

THE SIGNIFICANCE OF NON-MOTORISED TRANSPORT INTERVENTIONS: A CASE STUDY OF GREATER SEKHUKHUNE, LIMPOPO PROVINCE, SOUTH AFRICA

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ABSTRACT

South Africa has a significant proportion of learners (64%) that use walking as a means of transport on a daily basis to a place of education, and workers (21.1%) to place of work (Statistic SA, 2014), that are predominantly located in peri-urban and rural areas. In Limpopo Province, about a quarter of workers walked all the way (32,3%), majority of those who walked all the way to work were found in rural areas (38,4%) as opposed to urban areas (21,2%) (Statistic SA, 2014). Non-Motorised Transport (NMT) planning should have greater priority in rural areas, but it is largely neglected, due to the lack of awareness of the role of NMT modes of transport, minimal funding and other basic transport infrastructural needs take preference over NMT. Non prioritisation of NMT among other reasons, results in high rates of pedestrian accidents, with approximately 40% of pedestrian fatalities recorded in South Africa (Arrive Alive, 2012). The primary purpose of the research is to discuss NMT road user safety by investigating and evaluating effective and appropriate measures that will address poor NMT facilities and infrastructure arrangement that meets the needs of NMT users in the study area of Greater Sekhukhune in Limpopo.

1. INTRODUCTION

1.1. Background

“In rural areas there is that very often little provision of infrastructure for pedestrians and cyclists. These road users must share rural roads with vehicles that can sometime travel at very high speeds. On many roads, this problem is somewhat mitigated by the provision of paved shoulders that can be used by pedestrians and cyclists, but on many other roads, only gravel shoulders are available. Narrow road bridges, cuttings and fills often also create problems for pedestrians” (South Africa Department of Transport, 2003).

According to the National Transport-logistic report for published by Price Water Coopers (PWC), 2015, South Africa is regarded as one of the African countries with good infrastructure. However, this superior infrastructure is concentrated in urban areas and is rarely visible in rural areas. This condition is exacerbated by the fact that different municipalities are trying to improve their infrastructure with little

success, mainly due to high costs and insufficient technical resources, which often results in low quality designs and non-sustainable project approaches (Rathete, 2010).

“About 40% of all road fatalities in South Africa involve pedestrian and most pedestrian accidents (about 65%) happen when pedestrians cross a road while about 15% occur when they walk in the road and 10% when they walk on the verge” (Arrive Alive, 2012)

Many rural and peri-urban settlements have been left in the cold, due the country’s spatial development and town planning, with little or no existence of links between them and the urbanised settlements (South Africa Department of Transport, 2007). The existing practice of providing comprehensive road infrastructure that caters to all types of road users in urban areas; and only providing rural to urban links, often through higher order roads in rural and peri-urban settlements, has manifested into the current setting where roads in rural localities are primarily designed to meet the needs of motorised transport with little room to stimulate the co-existence between the other various modes of transportation (South Africa Department of Transport, 2007).

1.2. Research Questions

The questions leading to the ultimate findings in this research paper include:

- Policy and Framework: Since the development of NMT frameworks and policies for rural areas; to what extent is change brought about in safe and adequate NMT access to social facilities with the local study area?
- What is the current existing level of NMT infrastructure, within the selected rural case study area in Limpopo, in comparison with other road infrastructure?
- What are the critical repercussions identified in the study area due to the lack of adequate NMT facilities and amenities?
- Engineering, Education, Enforcement and Encouragement: To what degree were the four E’s of safety taken into account during the implementation of the R579 and R555 running through the built-up area in Sekhukhune?

1.3. Purpose for research

The primary purpose of this study is to highlight the current existing conditions of NMT interventions, constraints and opportunities within the selected study rural area in South Africa. The research has underlined the importance, the role, the benefits, design parameters, and influencing factors of NMT in order to have a clear understanding on the significance of the NMT and its required adequate facilitating infrastructure within rural and semi-rural areas in South Africa and at large, within African rural settlements.

1.4. Scope of the Research

The research conducted was limited to a specific South African rural location. The study was based on a case study area of Greater Tubatse Local Municipality, Ward 27, 28 and 29, located in the Limpopo Province South Africa, see Fig. 1. The three wards are serviced and dissected by the surveyed links.



Fig. 1. Location Area Maps: South Africa, Limpopo and Sekhukhune District Municipality

The study area was selected because of the layout of the land use in the area. All the primary schools which service young pedestrians are located adjacent to the high mobility roads which poses as safety issue for vulnerable pedestrians.

Of the three surveyed link, one is unnamed which is between the R37 and R579 of the study and referred to R579/R37 above. For the purpose of this study, it will be named “Link A1”;

2. METHODOLOGY

The method used for the research project was a combined qualitative and qualitative research method. The approved methods were used to collect the required data over a period of six weeks. These methods were used in order to determine the answers to the critical questions stated in item 1.2.

The study is focused on the construction of a case study analysing the NMT related problems in a rural community of the Greater Tubatse Municipality, Sekhukhune in Limpopo Province, South Africa. In order to obtain conclusive results regarding the significance of NMT in rural areas, data was collected from the selected case study. This included pedestrian surveys, site observations, road safety audit, interviews with various stakeholders and performing analysis of statistics given.

2.1. Literature Review

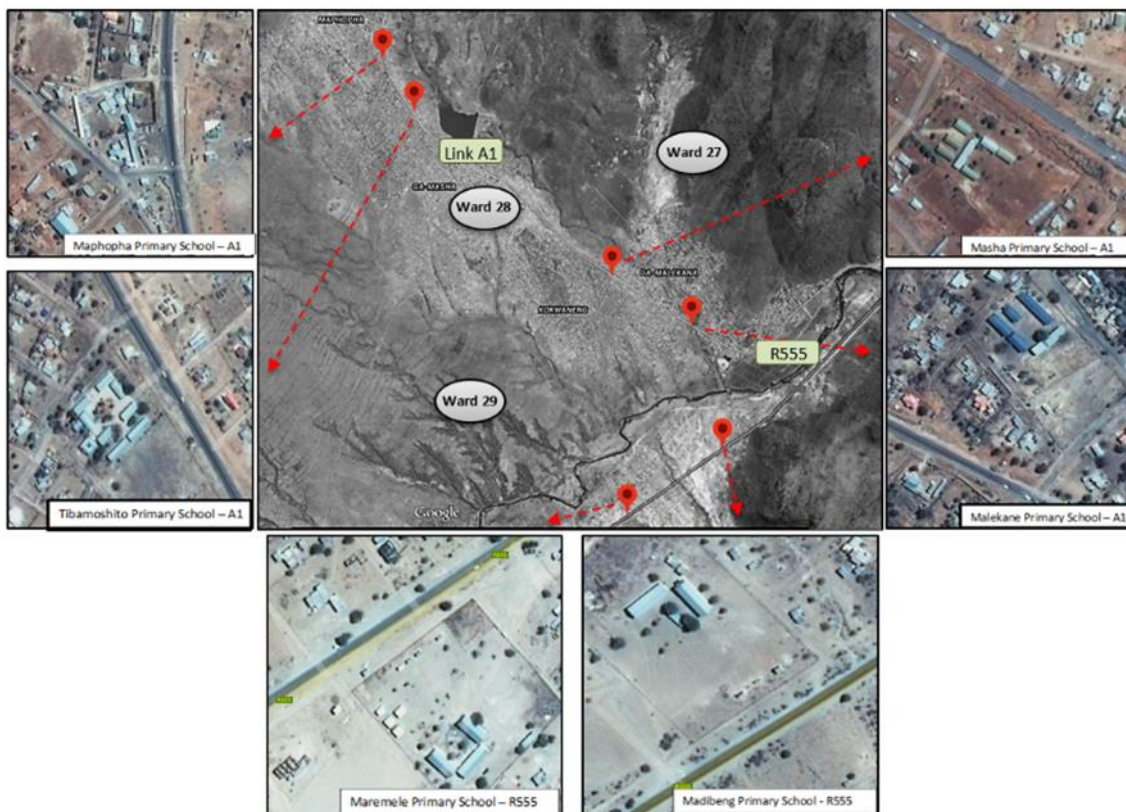
National and international literature was done in order to understand the impact of NMT infrastructure provision and other relevant interventions. The secondary data were collected from the review of academic journals, best practices, published and unpublished materials, government policies and frameworks from all three spheres of government, internet and print media.

2.2. Collection of Data

2.2.1. Location of data collected

The location for assessments, were identified together with the Traffic officer based on the location of high pedestrian concentration and where high accidents are recorded in the study area, see **Error! Reference source not found.**

- Maphopha Primary School – A1
- Tibamoshito Primary School – A1
- Maremele Primary School – R555
- Masha Primary School – A1
- Malekane Primary School – A1
- Madibeng Primary School - R555



2.2.2. Type of Data, Sources of Data and Collection Methods

The author was guided by the “Non-Motorised User Safety- a Manual for local rural road Owners” (Nabors & Sawyer, 2012), in order to formulate the questions for the instruments that were used during the data collection process, which were reviewed and approved by the University of Cape Town. The instruments used during the data

collection process focused on and, were made sure to be applicable to the guiding questions.

Information was collected by direct site observations, administering survey questionnaires, site photographs, site auditing, GIS or Google maps and by interviewing key community members. Pedestrian survey questionnaires, were performed in July 2013 as part of the pedestrian safety and security and NMT infrastructure assessment. The questionnaires related to socio-economic background of the respondents, the mode used for trips, the purpose of the trip and respondents inputs on views on how to improve pedestrian safety in the area. The questionnaires also contained questions regarding level of knowledge with respect to rules of the road and road signs, as well as a level of understanding of what is safe pedestrian behaviour.

This was followed by scheduled personal interviews of key community members that demonstrated to have a good understanding of the area, its people, and the road safety challenges experienced by the community.

The results were analysed in relation to the data collected from questionnaires, field observations, interviews and graphical information. The information acquired was cross examined to determine reliability and validity of the approach. The outcomes of the analysis were used to develop the method proposed in the research, and to draw conclusions and make recommendations.

3. CASE STUDY AREA

The study was based on a case study area of Greater Tubatse Local Municipality, located in the Limpopo Province South Africa. Local Municipality is made up of 31 wards which comprises of 166 villages (The Greater Tubatse Municipality, 2009). The geographical area of the municipality is approximately 4500 km².

The research concentrated on three of the 29 wards of the local municipality namely; Ward 27, Ward 28 and Ward 29 because the wards are serviced by the main roads that the author surveyed. The population of the three wards combined is 36 000 people that make up a total of 7 500 households (Census 2011, 2012).

3.1. Land Use

Fig 3 below indicates the land use within ward 27, 28 and 29. The study area is well represented by a number of schools, of which nine are primary schools and two high schools.

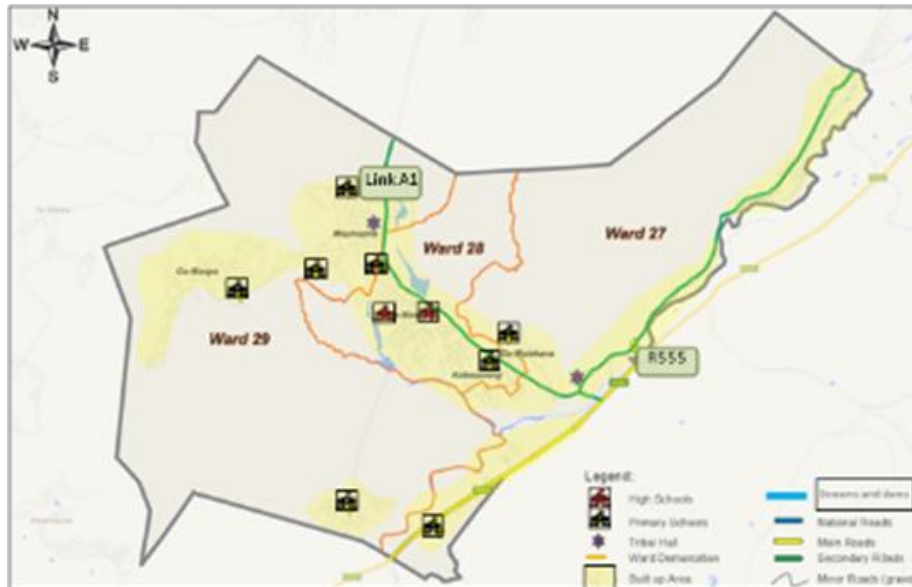


Fig. 3. Land use map

Majority of the schools are closely located to major routes running through the villages, which poses a major pedestrian safety risk. Most of the land uses, predominantly residential areas, have been developed in parcels around a secondary road network.

3.2. Transport and Road Network

3.2.1. Existing Transportation Network

The study focuses on two major links; the R555 and Link 1A. Both the mentioned links run through built up communities, connecting Polokwane and Burgersfort and Tshwane and Burgersfort respectively

3.2.2. Mode of Transport

At present, the car ownership is relatively low at 19% as compared to commuters who use alternative modes of transport (Sekhukhune District Municipality 2014). This evidently demonstrates that wards 27, 28 and 29 are a predominantly pedestrian community with an average of 81% of the population using foot as a mode of transport to access their final destination, or public transport (Sekhukhune District Municipality 2014).

3.2.3. Road Network Infrastructure

Transport infrastructure is crucial to the development of any nation (DBSA: 2006). Sustaining an effective accessible road network in rural areas, like the study area, is a challenge (Greater Sekhukhune District Municipality 2010). The study area is mainly characterised by gravel road, which showed to be rarely maintained through municipal programs. Fig 4 illustrates an example of the road conditions in the studies area which are in bad condition, filled with potholes and faded barrier lines



Fig. 3. Existing Road infrastructure and challenges along Link A1 and R555

3.2.4. NMT Network Infrastructure

Pedestrian sidewalks that are supposed to serve the large amount of commuters travelling by foot are non-existent. The only provisions made are pedestrian crossings which need to be repainted and a few bus shelters constructed on the new link just off the A1. Another challenge for pedestrians in the area, predominantly school kids, is the lack of crossing bridges over the distributaries running through the community from the Steelpoort River, see Fig. 4.



Fig. 4 Existing NMT infrastructure and challenges along Link A1 and R555

4. FINDINGS

4.1. Policy and legislative framework guiding rural NMT planning in South Africa

The existence of regulatory and institutional systems that promote and encourage NMT is one of the key pillars that will ensure the inclusion of consistent NMT planning processes. A series of national, provincial and local policies and frameworks were analysed in relation to the study area and rural areas at large.

The Limpopo Province Department of Roads and Transport's mission is "to develop, co-ordinate, implement, manage and maintain an integrated and sustainable multi modal transport system and appropriate infrastructure" and envisions "An integrated, safe, reliable, affordable, and sustainable multi-modal transport system and adequate infrastructure" (Limpopo Department of Roads and Transport 2014).

There is substantial backbone to rural development, rural transport planning, including NMT, from the national and provincial policy and legislative point of view. Furthermore, The National Department of Transport (DoT) has mandated all tiers of government to allocate adequate and sustainable funding for the development and promotion of NMT. The existing frameworks and policies provide adequate guiding principles, however it is evident that physical manifestation of the principles contained in the policies are lacking.

In terms of the Constitution (ref?), municipalities are accountable for municipal roads, municipal public transport, municipal planning, and roads and traffic. The municipal policy documents (Municipal Structures Act (1998) and Municipal Systems Act (2000), were examined and showed a significant awareness of the need to address, promote, and accommodate NMT in current and future years. This pertains to the planning and executing of operations and infrastructure, and to respond and complement the trends in national and provincial policy.

4.2. Analysis of Questionnaires

4.2.1. Demographics

According to the Census survey done in 2011, females made up 52% and males comprised of 48% of the population in the three wards in this study, therefore the data collected is a close true reflection of ward 27, 28 and 29 (Census 2011 Municipal Report 2012). The data implies that in the age group of 28 – 40 years which, most fall under the youth category, are the main users of NMT.

4.2.2. Travel Mode

People of Ward 27, 28 and 29 of the Greater Tubatse Municipality indicated that walking has become an intricate part of their daily lives, despite the significant difference in status of employment or lack of adequate facilities in the area.

Furthermore, the use of bicycles was not observed in the community, however 2% of respondents preferred to use bicycles as a mode of transport. It is, therefore, recommended that, they should be considered, see Fig. 5.

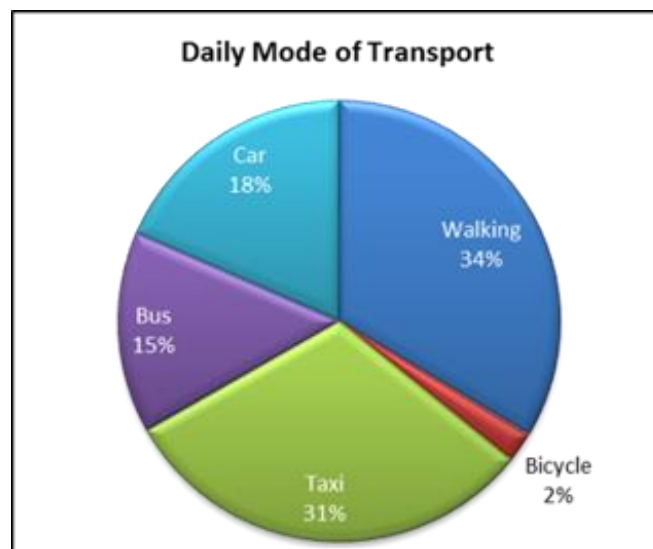


Fig. 5 Preferred mode of Transport

4.2.3. Road Safety

The questionnaire revealed that the knowledge of rules of the road and on road signs were high, with 89% of the participants answering correctly with respect to road signs and 86% demonstrating they understood the rules of the road. The 83% of the participants showed understanding on the importance of pedestrian safety, 91% were for road safety education in the community (see Fig. 6).

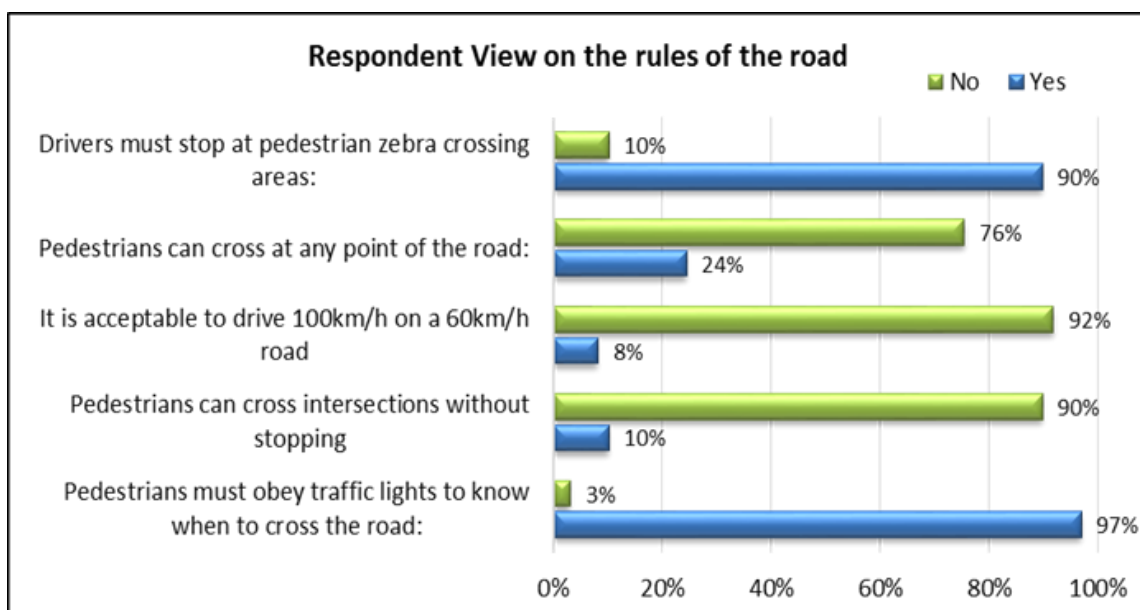


Fig. 6. Respondents views on road rules

Participants from the semi-structured interviews felt that there seems to be a lack of road safety knowledge and the most contributing factor is the issue of illiteracy. It

was mentioned that adult pedestrians ignore road signs, and that most commuters battle in interpreting road signs because they cannot read. Therefore, road signs do not translate anything to the majority of them.

Furthermore, it was indicated that the community implemented a Community Pedestrian Safety Project (CPSP) which involves the local community by liaising and training local members of the community to actively participate in road safety. This is more targeted at pedestrian safety education in schools. The CPSP aims at not only improving road safety knowledge amongst children but for the children to also actively participate (Groenewald 2013).

Road safety should, however, not only be focused on pedestrians, but more emphasis needs to be made towards motor vehicle drivers. In some cases, reckless drivers are perceived to be the main causes to pedestrian accidents, and it is vital for them to understand and adhere to rules of the road.

4.2.4. Pedestrian facilities

The importance of pedestrian facilities was also questioned, and the participants rated between 75% and 92% regarding shortage of different facilities, which include; from pedestrian phases at traffic signals, sidewalks, raised pedestrian crossings, road side barriers, lighting etc. When asked specifically what pedestrian facilities should be implemented, more than 75% requested more road signs, 65% requested sidewalks, and 62% requested more speed humps and 36% asked for more zebra crossings.

4.3. Analysis of Accident Data

In the ward 27, 28 and 29 area, Fig. 7 shows that an average of 47% of road accidents consist of pedestrians and according to the traffic officer interviewed, he indicated that from the collected statistics within the municipality, the majority of the accidents involved kids aged between 6 and 18years.

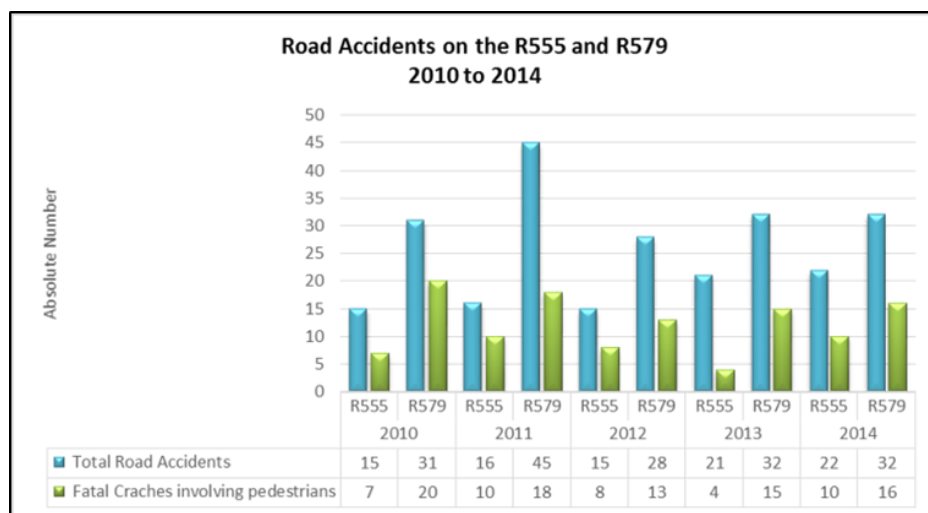


Fig. 7. 2010 -2013 Accident Trends

The R555, R579/37 runs adjacent to primary and high schools with a number of kids traveling by foot to access the schools. During the focused individual interviews, it was mentioned that the children in the community are the ones who are mostly involved in accidents. They further elaborated that this is due to the kids having to cross the road unaccompanied to get to school and back.

4.3.1. Reasons for accidents

During the focused individual interviews, the participants pointed out the following reasons when asked what could be the main reason for these accidents:

- Reckless vehicle drivers who don't adhere to the road speed limits or road signs in the area.
- Unattended domestic animals next to the road, which made vehicle movement difficult.
- No provision of adequate NMT facilities or road signs, which results in pedestrian's jay walking or walking on roads for convenience and comfort as opposed to gravel roads.
- Ignorant pedestrians and unattended school kids crossing the road, mostly during peak times of the day.

4.4. The road safety audit

Based on the issues identified from semi-structured interviews, road safety audit was done and this section gives a summary of the findings. Furthermore, the audit was executed to determine if the four E's of road safety, namely; Engineering, Enforcement, Education and Encouragement, were taken into account during the implementation of the studied routes.

This section includes not just an assessment of the pedestrian and road safety problems but also recommendations of how to improve the road safety in the study area.

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The objectives of a road safety assessment are to (Road Traffic Management Corporation, 2012):

- Provide an independent assessment of the design from a road safety perspective; Look beyond the project limits and consider the effects in transition areas the proposed design will have on the existing built environment;
- Identify potential safety problems for the particular design or section of road project; and
- Ensure that measures to eliminate or reduce the problems are presented to the asset owner for consideration.

An additional category is used to denote actions which may not improve safety, but which are needed to correct unintended non-conformances or poor maintenance.

Table 1 to Table 3 demonstrates the risk rating assessment process as outlined in the RTMC South African Road Safety Audit Manual (2012).

Table 1: Likely frequency of the problem to lead to a crash

Source: (Road Traffic Management Corporation, 2012)

Likelihood	
Frequent	Once or more per week
Probable	Once or more per year (but less than once a week)
Occasional	Once every five to ten years
Improbable	Less often

Table 2: Likely severity of the resulting crash

Source: (Road Traffic Management Corporation, 2012)

Severity of resulting crash	
Catastrophic	Likely multiple deaths such as: High-speed, multi-vehicle crash on a freeway Car runs into crowded bus stop Bus and petrol tanker collide Collapse of a bridge or tunnel
Serious	Likely death or serious injury such as: High or medium-speed vehicle/vehicle collision High or medium-speed collision with a fixed roadside object Pedestrian or cyclist struck by a car
Minor	Likely minor injury such as: Some low-speed vehicle collisions Cyclist falls from bicycle at low speed Left-turn rear-end crash in a slip lane
Limited	Likely trivial injury to property damage only such as: Some low-speed vehicle collisions Pedestrian walks into object (no head injury) Car reverses into post

Table 3: Resulting level of risk

Source: (Road Traffic Management Corporation, 2012)

Resulting level of risk		Likelihood of crash			
		Frequent	Probable	Occasional	Improbable
Likely severity of crash	Catastrophic	Intolerable	Intolerable	Intolerable	High
	Serious	Intolerable	Intolerable	High	Medium
	Minor	Intolerable	High	Medium	Low
	Limited	High	Medium	Low	Low

4.4.1. Likelihood, Severity and Risk Rating of identified 5 key elements:

From the assessment findings, all the 6 location that were assessed presented similar pedestrian and road safety issues. From the findings of the assessment, five detrimental road and pedestrian safety key elements were derived from the 6 locations and further assessed in terms of the likelihood, severity and risk taking, see Table 4.

Table 4 Resulting level of risk – R555, R579/37

Identified Key Aspects	Description	Likelihood	Severity	Risk Rating
Pedestrian Crossing	Pedestrians/scholars were observed walking on the road (jaywalking) or running while crossing the road. Perceived to be an uncomfortable and unsafe environment for pedestrians, especially if there are vehicles on road passing at speed. Running also increases the chances of them falling especially carrying a heavy backpack.	Frequent	Serious	Intolerable
Poor visibility at late afternoon of pedestrians	Glare late afternoon and reduced visibility of pedestrians at night contribute to higher pedestrian accident and fatality rate at night.	Frequent	Serious	Intolerable
Speed management	Drivers were perceived to be driving over the speed limit and observed to take unnecessary risks overtaking slower vehicles. This was compounded with heavy vehicles overtaking each other.	Occasional	Serious	High
Posted speed limit	The posted speed limit along the R555, A1 within the study area is 80 km/h. A typical driver would anticipate the operating speed limit of a two lane rural national road to be 120 km/h. Drivers appear to exceed 60 km/h	Probable	Serious	Intolerable
Public transport	Lack of public transport facility. Vehicles stop on the R555, A1 to pick up passengers.	Probable	Serious	Intolerable

5. RESPONSE TO THE RESEARCH QUESTIONS

In the first section of the paper, four questions leading us to the ultimate findings were established.

Q1: Policy and Framework: Since the development of Transport frameworks and policies for rural areas; to what extent is change brought about in safe and adequate NMT access to social facilities within the local study area?

To determine the answer to the question above, it is important to reproduce the vision and mission statement of the Limpopo Province Department of Roads and Transport; which reads:

Vision: “An integrated, safe, reliable, affordable, and sustainable multi-modal transport system and adequate infrastructure.”

Mission: “To develop, co-ordinate, implement, manage and maintain an integrated and sustainable multi modal transport system and appropriate infrastructure.”

(Limpopo Department of Roads and Transport 2014)

The vision and mission statement is realised in the Limpopo Province, however, mostly in the urban planning sector of the province. Urban/city planning has taken priority over rural area planning with regards to funding, implementing and maintaining. And should funds be allocated to rural areas for infrastructural and rural development, motorised transport takes priority over NMT often. The dominant position of urban planning and motorised traffic planning is one of the major deterrents for NMT planning and implementation within rural areas.

Government administration responsibilities of any province or local municipality revolves around planning, providing funding, implementing and maintenance. With regards to the study area, through the data administration process, it can be deduced that since the development of any transport related policies or frameworks, very little has been achieved.

Q2: What are the current existing level of NMT infrastructure within the study area in comparison with other road infrastructure ?

Section 4.4 of the paper discusses the key findings from the analyses of the road safety audit data collected in Ward 27, 28 and 29. The following are some of the finds that describe the current existing level of NMT infrastructure in comparison to the road infrastructure:

Lack of NMT Infrastructures

The research identified that there is a lack of pedestrian infrastructure, which are gravel based. The entire study area lacks constructed facilities, and adequate pedestrian signage, including traffic calming, and traffic speed controls. The study area presented no public transport facilities, such as holding areas, taxi laybys or bus stops. Taxi and bus drivers require convenient and safe areas to pick up and

drop off user's at all demarcated origins and destinations stops. Public transport facilities are important not only to encourage the use of services, but also to stop problems related to spontaneous parking on the side of road. Existing road and pavement conditions on the two study routes are in a bad condition, with potholes and drainage issues due to poor design and maintenance.

Level of accessibility: Pedestrian Paths

The study is characterised by a large amount of desire lines and gravel roads off the R555 and Link A1. The roads lack the connectivity and accessibility that can encourage NMT within the community. Lack of pedestrian bridges across water streams pose a challenge for pedestrians, more especially during the rainy season. Pedestrians are uncomfortable with having to cross the stream, which also poses as safety issue for vulnerable pedestrians.

Maintenance of existing infrastructure neglected

The study found exiting pedestrian raised speed humps and zebra crossings. However all the crossings had faint road markings and with the majority not done according to the standard specifications. Poorly maintained roads constrain mobility, significantly increase accident rates, and aggravate isolation, poor health, poverty, and illiteracy in rural communities (Burningham and Stankevich 2005).

Q3: What are the critical repercussions identified in the study area due to the lack of adequate NMT facilities and amenities?

The lack of adequate planning and implementation for NMT in rural areas has had a large negative impact on the following in the community:

Pedestrian Safety and Security.

As stated above, Ward 27 - 29 areas have significant death data per studied route in all identified NMT areas. Accident rates are tremendously high by world-wide standards and the main principal of NMT is to provide safe, good quality NMT facilities and amenities. The death toll of pedestrians, mainly learners who have to travel long distances by foot to access areas of education, is one of the consequences due to the lack of adequate infrastructure. The rate of accidents has caused a lot of pain and suffering for the victims' families in the community. For most families, some of the victims are considered as bread winners and their loss results in a loss of income, which in the end affects the standard of living.

Pedestrian safety is, however, not limited to road accidents only, but extended to personal violation incidents such as mugging and rape. In most cases, these incidents take place in areas that not busy or during the night. The studied area presented no form of street lighting implemented, which contributes to the lack security and safety for pedestrians.

Accessibility

Internal roads are impossible to access within the Wards. The study area has unplanned settlements, where walkways or paved roads are absent. This is the result of poor pathways, which were in most cases earthen and narrow. This problem forces pedestrians to make use of the roadway which is encouraged by the lack of all weathered surfaces.

Q4: Engineering, Education, Enforcement and Encouragement: To what degree were the four E's of safety taken into account during the implementation of the R579 and R555 running through the built-up area in Sekhukhune?

To have an effective sustainable transport system means there is a need to address transport related issues at different spheres of the transport field by working together as engineers, educators, law enforcement officials and other stake holders like employers, community leaders, and emergency services and health care officials. From the site inspection, the following was observed regarding the 4 E's:

Engineering-

During the site observation it was evident that during the construction of the R555 and Link A1, the provision for NMT facilities was not taken into account. This is mainly due to lack of funds in the municipality and designs that lack the NMT provision. Furthermore, traffic calming measures are limited and not implemented at all identified pedestrian concentrated locations such as primary schools and local shops. When plans for these roads were done, it can be concluded that road safety and security for NMT users was not considered.

Education

Road safety education in schools is encouraged and practiced in primary schools as indicated by the two teachers who were interviewed. This is also shown in the questionnaire assessments with more than 85% of the respondents showing to have good knowledge on rules of the road and on road signs. Furthermore, there are numerous organizations that are prepared to support the NMT sector. The CPSP program is one of first initiatives where its primary purpose is to improve road safety knowledge amongst children and to also actively implement road safety in order to change behaviour (Groenewald 2013). To ensure the success of this program it is imperative to have community leaders lead this program by pooling financial muscle and prioritising these programs and projects.

Enforcement

Law enforcement was not visible during the period of the assessments and motorists travelling above the speed limited where noticed at that time. Therefore, it can be concluded that, the level of ensuring that vehicles and road users are complying with road regulation is low which poses as a safety risk for pedestrians. However, during high pedestrian movement of scholars in the morning and afternoon, only three of the studied locations identified scholar petrol activities taking place along Link A1.

Evaluation

“Success can only be confirmed or failures identified through monitoring and evaluating the outcomes of initiatives” (Arrive Alive, 2011). Road infrastructure in the community seems to have been dilapidated over some time without monitoring or evaluation. Through monitoring and evaluation, problems that contribute to low pedestrian safety can be identified and mitigated

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

This research paper gives an overview on the significance of NMT, and its position in total mobility. From the research, it can be concluded that well-planned implementation of NMT infrastructure for wards 29, 28 and 29 is needed. Successful implementation and integration of non- motorised transport in the studied areas, and in all rural areas at large, creates a safe and well-balanced transport system. This is solely dependent on adequate developments of NMT facilities and infrastructure, road safety educations and awareness, promotion and visible and active traffic law enforcements that will encourage road safety.

Furthermore, the significance of this research is based on enhancing our understanding on the importance of NMT and the users of NMT in order to achieve proper planning and implementation. A deeper understanding of the planning process permits interested stakeholders to develop innovative strategies which will have a greater likelihood of success. A deeper understanding of the challenges faced by the NMT users, and more importantly the cause of these challenges is more crucial when it boils down to delivering a safe and convenient system for all intervention.

6.2. Recommendations

To develop a supporting environment for NMT, the significance of the NMT infrastructural and educational interventions in rural areas needs to be realised. This will ensure that road safety and security, encouragement of affordable modes of transport, improvement of health, or other potential benefits are addressed and implemented. In order to achieve that, the following is recommended:

- When new roads are being planned, designed and constructed and when existing infrastructure is rehabilitated, cycle lanes and pedestrian sidewalks should be included, and not excluding lights and other applicable amenities. Furthermore, extra programs focusing on adult road safety education are required to encourage safe walking skills.
- NMT needs to be mainstreamed and well integrated into the streetscape to modify the status quo (Gauteng Province Department of Roads and Transport 2013).
- Law enforcement is required to be more visible in the study, more especially during peak hours when children are traveling to schools to ensure the safety and security of NMT users.

- “In South Africa, NMT is often considered as an add-on and there is, therefore very little evidence of consistent NMT planning and infrastructure provision in most areas” (Gauteng Province Department of Roads and Transport 2013). A more realistic approach is needed to recognise the valuable role of the NMT mode in rural areas in order to promote walking and cycling; politicians and officials need to shift focus from giving motorised traffic priority over NMT.
- To assist municipalities in systematic planning and implementation of NMT facilities, it is important that they adopt NMT policies and strategies that will support and expand the role of NMT modes in rural transport, backed up by NMT master plans (Ribbens 2014).
- Municipalities that are not in the forefront in planning and implementing road infrastructure effectively should take initiative to learn from municipalities or countries with similar attributes that have successfully implemented NMT facilities.
- The DoT, with the support of the provinces, municipalities, and agencies should commission research projects to monitor and evaluate the current transport system within the community, and report progress on the planning and implementing NMT infrastructure.
- Authorities are required to concentrate on addressing funding mechanisms and to consider innovative or alternative ways of accessing funds that will aid in the planning and implementing of motorised and non-motorised road infrastructure. Furthermore, proper planning on allocating budgets to municipalities needs to be emphasised on, and to ensure that the money is spent accordingly; external experts should be consulted to give guidance.

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