research needs in the field of traffic management and safety, particularly in disadvantaged areas where significant safety issues are being experienced. The paper will address the needs from the perspective of the local authority and in particular the perspective of the City of Tshwane.

## **2. OVERVIEW OF RESEARCH NEEDS**

The research needs in the field of road safety are enormous and have many facets. In this paper it is not possible to address all such needs, and the paper will therefore only concentrate on those that are considered crucial from a local authority's perspective, and particularly from the road engineering perspective. Obviously there are research needs from other perspectives such as law enforcement and education and these needs could be more important than those addressed in this paper. The exclusion of research needs from these other fields does not imply that these needs are less important than those of the Roads and Stormwater Division of the Municipality.

The lack of reliable accident data is one of the most important concerns in the country and research is urgently required to identify the issues with accident data collection. Such data should form the basis of establish research focus areas. Without such data, the most important needs can only be identified on the basis of experience and judgement.

Some guidance can be obtained from focus areas and research needs identified in other countries although conditions may differ significantly. The following are examples of the

focus areas research needs that have been identified by the Federal Highway Administration (1):

- Intersections
- Pedestrians and cyclists
- Roadside safety
- Run-off road safety
- Speed management.

The Transportation Research Board has several committees that are concerned with road safety. Most of these have identified research needs. The following are examples of the committees.

- Access Management Committee. This committee has a wide range of research needs related to road access management (2). The needs include topics covering access management standards, impact and marketing.
- Highway Safety Manual Committee. This committee is involved in the development of the planned Highway Safety Manual.
- Statistical Methodology Committee. This committee is involved in the development of statistical methodologies for the analysis of accident data.
- Committee on Pedestrians. This committee is involved in the pedestrian safety and other pedestrian-related issues.

The Transportation Research Board recently developed a Research Needs Statement (RNS) database which currently contains about 700 research need statements that have been prepared and approved by its committees (3). The following are a number of the need statements in the accident field:

- Criteria for consistent design and safe operation of low-volume roads in level and mountainous terrains.
- Engineering countermeasures to reduce red-light violations and related crashes.
- Prototyping roadway engineering improvements to reduce drunk driving crashes.
- Quantifying the costs and benefits of red light camera enforcement.
- Safety and operational impacts of properly designed bike lanes.
- Pedestrian-vehicle conflicts near schools.
- Enhanced research on the traffic safety impacts of access management.
- Integrating pedestrian considerations into traffic signal design.
- Life cycle analysis of designing highways for safety.
- Guidelines for the provision of sidewalks.
- Investigation of alternative highway design processes.
- Guidance for the provision of left-turn lanes.
- Identification of landscape and roadside properties that contribute to increased roadside safety.
- Barrier system maintenance procedures.
- Development of a safer concrete barrier.
- Probability of utility pole collisions.

The European Commission (4) has taken the initiative to support and fund a cooperative exercise towards identification and dissemination of best practice solutions for road safety problems. The aim is to provide information on the most outstanding safety measures that can be implemented on various levels and from different perspectives. Various reports

have been published, including thematic reports that provide detailed descriptions of best available practices in different categories. The following infrastructure safety measures have been selected as best practices (5):

- Road safety audits
- Home zones (or Woonerf)
- 30 km/h zones in residential areas, near schools and in shopping streets
- Roundabouts.

The intention of this paper is not to list all research activities being undertaken in other countries or research that needs to be undertaken in South Africa. Although a large number of important research topics can be identified, this paper will concentrate on the following topics which are considered essential for local authorities:

- Road safety management systems
- Accident (and other) data
- General contributing factors to accidents
- Road safety in communities
- Vulnerable roads users
- Traffic calming.

More information on these research topics is provided in subsequent sections of this paper.

### **3. ROAD SAFETY MANAGEMENT SYSTEMS**

There is an important need to integrate road safety as a fundamental consideration in the decision-making processes of road authorities. This can only be achieved through a co-ordinated and structured approach and by making resources available to address road safety concerns.

Research is required to develop a practical road safety management system that can readily be adopted and implemented by local authorities. Such a system should preferably be results driven to ensure that meaningful contributions are, in fact, being made towards improving road safety. A comprehensive approach is required and the research should identify and prioritise actions that should be implemented.

Research is also required to develop practical guidelines for the implementation of safety investigations such as the following:

- Road safety assessments
- Road safety audits
- Hazardous location identification
- Safety remedial measures.

These investigations can be costly and are not always effective due to a lack of resources. Some procedures are data extensive requiring large volumes of data. Such methods can currently not be applied and alternative approaches are required that are practical and which deal with local realities.

The Roads and Stormwater Division previously used the South African Road Safety Manual (6) in a number of road safety engineering assessments and audits. One example

was the Olievenhoutbosch Pedestrian Safety Study (7) in which pedestrian safety was identified as a major issue. The experience with the application of the manual was that it is data intensive and costly to apply. This inevitably led to a limited application of the manual in the division. The Manual was released in 1999 and it should be updated or revised to take practical shortcomings into account (or other similar international documents may be considered).

#### **4. ACCIDENT (AND OTHER) DATA**

Accident data are fundamental to road safety management and are essential for purposes such as the identification of hazardous locations and the diagnosis of safety problems for monitoring road safety efforts. The lack of accurate and reliable accident data is hampering progress towards a safer road and transportation system in the country. Only limited progress can be made in improving road safety if data are not available on where, when, why and by whom accidents are made.

It is not the intention here to discuss the issues involved with the collection of accident data in the country. A research project is required to identify these issues and to find effective solutions for addressing them. Probably one of the biggest issues is that the police have many other priorities that need to be addressed, with the result that accident reporting may not receive the priority it deserves. Innovative methods are therefore required to ensure data are adequately collected and captured, even if collected data do not fully address all needs.

One of the biggest problems with accident data is the identification of accident locations. Various attempts have been made in the country to address this problem, but with limited success. It may not be possible to develop a system that would ensure the proper identification of accident locations, but if this is not possible, then alternative innovative methods should be developed for this purpose.

Another problem with the accident data is that even where data are available, it is often not possible to identify all the factors that contributed to a particular accident. It is unlikely that it will be possible to identify all contributing factors from an accident reporting system, though it may be possible to identify some of the factors. Research is required to improve the accident reporting system in this regard.

In addition to accident data, it would be desirable to also collect other data such as roadway characteristics, traffic volumes and speeds. Such data are essential for the identification of hazardous locations as well as in accident research.

#### **5. GENERAL CONTRIBUTING FACTORS TO ROAD SAFETY**

A lack of adequate accident data is not a reason for road authorities not to make some effort in identifying hazardous locations or to implement road safety measures. The current problem, however, is that there is considerable uncertainty on the effectiveness of the alternative improvement measures that are available. Engineers have their opinions on which measures are most cost-effective, but it should be borne in mind that these opinions are not always based on research.

Although it may not be possible to accurately identify the location of accidents or to establish all factors contributing to accidents, it is still possible to identify certain tendencies from available information. An example of such an approach was followed in

Tshwane in which accident data were used to identify the road elements where most accidents occur.

The Tshwane accident data allowed the identification of road elements where accidents occurred in about 85% of all reported accidents. Of these 85%, about 65% were found to occur at either intersections or access. An interesting finding was that nearly 50% of intersection accidents occurred at traffic signals. This information is unfortunately based on accident frequencies rather than accident rates, but it does provide some insight into the type of road element which needs specific attention. Unfortunately, it was not possible to identify the road improvements that would be most effective in reducing accidents.

Although it is not currently possible to undertake the accident studies required to establish the most effective safety measures, general accident statistics such as described above can be combined with findings from international research to identify effective safety measures. For example, Harwood et al (8) found that the provision of right-turn lanes (USA left-turn) at signal controlled four-legged intersections in urban areas can reduce accidents by about 20%. In rural areas, such lanes at priority controlled intersections can reduce accidents by nearly 50%. This information combined with the Tshwane data suggests that the provision of right-turn lanes could be an effective safety measure at intersections.

Practical research approaches as outlined above could be of great value to local authorities to identify cost-effective safety measures. It would also be particularly helpful if warrants for such measures could be identified and developed to indicate the conditions under which the measures would be effective.

## **6. ROAD SAFETY IN COMMUNITIES**

Road safety in communities is one of the primary concerns of a metropolitan authority. High levels of road safety problems are being experienced in these communities due to a general lack of road infrastructure and transportation facilities. These problems are increased by inadequate levels of law enforcement, poor driver discipline and a general lack of education on road safety.

Research is required to identify safety issues being experienced by communities and the causes of such issues. Major routes which run through communities and residential areas have been found to create serious road safety risks to pedestrians. Although the City of Tshwane has had some success in reducing fatalities in some areas, more research is needed to identify appropriate road safety measures, including traffic calming measures.

An important problem in many parts of the country is poor driver discipline, especially with regard to travel speeds. Research is therefore required on measures that can be implemented to either improve driver discipline or to mitigate the impact of poor discipline. It is particularly important to identify those roadway features that affect vehicle speeds, such as narrow lanes, speed humps, traffic circles and chicanes (speed calming measures).

A further important problem is the need for road safety in the vicinity of schools, especially where schools have been provided adjacent or near to main roads. Many accidents could be avoided if traffic operations near schools are made safer. Research is therefore required to identify typical accident causes at schools in developing areas and to find effective measures for improving road safety at such locations.

## 7. VULNERABLE ROADS USERS

It is important to focus road safety actions on vulnerable groups such as pedestrians, cyclists, the youth and the elderly. As a general rule, road safety programmes should focus around schools, locations where the youth congregate at night, areas where high pedestrian volumes are present and at old age homes.

Pedestrian casualties in the country continue to remain alarmingly high. According to a report of the Road Traffic Management Corporation (9), nearly half of fatal accidents in South Africa during 2005 and 2006 involved pedestrians (although the situation improved slightly during 2006). Accident studies that have been undertaken in the City of Tshwane indicate similarly high rates.

According to a report published by the World Health Organisation (10), road traffic accidents are the leading cause of death among young people between 10 and 24 years in the world. Nearly 400 000 young people are killed in traffic accidents every year while millions more are injured or disabled.

Road authorities are increasingly encouraged to consider provisions for all transport modes, including those required by vulnerable road users. Due to the limited funds available for such improvements, there is a need to identify those facilities which are essential for improving road safety.

The following are examples of research topics aimed at vulnerable road users:

- *Sidewalks.* Development of guidelines on when a sidewalk is required and when it is appropriate to provide sidewalks only on one side of the road. Guidance is also required on appropriate sidewalk widths for different land uses.
- *Midblock crossings.* In South Africa, it is not clear whether midblock pedestrian crossings are effective solutions for improving road safety. It has been argued that such crossings may give pedestrians a false sense of security and that the crossings could in fact increase accidents. Research is required to establish the effectiveness of such crossings as well as measures that are required to improve the effectiveness of the midblock crossings.
- *Traffic signals.* Pedestrian discipline at traffic signals is notably extremely poor. Most pedestrians ignore the pedestrian signals and will only stop when there are conflicting traffic movements. This attitude can, however, become particularly dangerous when heavy vehicles are stopped on an approach to the signal blocking the sight distance to moving vehicles. This issue has been identified as an important contributing factor in many accidents at traffic signal controlled intersections.

## 8. TRAFFIC CALMING

The National Guidelines for Traffic Calming was published by the Department of Transport in March 1998 (11). This document serves as a comprehensive guideline on traffic calming principles and methods. The Roads and Stormwater Division has used the guidelines quite extensively to develop a traffic calming priority list for the City. The system of prioritisation was adapted and refined to suit the conditions in the City.

The City has now developed a new approach and policy on traffic calming in which



emphasis is given to an integrated and holistic approach to traffic calming. Greater emphasis is given to area-wide planning rather than individual installations based on priority lists. The intention is to address safety problems over an area rather than a specific point on the network. Experience has shown that the type of safety problems that require traffic calming tend to occur over an area rather than at isolated locations on the road network.

The new policy largely depends on the involvement of the community to identify safety concerns (in developing as well as developed areas). Engineering investigations are then undertaken to identify the most appropriate traffic calming measures for an area.

The National Guidelines have now been in circulation for more than ten years and consideration should be given to revising the guidelines to incorporate the traffic calming planning processes developed in Tshwane.

## **9. CONCLUSIONS**

The intention of this paper was not to list all research topics, but to highlight only those that are of crucial importance for a metropolitan road authority such as the City of Tshwane. From the paper it is evident that there are a number of areas where research is needed, which include:

- A research project to develop a practical road safety management system that can readily be adopted and implemented by local authorities.
- Research to develop practical guidelines for the implementation of safety investigations such as road safety assessments, road safety audits, hazardous location identification and safety remedial measures. The South African Road Safety Manual was released in 1999 and has to be updated or revised to take practical shortcomings into account (alternatively, other international documents may be considered for adoption in the country). Practitioners should be involved in the revision process.
- A research project to identify issues regarding the collection, processing and distribution of accident data and to find effective solutions for addressing the issues. It is unlikely that it will be possible to identify all contributing factors from an accident report, but research should be aimed at improving the accident reporting system in this regard.
- It may not be possible to establish an accident data collection system whereby the identification of accident locations can be improved, but if this is not possible, then alternative innovative methods for such purpose should be developed.
- Research to identify safety issues being experienced by communities and the causes of such issues.
- Research regarding measures to protect vulnerable road users such as pedestrians, cyclists, the youth and the elderly.
- The National Guidelines for Traffic Calming should be revised and updated. Experiences with the document as well as new research and development should be incorporated into the new guidelines.

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