childsafe 40
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PREVENTION OF ROAD INJURIES IMPACTING CHILDREN IN SOUTH AFRICA (PRISCA)

Analysis of Current Child Road Injury and Fatality Data

unicef

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SUMMARY

Introduction

Road traffic crashes (RTCs) claim the lives of 1.25 million people every year (WHO, 2015). Currently, the pandemic is the ninth leading cause of death around the world but is expected to rise to the seventh leading cause of death by 2050. The problem is especially acute in low- and middle-income countries (LMIC), where 90% of road fatalities occur. Kopits and Cropper (2005) predicted that with rapid increase in population, urbanisation and motorisation, road deaths will increase by 80% between 2000 and 2020 in LMIC.

In line with the above, road fatalities are a public health issue that need urgent attention. World leaders have identified two goals, through Sustainable Development Goals (SDGs) 3 and 11, to improve road safety across all countries (United Nations Development Programme (UNDP), 2015). SDG 3, specifically target 3.6, is a more targeted goal, aimed at ensuring healthy lives and promoting wellbeing for all by halving global deaths from Road Traffic Injuries (RTIs) by 2020. This target is, however, quite ambitious, considering the fact that the number of road traffic injuries plateaued between 2007 and 2013.

While high-income countries (HIC) have been successful at reducing road fatalities in their countries, similar interventions have not had the expected outcome in LMIC (Mohan, 2002). This is, due to the fact that leaders of developing countries have failed to understand the local context and define the localised problem. Consequently, road deaths have continued to burden economies and the lives of various families that tragically lose their loved ones. Wegman (2016) found that RTCs cost LMIC between 1 and 3% of their Gross Domestic Product (GDP). However, no study can account for the emotional gap that families of these victims suffer after their loss.

Children are particularly vulnerable on the road, constituting 21% of road deaths every year (WHO, 2008). In South Africa, the burden is especially high with child road deaths accounting for double the world rate (Matzopoulos *et al.*, 2008). For children aged 5-14 years, road injuries rank as the second leading cause of death after HIV-related deaths [1]. Considering these findings, and especially since approximately a third of the population are children under the age of 17 (NHTS, 2013), the health of children should be considered a priority.

[1] *https://vizhub.healthdata.org/gbd-compare/ (Accessed 12 November 2018)*

Background

In 2018, Childsafe South Africa, in partnership with the United Nations Children Fund (UNICEF) undertook a multifaceted project aimed at raising and understanding the profile of issues that children face on the road. With research from the University of Cape Town, the project emerged out of the recognition that there is limited information available in the South African context that understands children's mobility patterns and the impact of road crashes on children, on a national, provincial and local level.

This analysis forms part of a wider research project, which aims to raise the importance of issues relating to child safety in terms of road transport in South Africa. While South Africa has general policies relating to road transport and safety, there no comprehensive report on road safety in relation to children. As a result, this report presents findings of a series of secondary data analysis with a focus on children's challenges on the road. Alongside this analysis, a report has been compiled, which reviews international and global literature relating to the different facets of road safety, as they relate to children (Annex A). A third report, focusing on a policy review is also available and elaborates on the various policies related to road safety and legislation with a focus on children and whether road safety is addressed in any of these policies. These three reports will inform the development of a comprehensive advocacy plan, which aims to raise awareness on the vulnerability of children in relation to South African roads.

Structure of the report

This report is divided into two parts with each part divided into various chapters. Both parts start with an introductory chapter, i.e. Chapter 1 for part 1 and Chapter 5 for part 2, describing the methodology used and the objectives set out. At the end of both parts, a chapter on implications of the analysis findings is provided i.e. Chapter 4 for part 1 and Chapter 8 for part II.

The first part is dedicated to unpacking the demographics and travel patterns of children in the nine provinces of South Africa that impact their safety on the road. The report also provides the same findings on a disaggregate district municipality level.

The second chapter of the first part of this report – Demographics – discusses the demographics in each province in South Africa. This describes the population of children, specifically the population of each gender group, i.e. male and female child population and reveals the household income analysis.

The third chapter of this part of the report – Travel Patterns – elaborates on children's travel, describing the findings of each variable mentioned in the methodology section. The fourth chapter of this part of the report – Résumé Part I– summarises the findings of the first part and their implications for road safety in South Africa.

The second part of the report analyses the current road fatality and injury databases to understand the road related problem in the country with respect to children, in general, and certain areas in particular, where better local provincial or municipal data is available.

The sixth chapter – Road Fatalities – discusses the Road Traffic Management Corporation (RTMC) road fatality database analysis, on a national and provincial level.

The seventh chapter – Case Studies – discusses the findings of databases that provided both, road injury and road fatality data. These databases included data that provide locations of crashes from the Western Cape Province and eThekwini Municipality. Additional child road injury information is provided by the Childsafe database that manages the record of all children treated at the Red Cross War Memorial Hospital in Cape Town. The eighth chapter of this part of the report – Résumé Part II ¬– summarises the findings of the analysis and its implications.

The ninth chapter of the report – Implications – combines the findings of both parts and the measures that these findings imply on child road safety in South Africa.

Findings

Approximately 17.5 million children live in South Africa with the majority (56%) living in the provinces of KwaZulu-Natal (KZN), Gauteng (GT) and the Eastern Cape (EC) (NHTS, 2013). Within these provinces, most of the children reside in the districts of eThekwini (KZN), City of Johannesburg (GP) and O.R. Tambo (EC). The likelihood of child injuries and fatalities is higher in these provinces, where more children live.

In the case of KZN and the EC, a significant proportion of children live with a single biological parent, or no parent at all, which also increases the likelihood that children are left unsupervised on the road. No area has a significantly higher male child population. Therefore, the higher rate of male child road crashes cannot be attributed to demographics but can only be explained by personal differences (for instance, hormones and susceptibility to peer pressure).

The majority of children walk to home (43%) or to school (40%) every day. Sixty three percent of children walk for more than 15 minutes to access education in the country, with an average travel time of at least 16 minutes across all provinces. Children living in KZN walk longer, with 81% of the child population walking for more than 16 minutes. A child in South Africa is, therefore, spending a significant amount of time on roads that have historically catered for motorised cars (Vanderschuren *et al.*, 2017), and this increases the likelihood of crashes.

Approximately 1 300 children (under the age of 17 years) are killed on South Africa's road every year. From 2015 to 2017, child road fatalities increased by an overall 22%, indicating that child road safety is a challenge in South Africa. The majority of child road fatalities occur in KwaZulu-Natal, Gauteng and the Eastern Cape. These provinces also cater for most of South Africa's children, hence, this finding is expected. However, in the case of KwaZulu-Natal and the Eastern Cape, the absence of both biological parents, as mentioned previously, may be playing a major role. In healthcare research, fatalities per 100 000 population is often used as a variable to determine the relative risk of fatalities. Considering this variable, the Northern Cape, which has a relatively small child population, is found to have the highest child road fatality rate of 32.2 per 100 000 child population.

Based on vulnerability by day of the week, weekends are particularly dangerous periods for children with 42% of child road fatalities occurring over this two-day period. This is because, during weekends, the traffic is calmer, and drivers are more likely to speed on roads during the weekend. On weekdays, children are observed to be vulnerable during their travel to and from school, while over the weekend, children are vulnerable during the afternoon and evening periods, when visibility on the road is lower. Child pedestrians and passengers are at most risk during the months of April, August and December. The festive breaks of Easter and Christmas fall during the April and December months, when road fatalities are high on South African roads (Arrive Alive, 2017). Speeding, drunk driving and extensive walking are the leading cause of deaths during this period, also endangering the lives of children. Lastly, private car vehicles cause approximately half of the nation's child road fatalities.

According the Childsafe database, 2 662 children were treated for road injuries at the Red Cross War Memorial Hospital from 2015 to 2017. These injuries mostly represent children from the city of Cape Town and furthermore, represent children aged 12 years and under. During this period, the RTMC database showed that 183 child road fatalities occurred. Therefore, for every fatality recorded on the RTMC database, there were at least 14 children injured that presented themselves at the hospital. An important finding from this database, is that children aged 5-9 and 1-4 are the most vulnerable on the road, respectively.

The analysis on data with the location of fatalities and injuries suggests that highest number of child fatalities and injuries mostly occur along long stretch straight roads and in residential and school areas.

Recommendations

The findings of the various datasets points towards two focus areas that particularly cause a high number of child road fatalities and injuries – speed, alcohol and infrastructure. During weekends, 42% of road fatalities occur since traffic is calmer and drivers are more likely to speed. Many hazardous zones are also located along long stretch roads, which enable the driver to speed. A lack of pedestrian facilities and traffic calming measures amplify this.

Findings with respect to the month of the year, point towards the fact that child road fatalities mostly occur during the months of April and December, when drunk driving intensifies the tendency to speed.

In the short term, stricter enforcement may play a major role reducing child road fatalities and injuries. However, for South Africa to achieve a lasting impact on the pandemic of road fatalities, it is important to focus on educating drivers and road users on negative impact of speed and alcohol in the medium term. In the long term, the infrastructure and the environment has to be adapted to incorporate children as road users.

PART I

STATUS QUO ON CHILD DEMOGRAPHICS AND MOBILITY

OVERVIEW

Introduction

This is the first part of the report that unpacks child demographics and mobility through the analysis of the National Household Travel Survey (NHTS) 2013. The second part of the report, namely child road injuries and fatalities, follows on page 16.

Background

Literature from both international and South African studies show that males are significantly more vulnerable on the road than females. This finding applies to both the general population and to children specifically (Backett and Johnston, 1997; Mabunda *et al.*, 2008; WHO, 2008; WHO, 2015). Similarly, Braddock *et al.* (1991) and Janmohammed (2017) found that the pedestrians from low-income areas are particularly at risk since they are likely to cross more roads than pedestrians from high-income areas. In developing countries, the population is placed at a higher risk as they cross high-speed arterials that are not designed for pedestrian traffic (Behrens, 2005).

Furthermore, most road users depend on walking as their primary mode of transport in developing countries (Watson, 2015). Consequently, it comes as no surprise that the majority of road fatalities impact pedestrians (Naci *et al.*, 2009) on roads that generally cater for cars (Amend and FIA, 2016). The opposite is true in developed countries, where road users travel as drivers or passengers and road fatalities impact car users the most (WHO, 2015).

The implication of the above findings is that areas with a higher male population have a higher probability of road traffic crashes[2] (RTCs) than areas with a higher female population. The likelihood of RTCs is also higher in areas with low-income households than areas with high-income households.

Additionally, these findings infer that there is a clear link between mode usage and the road user affected in terms of road fatalities. However, few studies discuss the relationship between the two variables. For instance, Odero *et al.* (2003) and Afukaar *et al.* (2016) both found that in rural regions of Kenya the majority of road deaths impacted passengers since the local population used paratransit services to travel. Alternatively, pedestrian fatalities constituted the majority in urban areas, where the population uses walking as their primary mode.

Similarly, Moeinaddini *et al.* (2015) performed a study using a Generalised Linear Model (GLM) to define a more direct relationship between the two variables. The study found that, in France, the number of road fatalities is reduced when public transport, bicycle and walking are used more. It is, therefore, important to understand the South African local context of the various variables and their potential impact on child road users.

[2] The term 'crash' is intentionally aligned with the definition as in SANS/ISO 39001 and is used throughout this report. 'Crash' imparts the same meaning as "accident" noted in the National Road Traffic Act, Act 93 of 1996."2 The term 'crash' is intentionally aligned with the definition as in SANS/ISO 39001 and is used throughout this report. 'Crash' imparts the same meaning as "accident" noted in the National Road Traffic Act, Act 93 of 1996."

Objectives of Part I

This part of the report aimed to analyse the variables that impact the vulnerability of children as road users. The literature review conducted, as part of this research (Annex A), helped identify two primary variables that impact children on the road (i) **Demographics** and (ii) **Travel Patterns.** These variables are analysed in this part to provide a holistic overview of the challenges that children face.

In terms of Demographics, the following variables are found to have an effect:

- Child Population,
- Child Gender Division, and
- Household Income Status.

Similarly, the literature identifies the following variables as impactful on child road users in terms of Travel Patterns:

- Children's travel needs and purpose,
- Children's mode of travel, and
- Children's time of travel.

Methodology

The study analysed the 2013 NHTS data, which is recognised as the best available source for determining the demographics and travel statistics for the general population, including children.

The National Department of Transport identified 342 National Travel Analysis Zones (TAZs) through consultation with different transport authorities within the country. The whole country is divided into TAZs. These TAZs are based along the district municipalities and provincial boundaries. There are instances where the TAZs cut across the provincial boundaries (STATSSA, 2013). In this report the analysis is based on provincial and district municipality boundaries. Figure 1–1 provides a graphical representation of the district municipalities.

Figure 1-1: District Municipalities and Provinces of South Africa

This document reports the results of the NHTS analysis, with a particular indication on the most significant results. Figure 1–2 shows the described methodology sequence:

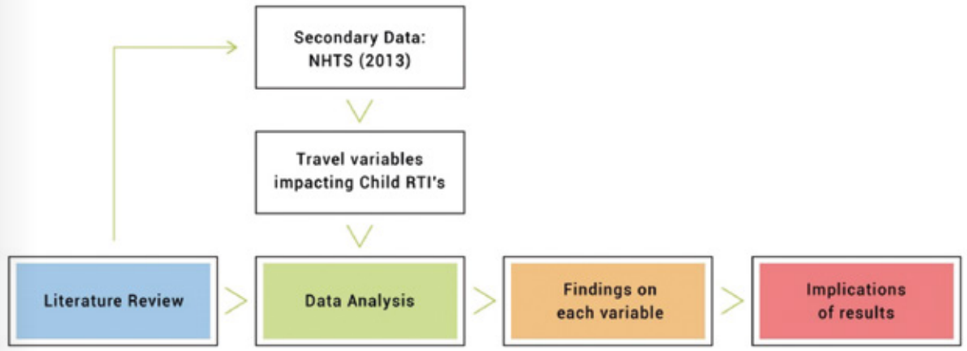


Figure 1-2: Data report part I methodology flowchart

The analysis performed has mainly used two platforms ArcGIS and Microsoft Excel. Both platforms also enabled the development of interactive maps that have been used throughout this report to display the findings. An elaborated description on the tools used is provided in the comprehensive data report (Annex A1).

Scope and Limitations

As mentioned previously, the analysis in this part is performed using the Household Travel Survey collected in 2013. The database analyses a particular sample size (approximately 157 000 persons) as representative of the national population (52,7 million). A limitation with this dataset is that it is now approximately five years old as of the publication of this report and does not, therefore, exactly provide the latest statistics. However, the NHTS still provides specific data that is pivotal when performing a national analysis and understanding the relative provincial challenges in terms of demographics and mobility.

Structure of Part I

This part is divided into three chapters.

The **second chapter** of the first part of this report – **Demographics** – discusses the demographics in each province in South Africa. This describes the population of children, specifically the population of each gender group i.e. male and female child population, and reveals the household income analysis.

The **third chapter** of this part of the report – **Travel Patterns** – elaborates on children's travel patterns, describing the findings of each variable mentioned in the methodology section.

The **fourth** and last chapter of this part of the report – **Résumé Part I**– summarises these findings and their implications for road safety in South Africa.

DEMOGRAPHICS

According to the 2010 revision of the United Nations Secretariat's World Population Prospects, South Africa's total population was 50.1 million in 2010, compared to only 13.7 million in 1950. The South African Bureau of Statistics estimates that the demographics of South Africa encompasses currently an estimated 57.7 million people of diverse origins, cultures, languages, and religions (Statistics SA, 2018).

Children constitute a significant percentage of South Africa's population. The 2013 NHTS data suggests that approximately 17.5 million children live across the nine provinces in South Africa and constitute 1/3rd of the total South African population. When comparing the nine provinces, the ratio of child population to the overall population is observed to be particularly high in Eastern Cape (38% of the population), Limpopo (38% of the population) and KwaZulu-Natal (37% of the population) (see Figure 2–1).

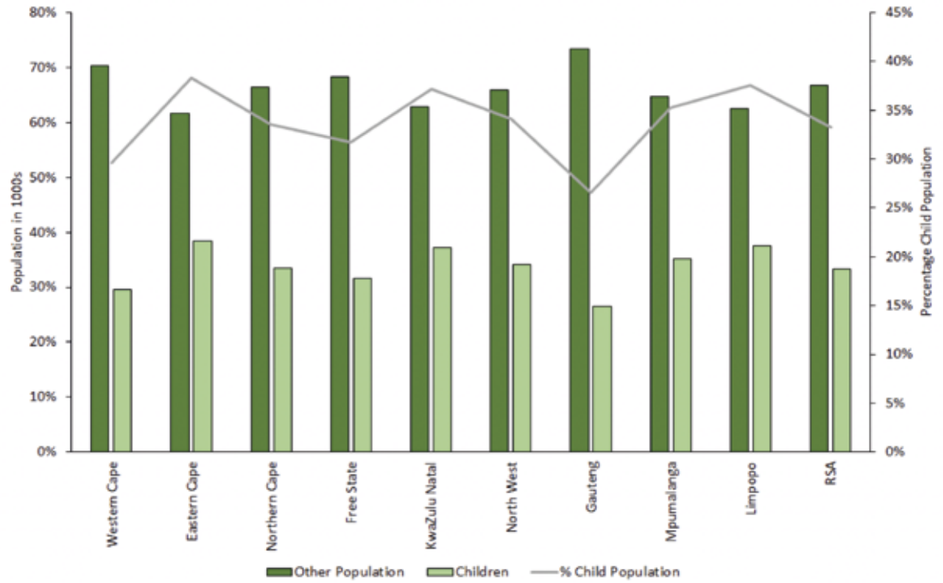


Figure 2–1: Percentage child and other population in South Africa. Data Source: NHTS, 2013

A factor that plays an important role in children's safety on the road is supervision. Zeedyk *et al.* (2002) found that a child generally finds it difficult to navigate a road because of his/her limited cognitive abilities. A role of a parent becomes crucial in this case. However, in South Africa, 26% of children aged 7-17 live without their biological parents (Figure 2–2), which does suggest that a significant number of children tend to navigate the roads without supervision. Similarly, 41% of children live with only a single parent – who is required to rotate several tasks during the course of the day – and is therefore less likely to supervise the child closely in all tasks, including crossing the road. This is especially problematic in the Eastern Cape, KwaZulu-Natal and Limpopo where a relatively higher percentage of children live without biological parents. In Gauteng and Western Cape, most children live with two biological parents but equally crucial is that a significant percentage live with a single parent.

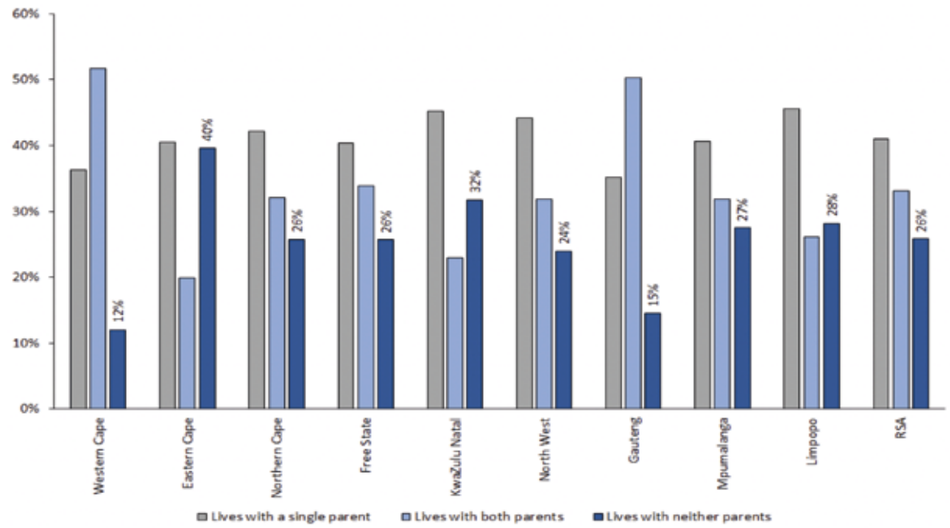


Figure 2–2: Distribution of children aged 7-17 by presence of biological parents in households and province, 2016
Source: Statistics SA, 2018

Child Population in Provinces

KwaZulu-Natal (3.7 million), Gauteng (3.4 million) and Eastern Cape (2.5 million) account for nearly 56% of the child population. Free State and Northern Cape have the lowest child populations, accounting for approximately 870 000 and 389 000 children, respectively. In terms of the male vs female child distribution, the NHTS (2013) data shows that there is an equal, or mostly equal, distribution of both genders across all provinces.

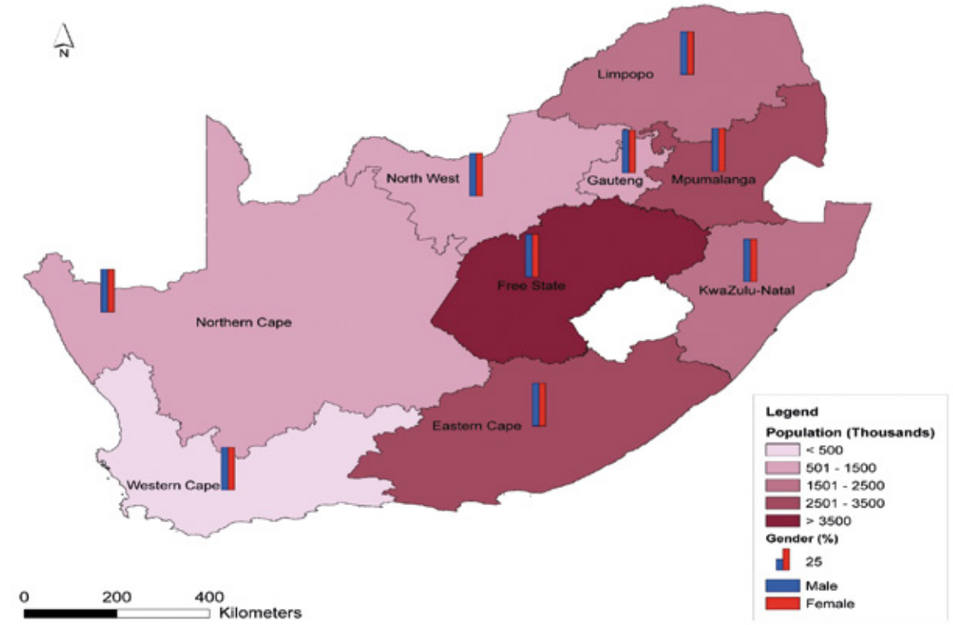


Figure 2–3: Provincial child population with gender distribution Data source: NHTS, 2013

Within KwaZulu-Natal, the majority (30%) of children live in the eThekwini District (1.09 million) with more than 300 000 children living in the districts of Ugu, Umgungundlovu, Uthungulu and Zululand. In the case of Gauteng, approximately 1.2 million children reside in Johannesburg, while approximately 860 000 and 785 000 children live in Tshwane and Ekurhuleni, respectively. Lastly, the majority of children - approximately 720 000 (29%) - in the Eastern Cape live in the O.R. Tambo district. Similar to the provincial gender distribution, all districts have an approximately equal male and female population distribution, except for the Central Karoo, where female children are considerably in the majority (58% female vs 42% male). See Appendix for district municipality figures.

Household Economics

International literature links mobility patterns to household income (Braddock *et al.*, 1991). This is likely to influence child mobility too. This section provides an indication of household income in the various provinces and district municipalities, with the aim to connect this to the child mobility section that follows.

The NHTS (2013) income data is categorised into five quintiles (Q) based on monthly income:

- Q1: Household income of less than ZAR 3 000,
- Q2: Household incomes between ZAR 3 000 and ZAR 7 999,
- Q3: Household incomes between ZAR 8 000 and ZAR 14 999,
- Q4: Household incomes between ZAR 15 000 and ZAR 24 999 (Q4), and
- Q5: Household incomes above ZAR 25 000.

Quintile 1 forms the category with the lowest monthly earnings. The analysis in this section highlights the percentage of the population in each province and various district municipalities that falls into this category (Figure 2–4).

Figure 2–4: Percentage low-income households by province Data source: NHTS, 2013

TRAVEL PATTERNS

In developing countries, the majority of road users depend on walking as their primary mode of transport (Watson, 2015). Vanderschuren and Jennings (2017) found the same, identifying that almost every urban center in Africa, non-motorised transport (NMT) and walking, in particular, is the dominant mode of travel, driven by financial necessity rather than by sustainability or health motives. The Sub-Saharan African Transport Policy Programme (SSATP), a partnership between 40 African countries, reports that walking currently makes up between 50% and 90% of daily trips (SSATP, 2015).

Vanderschuren and Jennings (2017) revealed that the percentage walking in Africa cities varies, even within one location (over time). In their analysis of three urban agglomerations in Africa, namely Dar es Salaam, Nairobi and Cape Town, walking accounted for between 20% and 90% of trips (Figure 3–1). The South African agglomeration, i.e. Cape Town, displays the lowest percentage of walking, compared to its African counterparts. In the mobility data specifically collected for Cape Town, the average walking time was 12 minutes, with a standard deviation of 19 minutes. However, the maximum recorded walking time was 4 hours. This is in line with results found by Behrens (2002), who established that low income household members, often walk home all the way in the afternoon, to save a few Rands.

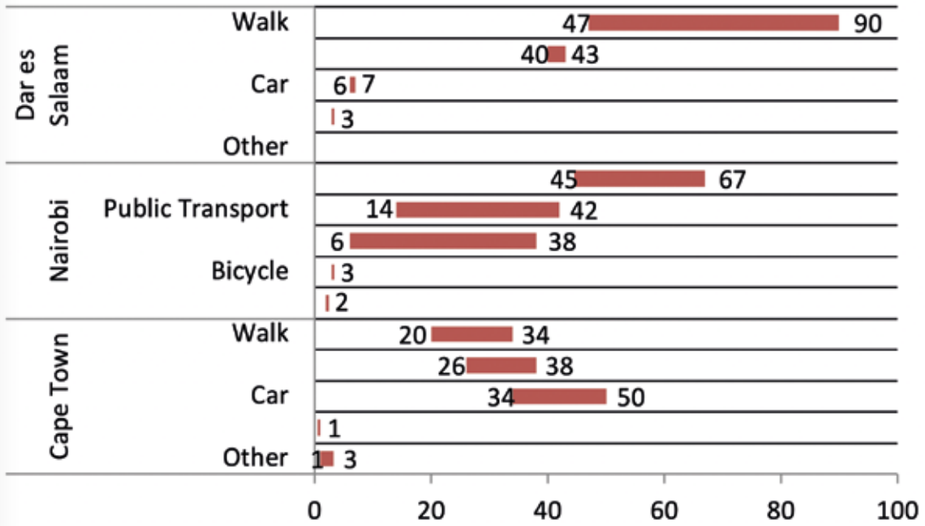


Figure 3–1: Historic data - modal split for all trips (%)

Source: Dar es Salaam: Pendakur, 1994; Howe& Bryceson, 2000; Temeke, 2000
Nairobi: Howe and Bryceson, 2000 Pendakur, 2005;
Cape Town: NHTS, 2003; Census 2011; CoCT 2013; NHTS 2013

According to the NHTS (2013), the South Africa society makes, on average, over 42.8 million walking trips per day. Some 77% of these trips are indicated to be nearly. Furthermore, over 6% of South Africans indicate that they walk by choice, while, almost 9.5% of South African indicate that using public transport is too expensive and that is why the walk. Another 5.5% of South Africans indicate that there are either no public transport services or there are not enough services.

A total of 22.8 million of walking trips are made by persons under the age of 18 years. Some 80% of children indicate that they walk all the way as the destination is nearby. Almost 9% of minors also indicate that public transport is too expensive, while another 5.7% indicates that there is either no public transport or not enough pubic transport.

Why do Children Travel?

Most children in South Africa tend to either travel to access education (40%) or to access their homes (43%) (Figure 3 2). The same finding applies across all provinces, where the children's trips are either to home or to education. However, Gauteng, Eastern Cape and Northern Cape provide interesting findings regarding this variable. There, the total trips to both destinations account for less than 80% of total trips. In these provinces, a significant percentage of children tend to also visit relatives and friends and to travel to shops.

In districts, children also tend to make, percentage wise, more trips to education or to home. However, in certain districts, children tend to also travel for other purposes. In Namakwa (Northern Cape), Thabo Mofutsanyane (Free State) and Xhariep (Free State), more than 10% of children travel to visit relatives and friends. In Namakwa and Xhariep, children also make a significant percentage of trips to shops. See Appendix for district municipality figures.

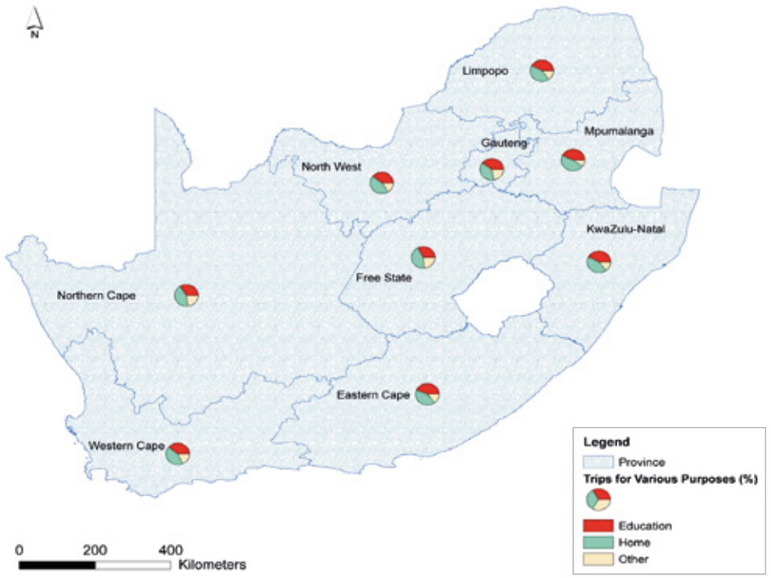


Figure 3 2: Purpose of child travel by province Data source: NHTS, 2013

How do Children Travel?

Across all provinces, when travelling for any purpose, walking is the primary mode of travel for children (Figure 3–3), with usage varying from 48% in Gauteng to 80% in Limpopo. Children also travel as passengers, either in private cars, minibus taxis (MBTs) or buses. In Gauteng and Western Cape, an almost equal number of children travel as either passengers or pedestrians.

In all districts, for all purposes, more children are pedestrians than are passengers, except in Tshwane where 45% walk vs 51% who travel as passengers and in Johannesburg, where 44% walk vs 44% who travel as passengers. When using public transport, a significant percentage of children use buses and MBTs over trains. See Appendix for district municipality figures.

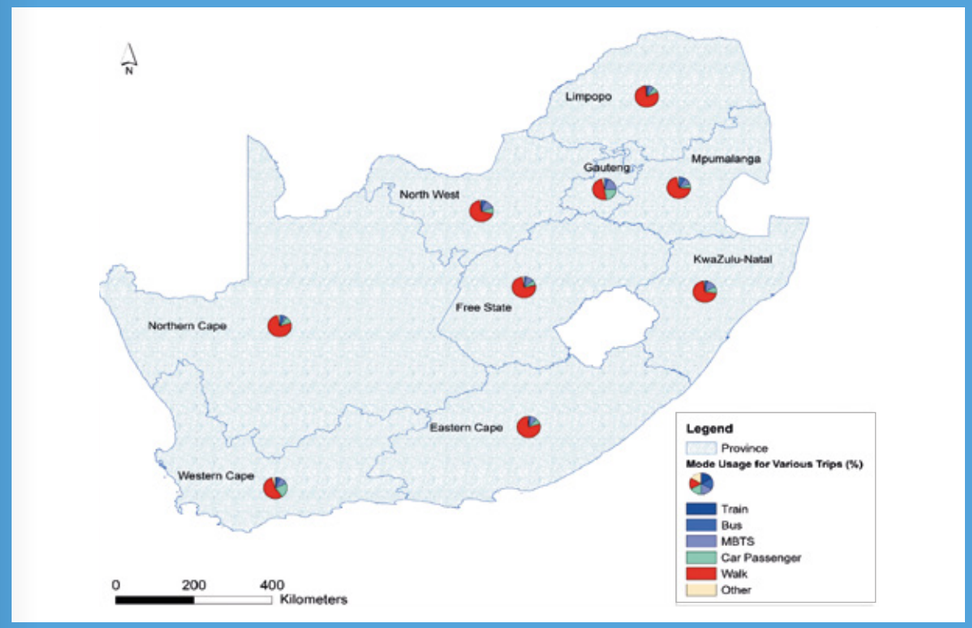


Figure 3 3: Child mode used for various purposes Data source: NHTS, 2013

How do Children Travel to School?

As seen in the previous section, a significant percentage of children either travels to home or to education, as pedestrians, suggesting that children are susceptible to road injuries on their journey to and from school and home (Figure 3–4). However, in Gauteng and the Western Cape, comparatively fewer children are pedestrians, and a significant percentage are transported as passengers in private cars. MBTs and buses are the third- and fourth-most-used mode by children.

Pedestrian children constitute the majority mode in all districts as well. More than 20% of children travel as private car passengers in Cape Town (29%), Johannesburg (28%), Tshwane (27%), Nelson Mandela Bay (27%), the Cape Winelands (24%), Ekurhuleni (22%) and Frances Baard (21%). In contrast, in certain districts — Bojanala (19%), Buffalo City (22%), Tshwane (20%), Ekurhuleni (21%), iLembe (24%) and West Rand (19%) — children mostly use MBTs.

In all provinces, most educational trips by children are within the TAZ they live. Exceptions are the Northern and Western Cape, there 21% and a staggering 52% of educational trips are outside the TAZ where children live. Regarding the district municipalities, Cacadu (Eastern Cape), Central Karoo (Western Cape), John Taolo Gaetsewe (Northern Cape), Namakwa (Northern Cape), Pixley ka Seme (Northern Cape) and Z F Mgcawu (Northern Cape) have significantly higher external education trips, indicating a combination of long travel distances to school, and smaller TAZs. See Appendix for district municipality figures.

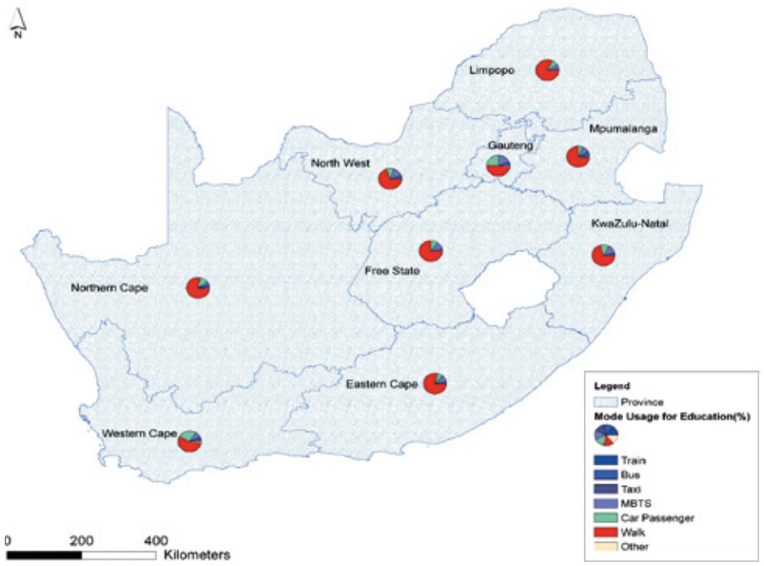


Figure 3–4: Provincial mode used by children for education

How Long do Children Travel to School?

The NHTS data (2013) shows that, on average, 63% of children walk more than 15 minutes to access education in South Africa (see Figure 3–5 and Figure 3–6). In KZN, the children walk for the longest time, in comparison to other provinces. There, 81% of children walk more than 15 minutes to school, while Western Cape children walk for the least time, with 56% making journeys 15 minutes or less. Consequently, Western Cape children are exposed to less traffic as they spend less time on the road.

Another notable finding at the provincial level relates to pedestrian journey time in the Northern Cape (NC) Province. As seen in Figure 3–7, majority of NC children make significantly higher number of trips outside their area of residence i.e. external TAZ trips (79% external vs. 21% internal). Despite this, most children (86%) complete their education trips in 30 minutes or less. At a district level, children in the Cape Winelands and Cape Town walk for the least time to access education (66% and 60% of pedestrian trips are within 15 minutes respectively) while children in the Umkhanyakude and Umzinyathi districts walk for the longest time (88% and 86% pedestrian trips are longer than 15 minutes respectively). Both districts are located in KZN, where children make the longest walking trips. See Appendix for district municipality figures.

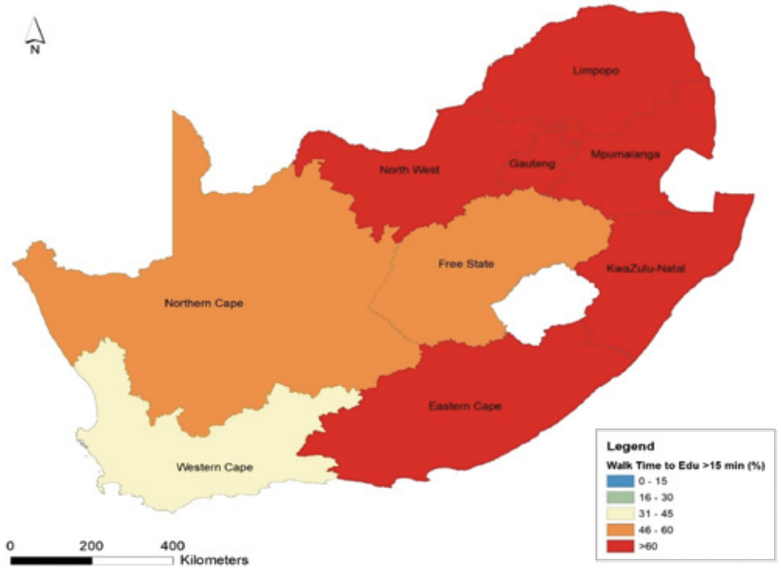


Figure 3–5: Percentage of children that walk more than 15 minutes to access education Data source: NHTS,2013

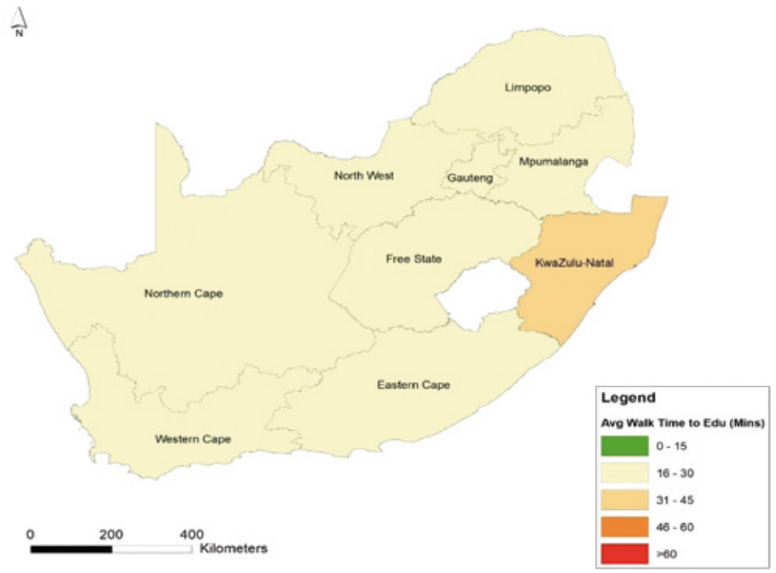


Figure 3–6: Average walking time to education for child pedestrians Data source: NHTS, 2013

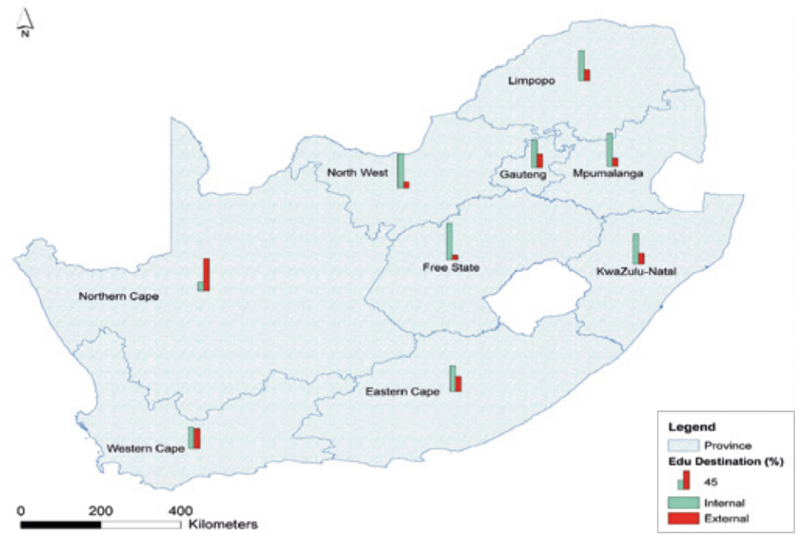


Figure 3–7: Provincial internal vs. external education trips Data source: NHTS, 2013

Children in South Africa who travel as passengers take longer to access their education, with an estimated 77% travelling 16 minutes or more. Similar to child pedestrians, compared with children in other provinces, child passengers in KZN travel more, while child passengers in Western Cape travel the least (Figure 3–8 and Figure 3–9). Mpumalanga is similar to KZN, with only 13% of children being able to access education within 15 minutes.

In the districts of Amajuba (KZN), Ehlanzeni (MP), iLembe (KZN), O.R.Tambo (GT), Umkhanyakude (KZN) and Uthungulu (KZN), less than 10% of child passengers can access education within 15 minutes. By contrast, Central Karoo (WC) and Overberg (WC) provide better accessibility to children with 68% and 55% of children, respectively, able to reach their school in 15 minutes or less. See Appendix for district municipality figures.

RÉSUMÉ PART I

Approximately 17.5 million children live in South Africa. The majority (56%) live in the provinces of KwaZulu-Natal (KZN), Gauteng (GT) and Eastern Cape (EC) (NHTS, 2013). Within these provinces, most of the children reside in the districts of eThekwini (KZN), City of Johannesburg (GT) and O.R. Tambo (EC). In terms of the gender distribution, the data shows that the number of male and female children is approximately equal across all provinces and districts. These findings suggest that the likelihood of a child being injured is higher in KZN, GT and EC, where more children live. In the case of KZN and the EC, a significant proportion of children live with a single biological parent, or no parent at all, which also increases the likelihood that children are left unsupervised on the road. No area has a significantly higher male child population, so the risks mentioned earlier of more injuries to male children can only be explained by personal differences (hormones, susceptibility to peer pressure etc.) and not demographics.

The majority of trips undertaken by children are either to home (43%) or to school (40%). Walking is the preferred mode of transport when children travel to these destinations. Consequently, it can be inferred that children are mostly travelling to and from home and school. Sixty three percent of children walk for more than 15 minutes to access education in the country, with an average travel time of at least 16 minutes across all provinces. Specifically, children living in KZN walk longer, with 81% of the child population walking for more than 16 minutes. As a result, a child in South Africa spends a significant amount of time walking on the roads, that are seen to generally cater for private cars (Vanderschuren *et al.*, 2017), which increases their likelihood of collisions with a motorised car.

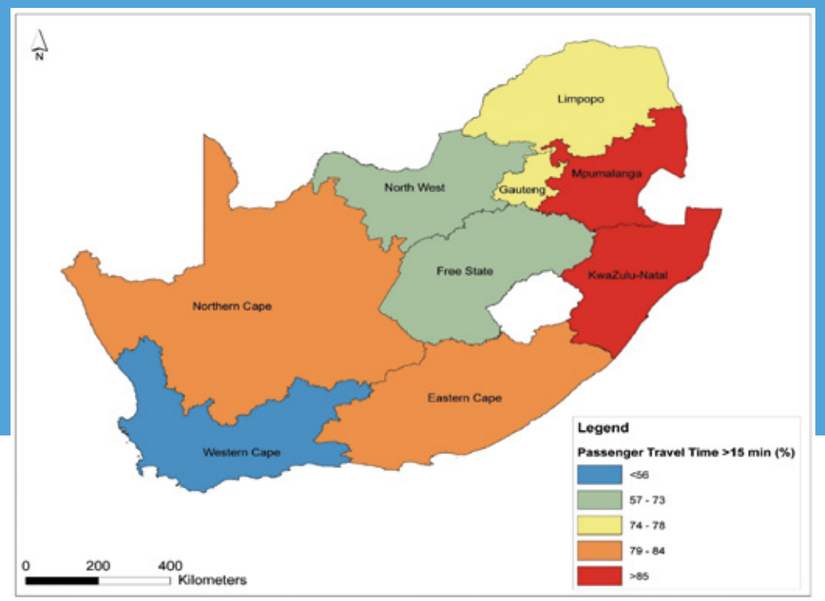


Figure 3–8: Percentage of children passengers that travel more than 15 minutes to access education
Data source: NHTS, 2013

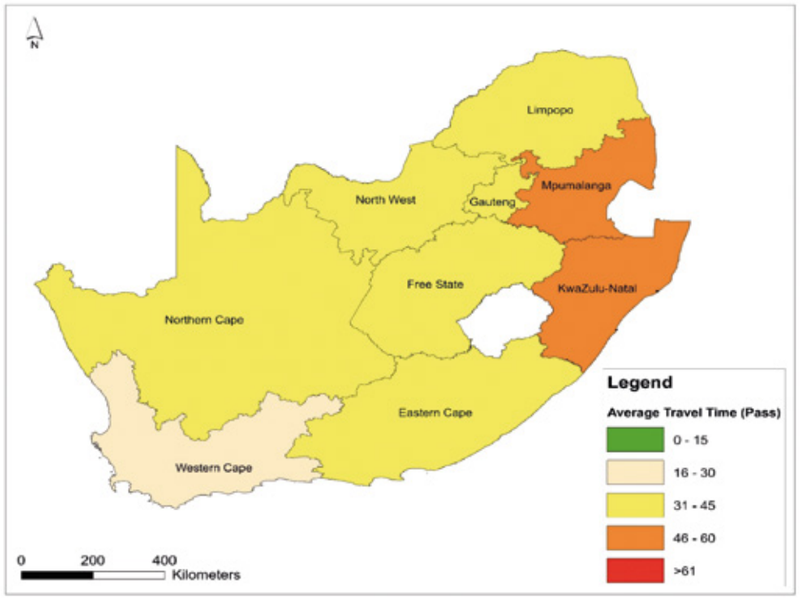


Figure 3 9: Average walking time to education for child passengers Data source: NHTS, 2013

PART II

CHILD ROAD FATALITIES & INJURIES

OVERVIEW

Introduction

This is the second part of the report that described the national analysis of child road fatalities through the use of the Road Traffic Management Corporation (RTMC) database on road fatalities. In the case of the Western Cape Province, eThekwini Municipality and Cape Town additional data was obtained from provincial or local government departments and organisations. Consequently, this part also elaborates on the analysis of these secondary databases. The first part of the report, status quo on child demographics and mobility, can be found on page 1.

Background

According to the World Health Organization (WHO, 2015), approximately 1.25 million road deaths occur every year, and 90% of these fatalities occur in low- and middle-income countries (LMIC). In 2012, road crashes[3] were ranked the ninth leading cause of death and the WHO (2015) projects that road crashes will move to the seventh position of global deaths by 2030. Victims of these road crashes are sometimes children who live/study close to the road, play on the road or even work on the road. WHO (2008) states that 21% of global road fatalities impact children.

Every day, over 500 children are tragically killed or seriously injured on the world's roads, often on their way to or from school (WHO, 2008). The precise number of children injured or disabled each year as a result of road traffic crashes is not known. But it has been estimated to amount to approximately 10 million by the WHO (2008). A major proportion of children injured or killed on the roads worldwide each year (38%) are pedestrians, as shown in Figure 5–1. In LMIC, where these fatalities occur most often, children walk along roads where there is a mix of different transport modes – some moving at high speed – and where infrastructure, such as sidewalks, cross walks and safety barriers, are missing.

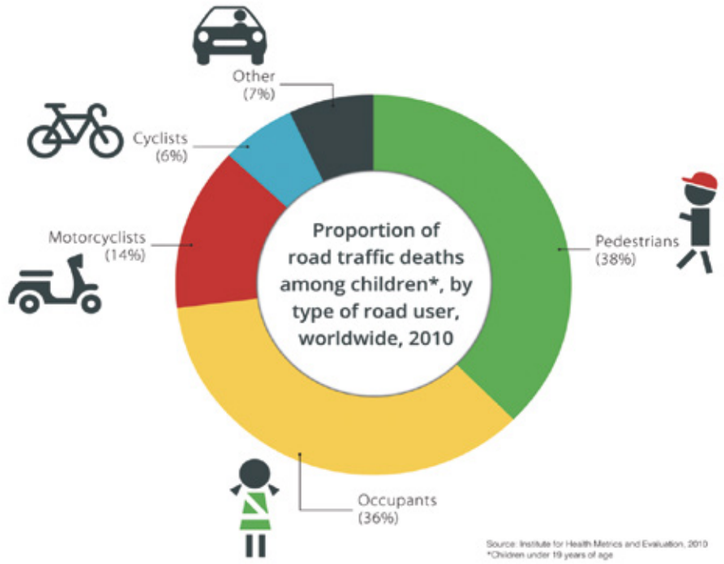


Figure 5 1: Proportion of road deaths among children by road user type worldwide, 2010
Source: Institute for Health Metrics and Evaluation

South Africa is one of the highest contributors to World's road fatality figures. For the general population, the country accounts for 25.1 fatalities per 100 000 population, which is greater than the global average of 17.1 fatalities per 100 000 population (WHO, 2015) and for children, the country has double the world fatality rate (Matzopoulos *et al.*, 2008). For children aged 0-19, road traffic crashes (RTC) account for 20% of all passenger and pedestrian deaths in the country. These statistics suggest that a child born and/or living in South Africa has an unacceptably high probability of dying through a RTC, especially if they depend on walking as their primary mode of transport.

In line with these findings, the main aim of this part of the report is to determine situational analysis of South Africa, and certain parts of South Africa, in terms of child road injuries and fatalities.

[3] *The term 'crashes' is intentionally aligned with the definition as in SANS/ISO 39001 and is used throughout this report. 'Crashes' imparts the same meaning as 'accidents' noted in the National Road Traffic Act, Act 93 of 1996."*

Objectives of Part II

In order to meet the main aim of this part of the report, the following variables are determined using mainly four secondary databases (see Methodology section). It is important to note that certain analysis is limited to specific areas since this information is only available in these locations (see Methodology section):

- Number of child road fatalities and fatality rate,
- The child road user impacted by road crashes,
- The day, time and month when children are most vulnerable,
- The vehicles types that are involved in child road fatalities,
- Hazardous locations where child pedestrians and passengers are most vulnerable in eThekwini Municipality and Western Cape Province and
- eThekwini Municipality schools with the highest number of child road fatalities and injuries.

Methodology

A list and description of databases used to perform this analysis, and the type of information gathered from each database is included below. These databases provided sufficiently reliable information to be used in this report:

a) Road Traffic Management Corporation (RTMC)

The RTMC database collects road fatality statistics from all local municipalities and is also known to be the best information source on understanding the road safety status quo on a national scale. Analysis using this database determined the number of child road fatalities and child fatality rate in South Africa, the road user impacted by fatalities, the day, month and time when children are the most vulnerable, and the vehicle types involved in child fatalities.

b) Western Cape Provincial Accident System (iPAS) database

The Western Cape Provincial Accident System (iPAS) database provided geocoded locations of road fatalities and injuries in the Western Cape, with the majority of road fatalities and injuries clustered around major roadways. Due to the limited coverage of this data, hazardous locations are determined and merged for both pedestrian and passenger crashes.

c) eThekwini Municipality database

The eThekwini database provided the information on geocoded locations of road fatalities and injuries. However, this dataset is limited to the eThekwini Municipality only. The dataset provided information on the hazardous locations for child passengers and pedestrians in the area, and deduce the high-risk schools based on the proximity of road crashes.

d) Children Accident Prevention Foundation of South Africa (Childsafe)

Childsafe collects and maintains a record of all children admitted to the Red Cross War Memorial Children's Hospital Trauma Unit for treatment of various intentional and unintentional injuries, including road traffic injuries (RTIs). Consequently, this database provided similar information on the various variables as the RTMC, but focused on injuries rather than fatalities. The Childsafe database also recorded the age of the children involved in the accidents, which provides valuable information on vulnerability per age group. As the Red Cross War Memorial Children's Hospital is location in Cape Town, the data mainly represents patients from that municipality.

Figure 5–2 shows the methodology described.

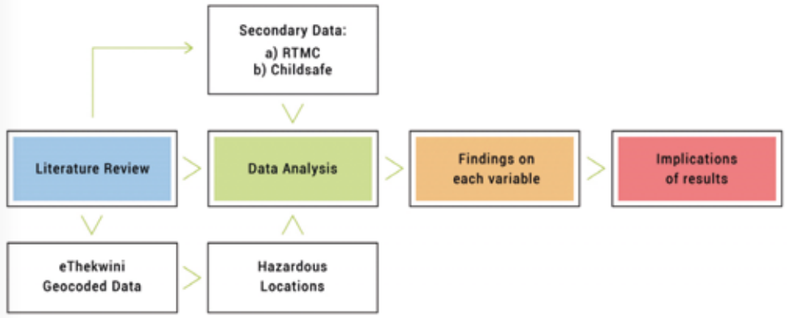


Figure 5–2: Data report part II methodology flowchart

Analysis of the geocoded Western Cape iPAS data and eThekwini data required inference from various literature sources to derive the precise details. The review on blackspot[4] analysis suggests that road injuries should be weighted based on severity with fatalities weighted the highest followed by serious and slight injuries, respectively. However, given the focus on children for this analysis, the weighting was modified from the literature (Harruff *et al.*, 1998) to better represent the burden of injuries that specifically impact children (Equation 1). Three sets of the top 10 hazardous zones were then created by ranking, based on three different variables: number of crashes, total number of children involved, and total weighted injuries. A detailed description on the weighting used is provided in detailed analysis report (Annex B1).

Equation 1: Weighting used in the analysis

*Weighted variable = 3*fatalities + 3*serious injuries + 3*slight injuries*

Similar to part I of the report, the analysis performed in this part of the report is based on provincial and district municipality boundaries. Figure 5–3 provides a graphical representation of the district municipalities. In the case of eThekwini Municipality database, the analysis is based on eThekwini TAZs and a graphical representation of this is provided in Chapter 7 with the analysis.

[4] *The term blackspot or hazardous location also refers to high accident locations.*

Figure 5-3: District Municipalities and Provinces of South Africa

Scope and Limitations

The data used in this study was obtained from various sources (described in the Methodology section). The verification of this data was not possible though, especially in the case of fatality and injury locations where certain errors were either identified and corrected, or omitted. It is widely accepted, however, that the agencies responsible of capturing the fatalities data in the country have improved their data collection methods, though, gaps are still present. Despite this, the data is sufficiently reliable and can be used to perform analysis.

Additionally, the time constraints and scope of this project did not allow for detailed investigations of hazardous locations in specific study areas, where a comprehensive analysis of localised interventions would be required.

Structure of Part II

This part of the report is divided into three chapters.

The **sixth chapter – Child Road Fatalities** – discusses the findings from the RTMC database. The RTMC database is analysed on a national and provincial level, before outlining the risk for the vulnerable road users.

The **seventh chapter – Case Studies** – discusses the findings of databases that provided both, road injury and road fatality data. These databases included data that provide locations of crashes from the Western Cape Province and eThekwini Municipality. Additional child road injury information is provided by the Childsafe database that manages the record of all children treated at the Red Cross War Memorial Hospital in Cape Town.

The **eighth** and final chapter of this part of the report – **Résumé Part II** – summarises the findings of the analysis and its implications.

ROAD FATALITIES

In this chapter, road fatalities are discussed based on the data provided by the Road Traffic Management Corporation (RTMC). The RTMC is the lead road safety agency in South Africa and has been mandated by the Department of Transport (DOT) to capture, process and verify all road fatality statistics (RTMC, 2016). This dataset, therefore, provides the best available information to understand the current road safety status quo for children on a national scale. This section describes the findings of the RTMC data analysis from 2015 to 2017 (a three-year analysis). This period is chosen based on communications with RTMC that suggest that data during this period provides relatively accurate information. Similar to the NHTS database, the RTMC database is first analysed on the provincial scale before describing findings and trends observed on a district level.

Overall Road Fatalities Statistics

Annually, the RTMC reports approx. 14 000 fatalities on the country's roads, costing the South African road network around ZAR 142.95 billion (RTMC, 2016). Pedestrians make up the largest number of road fatalities, with approx. 38% of all fatalities (see Figure 6-1), followed by passengers (approximately 32%) and drivers (approximately. 26%). Over the three years, the number of road fatalities for all road users increase from 2015 to 2016, however, remained relatively equal from 2016 to 2017.

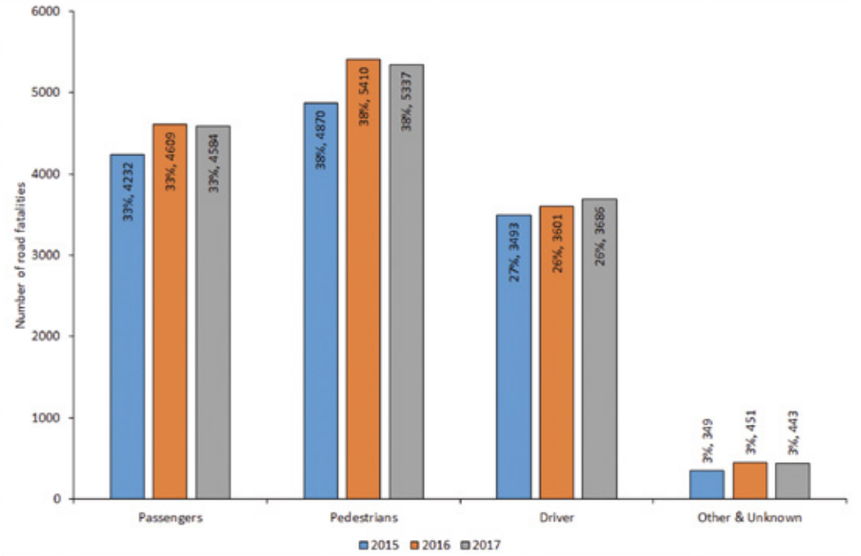


Figure 6–1: Overall road fatalities by road user group Data source: RTMC, 2015-2017

Child Road Fatality Statistics

The statistics suggest that, in South Africa, 3 868 children were killed from 2015 to 2017, an average of approximately 1 300 children every year. Overall, children made up approximately 9% of the road fatalities during the three years (2015-2017). In contrast to the overall population, pedestrian children constituted the majority of road fatalities (62%), followed by child passengers (36%), who are the second most vulnerable group in the country. These trends are not surprising, since the majority of the children walk long distances to travel to school (See Chapter 3), which increases their exposure to danger on the road.

Child road fatalities showed a varying level over the years (Figure 6–2), which is also witnessed in overall fatality numbers in South Africa. Child fatalities increase by 22% from 2015 to 2017 (Figure 6-3), with an increase of 34% from 2015 to 2016 followed by a decrease of 9% from 2016 to 2017. The percentage split of child fatalities over the modes of transport, also show fluctuations.

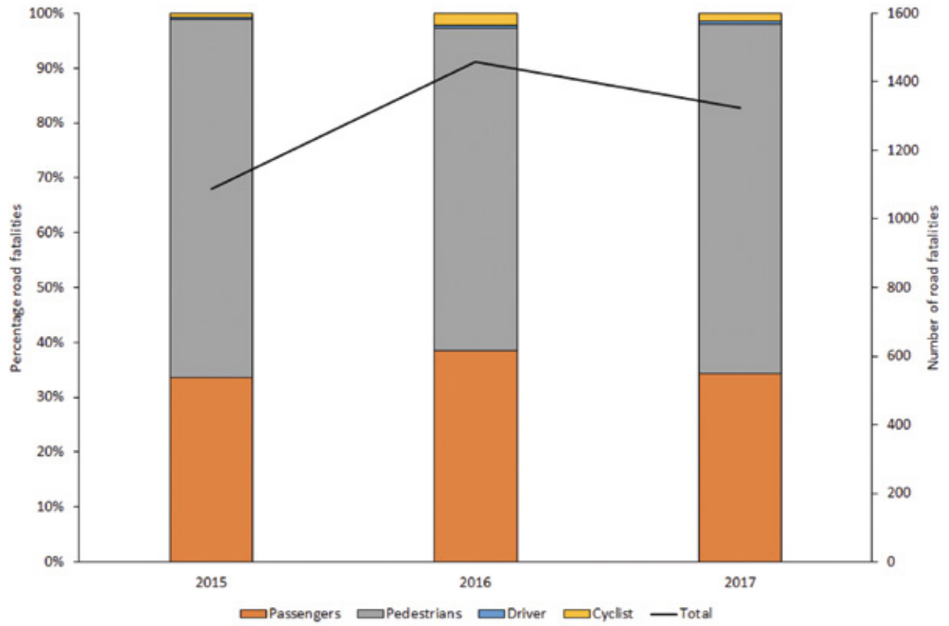


Figure 6–2: Child road fatalities per year by road user group Data source: RTMC, 2015-2017

Accumulating the child road fatalities for 2015 to 2017, KwaZulu-Natal (KZN) recorded the highest number of child fatalities (828 fatalities) during the three years analysed, followed by Gauteng (GT, 580 fatalities) and Eastern Cape (EC, 519 fatalities). Since 56% of South African children live in these provinces (see Chapter 2), this finding aligns with the previous inference that areas with a higher child population are likely to have more child road fatalities and injuries. In the case of KwaZulu-Natal and Eastern Cape, the majority of children also live with only a single biological parent or no parent at all. In these provinces, the lack of supervision may, therefore, also be a factor. The Free State and Northern Cape had the fewest child road fatalities with 291 and 136 fatalities, respectively (Figure 6–3).

The analysis performed on the district municipality level found that child road fatalities in eThekwini (KZN), City of Johannesburg (GT) and City of Cape Town (WC) contributed to 20% of South Africa's fatalities. Children from these three districts also constitute of 20% of the South African child population (NHTS, 2013). By contrast, the districts of John Taolo Gaetsewe (NC), Xhariep (FS) and Namakwa (NC) recorded the lowest number of child fatalities and also account for the least number of children. See Appendix for district municipality figures.

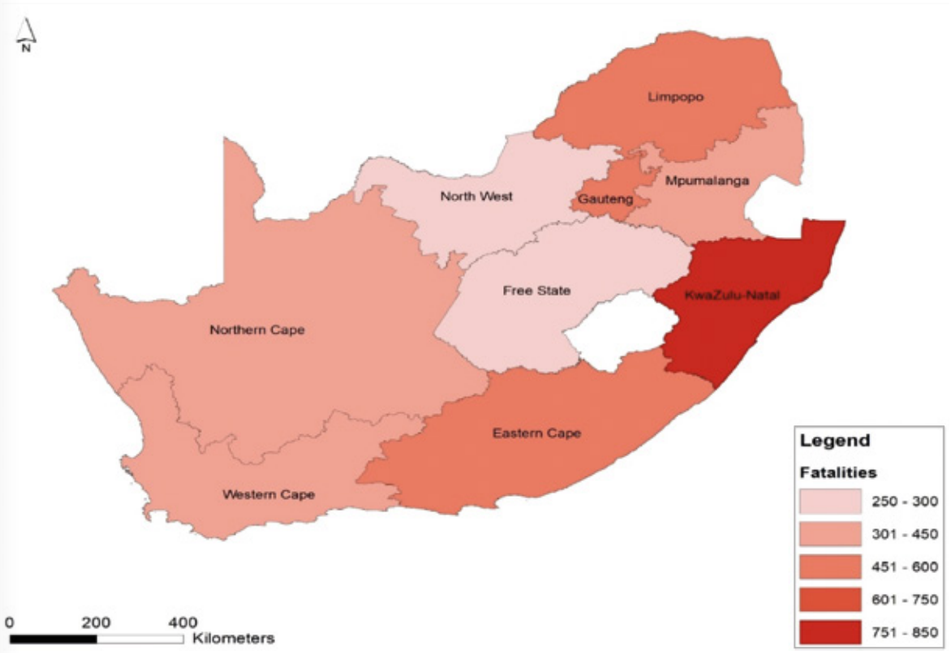


Figure 6–3: Child road fatalities by road user group by province Data source: RTMC, 2015- 2017

In healthcare research the fatality rates per 100 000 inhabitants is commonly used to compare risk exposure. Within South Africa, fatality rates per 100 000 children is approximately 7.4 fatalities per 100 000 children per annum. Figure 6-4 shows the road fatality rate per 100 000 child population for each province. As depicted, the fatality rates provide a different perspective from the ones observed in Figure 6–3, with Northern Cape having the highest fatality rate (32.2) and Gauteng having the lowest fatality rate (5.8). The two findings suggest that the focus area depends on the depth of the analysis as well as the dimension considered.

Various authors have found that fatality rates can differ substantially between different regions and even suburbs in metropolitan areas (see for example: Odeo *et al.*, 2003; Vanderschuren et al., 2017; Janmohammed, 2018). Even though eThekwini continued to have the one of the highest fatality rates in the country, the City of Johannesburg (GT) and City of Cape Town (WC), had relatively lower fatality rates, at 8.5 and 6.1 fatalities per 100 000 child population, respectively. Nelson Mandela Bay (EC) had the highest child road fatality rate (65.5) and Namakwa (NC) had the lowest (0.5). See Appendix for district municipality figures.

Child passengers constituted the majority of road fatalities in 12 of the 52 districts[5], while in the remaining 40 districts child pedestrians were the majority.

[5] *Central Karoo (WC), Namakwa (NC), Chris Hani (EC), Pixley ka Seme (NC), Waterberg (LIM), Xhariep (FS), Nkangala (MP), Cacadu (EC), Fezile Dabi (FS), Z F Mgcawu (NC), Thabo Mofutsanyane (FS) and Dr Ruth Segomotsi Mompati (NW)*

Figure 6–4: Child road fatality rate per province Data source: RTMC, 2015-2017 and NHTS, 2013

Based on the day of the week (Figure 6–5), although more fatalities occur during the course of the week (2 249 fatalities), 42% of child road fatalities happened during the two-day weekend (1 619 fatalities). During the week, the highest number of fatalities (607 fatalities) are observed to be on a Friday, the day leading up to the weekend. A similar trend is observed across all provinces, except in KwaZulu-Natal, where approximately equal number of fatalities occur on four days of the weekday: Monday (100 fatalities), Tuesday (105 fatalities), Thursday (108 fatalities) and Friday (108 fatalities). See Appendix for provincial figures.

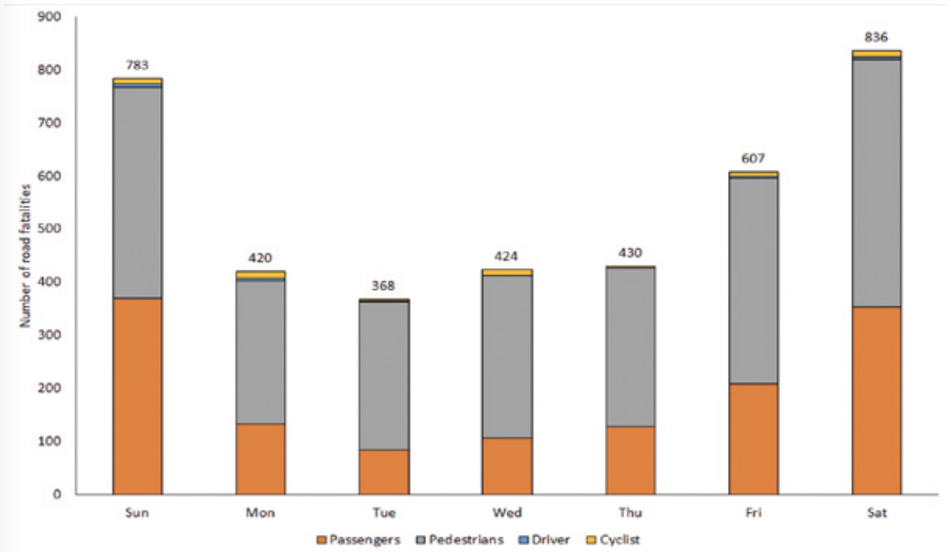


Figure 6–5: Child road fatalities by day of the week by road user group Data source: RTMC, 2015-2017 and NHTS, 2013

The number of child road fatalities vary each month during the course of the year, with the lowest number of fatalities observed in February (243 fatalities) and the peak observed in December (468 fatalities) (Figure 7-6). Generally, pedestrian fatalities increase every month with peaks in April, August and December. However, child passengers show a haphazard variation each month, with peaks observed during the months of April and December.

In most provinces, the month of December is observed to be a vulnerable period for all road users, except in the case of the Northern Cape (NC), KwaZulu-Natal (KZN) and Mpumalanga (MP). In Northern Cape and Mpumalanga, child road crashes mostly occur in April, while, in KwaZulu-Natal, road crashes are generally spread equally across the months of April (79 fatalities), August (88 fatalities), September (80 fatalities), October (78 fatalities) and December (83 fatalities). The finding with respect to KZN is particularly interesting, as the province with the highest fatalities (Figure 6-3) is found to be vulnerable for children during five months of the year.

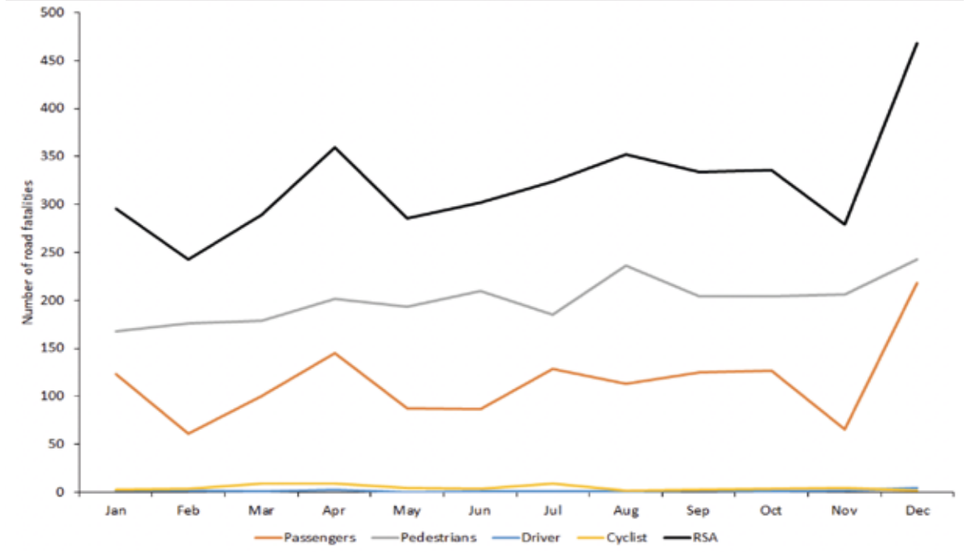


Figure 6–6: Child road fatalities by road user group for each month Data source: RTMC, 2015-2017

To analyse the vulnerability of children on the road based per time of the day (Figure 6–7 and Figure 6–8) a separate analysis was performed for weekdays, when children travel to school, and the weekend, when children are engaged in other activities. The analysis showed notable results for each period. During the weekday, child fatalities were the highest during the morning period of 06:00-08:00 and the afternoon/evening period of 13:00-19:00. By contrast, during the weekends, children were most vulnerable during the afternoon/evening period of 14:00-21:00. The latter period includes periods of darkness, where low visibility on the road can be attributed to some of the road fatalities.

In the Western Cape, Northern Cape, Gauteng and Mpumalanga, children are mostly vulnerable after school hours during the weekday. While in the case of the other five provinces[6], children are observed to be vulnerable when travelling to and from school during the weekday. Similar to the National analysis, weekend fatalities mostly occur during the afternoon/evening period of 14:00-21:00, including the period when there is reduced visibility on the road. In Western Cape, Eastern Cape and Northern Cape, road fatalities also occur during particular hours of the morning, which suggests that activities that children are involved in during that period make them more vulnerable.

[6] *Eastern Cape, Free State, North West, Mpumalanga and Limpopo*

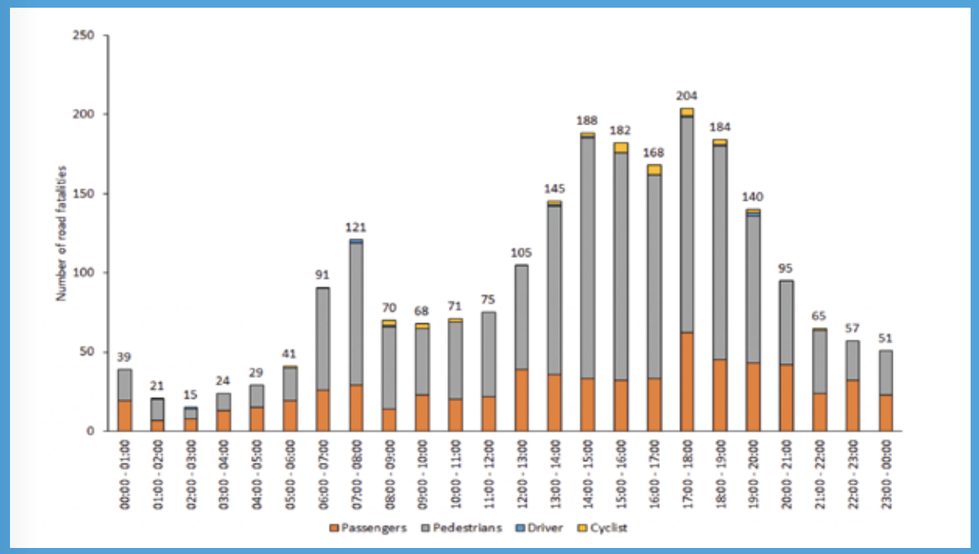


Figure 6–7: Vulnerability of children based on time of the day during weekdays Data source: RTMC, 2015-2017

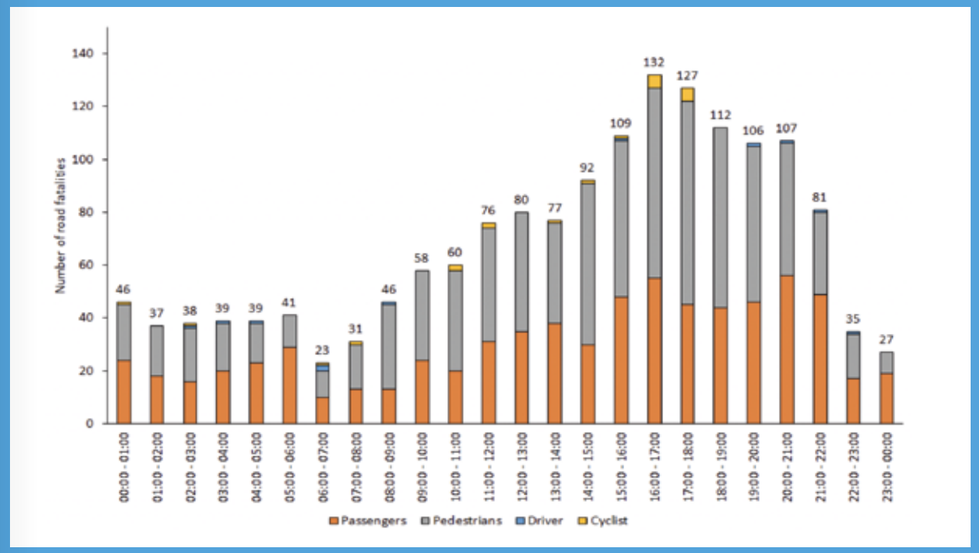


Figure 6–8: Vulnerability of children based on time of the day during weekends Data source: RTMC, 2015-2017

The last part of the national and provincial analysis aimed to determine vulnerability based on the type of vehicle involved in road fatalities (Figure 7-9). Private cars placed children at more risk than any other vehicle on the road, contributing to almost half of all road fatalities from 2015 to 2017. Light duty vehicles (LDVs) and minibus taxis (MBTs) were the second and third most dangerous vehicles on the road, causing 986 and 516 road fatalities, respectively. However, this analysis does not consider vehicle kilometres travelled (VKTs), which may change how vulnerable children are based on vehicle exposure on the road. The analysis on the provincial level resulted in similar findings except in the Eastern Cape and Free State. In these provinces, private cars and LDVs caused the most fatalities, however, heavy duty vehicles caused more fatalities than minibus taxis.

CASE STUDIES

In this chapter, road traffic fatalities and injuries impacting three case studies are elaborated upon:

- The Western Cape Province iPAS system records all crashes, including fatality and injury data. The first case study describes the analysis from this data for 2011- 2015 period, for which the data was available and complete. This data includes geocoded data that assists in identifying hotspots,
- The second case study elaborates on the eThekwini Municipality road crash data that also includes geocoded information. The research team analysed this data for a longer period, 2011-2017, than the Western Cape iPAS data as it had access to the latter years, which provides a more recent overview of challenges, and
- The third and final case study is the analysis of the Red Cross War Memorial Hospital data. Childsafe collects and maintains the data of all children admitted at the hospital. To continue the consistency of the three-year analysis from the RTMC data, the Childsafe database from 2015 to 2017 was analysed to obtain an understanding of the demographics of children that are admitted at the hospital, due to Road Traffic Injuries (RTIs).

The Western Cape Province

The Provincial Government of the Western Cape collect crash data, including road fatalities and injuries on a continuous basis. The data is stored in the Provincial Accident System (iPAS). For this analysis, the team has access to iPAS data from 2011-2015. The research team used this period as the data was available and complete. Furthermore, for the geocoded analysis, it is advisable to have a sample that is as large as possible. The data reflects a total of 743 crashes involving children (averaging 149 crashes/year). Overall, these crashes caused 242 child fatalities (48 fatalities/year), 578 serious child injuries (116 injuries/year), while an overall number of 743 children were involved in these crashes (149 children/year).

The Western Cape Government has invested substantially in combatting road fatalities, especially since 2009. The available data suggests an overall decrease in crashes and injuries over the five-year period. Vanderschuren et al. (2017) found an overall decrease of fatalities of 28% between 2009 and 2015. The results in this analysis are encouraging as measures have also led to a decrease in child fatalities and injuries. The total road child crashes reduced by around 50% between 2011 and 2015 (Figure 7–1) (Western Cape iPAS Data, 2011-2015).

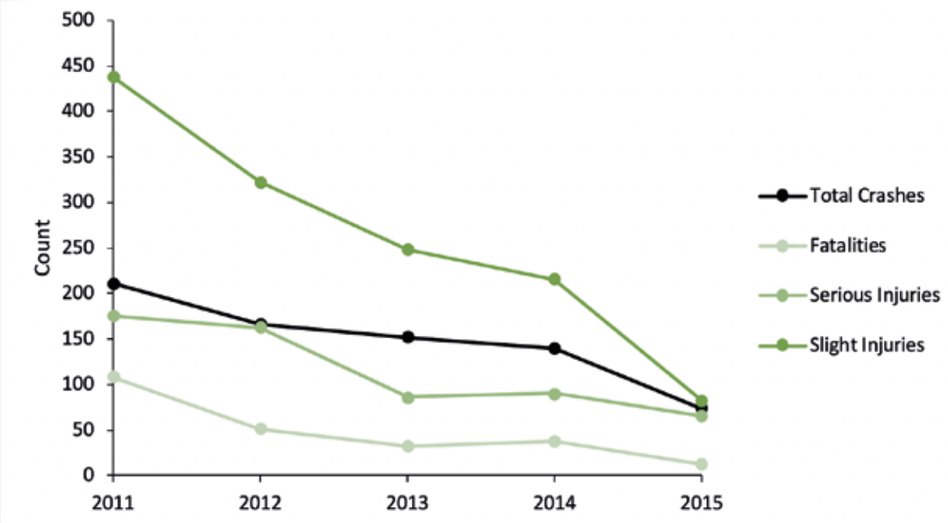


Figure 7–1: Total number of child crashes, fatalities and injuries per annum in Western Cape
Data source: Western Cape iPAS Data, 2011-2015

In this analysis, the top 16 hazardous hotspots were identified, based on ranking of the top 10 hazardous zones using three different variables: number of crashes, total number of children involved and total weighted injuries (see Chapter 5 for weighted equation). Duplicate hazardous zones identified by all variables were removed and sixteen hazardous zones were eventually identified. Figure 7 2 shows the results on a GIS map with the hotspot size proportional to the number of children involved. The data identified hazardous zones in the districts of Cape Town, West Coast, Cape Winelands, Overberg, and Eden. Cape Winelands contained the most (five) hazardous zones. Based on this dataset, the number of children involved varied from 15 children on Augsburg Road in West Coast District to one child on the N7 in Cape Town.

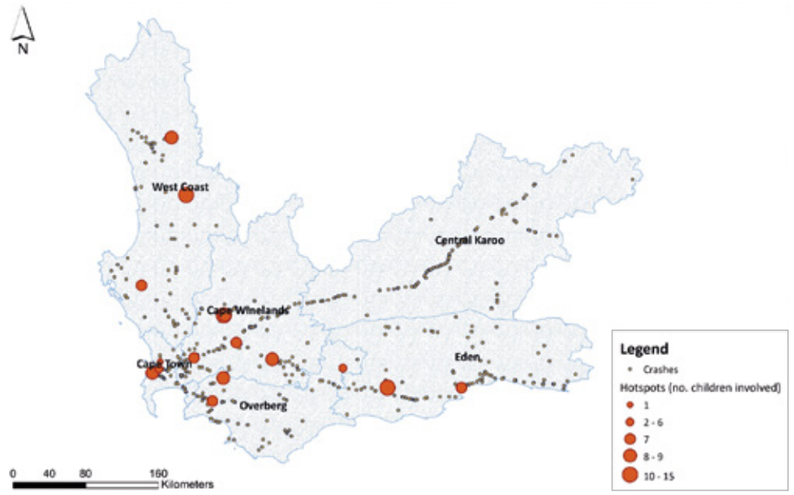


Figure 7–2: Western Cape district map showing top 16 hotspots Data source: Western Cape iPAS Data, 2011-2015

Ninety two crashes occurred in the top 16 hotspots, with 143 children involved. Passengers made up the majority of crashes, as opposed to pedestrians. The most affected age group was primary school-aged children (five to nine year-olds). Male children were involved in more crashes than female children. Furthermore, the majority of crashes that resulted in fatal or serious injuries occurred during the weekend and after daylight hours. Lastly, 75% of crashes in the top hotspots occurred during the school year (according to the posted school calendar on https://www.gov.za/about-sa/school-calendar).

The time ranges for the top pedestrian hotspots for children to be involved in crashes show three significant peaks: one from 8:00 to 9:00, one from 14:00 to 15:00, and one from 18:00 to 19:00. Most schools start between 7:30 and 8:00 and end between 14:00 and 15:00[7], so the high incidence of child crashes during these times is evidently in line with children traveling to and from school. The peak from 18:00 to 19:00 may be related to the loss of daylight.

Three themes emerged from the Western Cape hotspot. The first and most prevalent theme is crashes occurring along high-speed straight roads. The high incidence of such crashes could be over-represented in this data set, which shows crashes primarily spread across the major national highways. The hotspots that fall into this theme merely appear as a result of the danger of the speed on a certain section of the road being too high for its location. The second theme is T-junctions, and the third, related theme is intersections.

[7] *http://www.expatcapetown.com/south-african-schools.html*

eThekwini Municipality

The eThekwini Municipality collects and maintains records of road fatalities and injuries that occur in the municipality, together with geocoded locations of each crash. The research team analysed this database for a longer period, i.e. 2011 to 2017, than the Western Geocoded data because it had access to the latter years, which provides a more recent overview of the challenges. Additionally, the methodology for determining a hazardous location remains the same for shorter and longer periods (Geurts and Wets, 2003), with more than one crash per year in one location termed as a hazardous zone. The reader is referred to the comprehensive Data Analysis report for an elaborated methodology. The dataset provided information on the hazardous locations for child passengers and pedestrians in the area and deduced the high-risk schools for child pedestrians that play around the school area, based on the proximity of road crashes.

Pedestrian hotspots

A total of 5 109 pedestrian crashes (averaging 730 crashes per year) were recorded in the eThekwini Municipality for the years 2011-2017. Out of these crashes, a total of 5 273 children were involved (753 per year), with 280 fatalities (40 per year) and 1 606 serious injuries (229 per year).

The top 15 hazardous zones for pedestrians, termed hotspots, are based on ranking of three different variables: number of crashes, total number of children involved and total weighted injuries ranked by the number of children involved. Figure 7–3 shows the results on a GIS map with the hotspot size proportional to the number of children involved. The data identified hazardous zones in Inner West, Umlazi, Kwa Mashu, Inanda, Phoenix, Umgeni South, Osindesweni, Umbumbulu, and Tongaat. Umlazi contained the highest number of hazardous zones, with four hotspots, followed by Inner West, Inanda, and Umgeni South with two hotspots each. Based on this dataset, the number of children involved varied from 27 children at Dermat Road in Inner West to eight children at three different hotspots.

In these pedestrian hotspots, 192 crashes involved 203 children. The most affected age group was five- to nine-year-olds, correlating with the age young learners attend primary school. Male children were involved in more crashes than female children. The majority of crashes resulting in fatal or serious injuries occurred during the week and during daylight hours. Lastly, 85% of crashes in the top hotspots occurred during the school year (according to the posted school calendar https://www.gov.za/about-sa/school-calendar).

[8] *http://www.expatcapetown.com/south-african-schools.html*

Speed limits on roads in the hotspot areas range from 60 km/h to 80 km/h, which are generally slower than the speed limits featured in child passenger crashes.

The time of day that road crashes occur at the top pedestrian hotspots for child injuries show two significant peaks: one from 7:00 to 8:00 and one from 15:00 to 16:00. As most schools start between 7:30 and 8:00 and end between 14:00 and 15:00[8], the high incidence of pedestrian crashes during this time is clearly related to children walking to school.

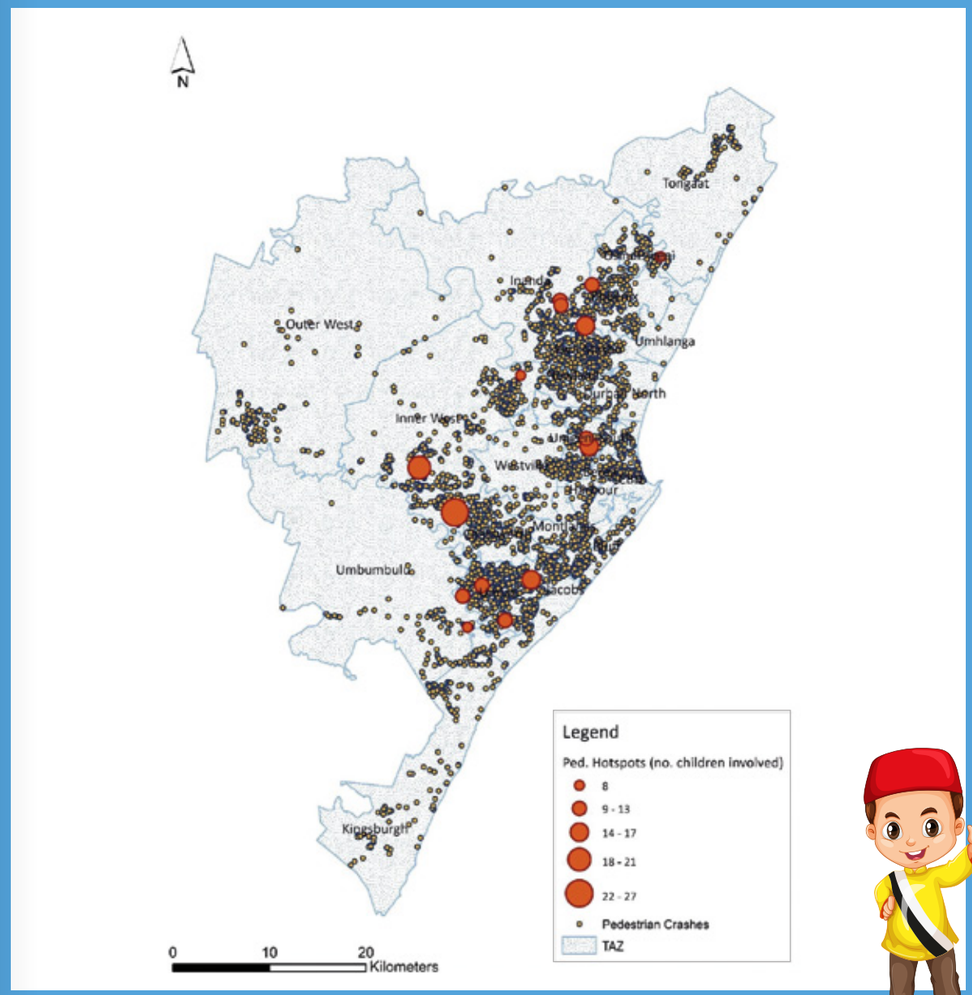


Figure 7–3: Top 15 pedestrian hotspots in eThekwini on the TAZ map
Data source: eThekwini Municipality, 2011-2017

The details of actions, manoeuvres and locations of pedestrians, depicted in Table 7–1, are particularly helpful in understanding what child pedestrians are doing and where they are when they are involved in road accidents.

The data shows that children were primarily walking and crossing the road more than 50m outside a crosswalk . The specification of walking (as opposed to standing or playing) also aligns with the times that children walking to school.

The time of day that road crashes occur at the top pedestrian hotspots for child injuries show two significant peaks: one from 7:00 to 8:00 and one from 15:00 to 16:00. As most schools start between 7:30 and 8:00 and end between 14:00 and 15:00[8], the high incidence of pedestrian crashes during this time is clearly related to children walking to school.

Variable	Specification	Count of Crashes
Pedestrian action	Walking	146
	Running	42
	Standing	8
Pedestrian manoeuvre	Crossing road	167
	Facing traffic	20
	Back to traffic	3
Pedestrian location	Not at crossing	121
	Within marked crossing	44
	Within 50m from crossing	31

Table 7–1: Pedestrian specifications at 15 pedestrian hotspots combined Data source: eThekwini Municipality, 2011-2017

Three contextual themes emerged from the 15 pedestrian hotspots, with each hotspot correlating with at least one theme, namely:

- The first theme, busy streets in primarily residential areas, describes the context of at least nine of the top fifteen hotspots. It was found that the speed limit is mostly 60 km/h. Many cases of speeding and visibility problems were recorded as probable causes at hotspots in residential areas than the general hotspot data. This indicates the need for speed limits to be more enforced, combined with more signage and greater visibility of pedestrian crossings within residential areas. Although the pedestrian crossing behaviour outside a 50m distance from a crosswalk is not illegal, pedestrians, especially child pedestrians could be educated regarding the road safety risk when crossing in these areas,

[8] *http://www.expatcapetown.com/south-african-schools.html*

- The second most common theme describes the context of at least five of the top fifteen hotspots: those in direct proximity to schools. In this theme of hotspots, children are most vulnerable in streets that lie between the school and its surrounding residential areas. Supporting this theme, a high percentage of crashes occurred while school was in session, during the week, and during daylight. After pedestrians entering roadways unsafely, speed was the second-most common probable cause in school-related hotspots. A potential intervention for this kind of hotspot is to have graduated speed limits during school arrival and departure times (Lambert and Venter, 2015).
- The remaining hotspots fit into the last theme of accidents occurring on a mostly straight stretch of road that is generally unsafe. Pedestrian crashes are scattered over al long distance on road links. For these types of hotspots, lowering speed limits could play a critical role in reducing child pedestrian crashes, similar to the positive impacts achieved from lowering speed limits in other countries (Waiz et al., 1983, McLean *et al.*, 1994). The challenges can also be tackled through the introduction of traffic calming measures, together with pedestrian friendly infrastructure.

Passengers hotspots

A total of 1 115 child passenger crashes (averaging 160 crashes/year) were recorded in the eThekwini Municipality (Figure 7–4). Of these crashes, 180 were fatalities (26/year), 1 083 resulted in serious injuries (155/year), while a total of 1 623 children were involved in crashes (232/year).

Figure 7–4 shows the top 14 passenger hotspots identified, based on the methods described previously and ranked by the number of children involved. The hotspot size is proportional to the number of children involved. The data identified hazardous zones in Umgeni South, Chatsworth, Umbumbulu, Inner West, Kinsburgh, Harbour, Umlazi, Jacobs, Westville, and Osindisweni. Kingsburgh contained the highest number of hazardous zones, with four hotspots, followed by Chatsworth with two hotspots. Based on this dataset, the number of children involved varied from 20 children at Higginson Highway in Chatsworth to two children at two different hotspots.

In these passenger hotspots, 122 children were involved in 54 crashes. The most affected age group was 10 to 14-year-olds, closely followed by children of five to nine-years old. The age groups are more equally dispersed for passenger hotspots than they were for pedestrian hotspots. Female children were involved in slightly more crashes than male children. The majority of crashes resulting in fatal or serious injuries occurred during the week and during periods of reduced visibility. Lastly, most crashes in the top hotspots occurred during the school year.

The speed limits in the hotspot areas range from 60 km/hr to 80 km/hr. The time ranges for the top pedestrian hotspots where children are involved in accidents show peaks during normal high-density traffic times: in the morning from 6:00 to 8:00, during the lunch hour from 12:00 to 13:00, during afternoon rush hours from 16:00 to 17:00 and again after dark from 19:00 to 20:00.

The probable causes with more than one crash each are listed in Table 7–2. Although many seem to be driver errors, analysing the causes reflects what the literature suggests, which is that a mix of driver errors, environmental conditions, and vehicle error (Botha, 2005) are responsible for crashes. For example, the second most common cause is drivers not paying attention and driving into the rear of a vehicle as a result. However, the road environment could add to this human error if visibility is inadequate or the speed limit is too high.

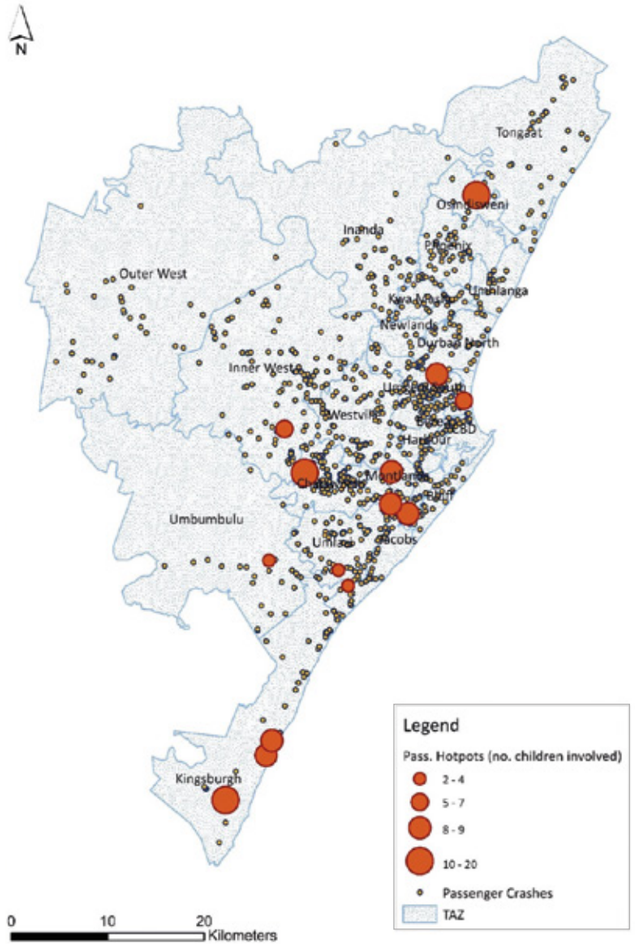


Figure 7–4: Top 14 passenger hotspots in eThekwini on the TAZ map
Data source: eThekwini Municipality, 2011-2017

Probable Cause	Count of Crashes
Turning in face of oncoming traffic	10
Driving into rear of front vehicle	8
Losing control of vehicle/skidding	7
Disregarding red traffic signal	5
Brake failure	3
Disregarding road traffic sign - stop sign	3
Driver failed to keep left on roadway	3
Entering road when unsafe to do so	3
Overtaking	3
Disregarding road traffic sign - No U-turn sign	2
Driver taking evasive action for another vehicle	2

Table 7-2: Probable cause of top 14 passenger hotspots combined Data source: eThekwini Municipality, 2011-2017

Primarily two themes existed in the analysis of passenger hotspots namely, crashes occurring on major intersections and straight road areas. The second theme is similar to the one observed for pedestrian hotspots. In just one zone, 18 injuries occurred on a 120 km/hr road, involving nine children. Cutting speed limits could play a critical role in reducing the risks of accidents in these areas, similar to the way that reduced speed limits had achieved positive impacts in other countries (Waiz et al., 1983; McLean *et al.*, 1994).

School zones

In this analysis, 13 schools were identified as high-risk, based on the methods described previously. These were ranked for the largest number of crashes within one kilometre zone around the schools to better represent the reality of children walking around 10 minutes to school. Figure 7–5 shows the results on a GIS map with the hotspot size proportional to the number of children involved. Based on this dataset, the number of children involved varied from 104 children at Inkonkoni Primary to 21 children at Folweni Secondary.

Taking the top 13 high-risk schools together, 653 crashes occurred within the one kilometre range, with 683 children involved. The five- to nine-year-olds were most affected, with male children involved in more crashes than female children. The majority of crashes resulting in fatal or serious injuries occurred in the daylight. Lastly, 85% of crashes in the top hotspots occurred during the school year.

Speed limits in these school zones range from 60 km/h to 80 km/h, which are generally slower than the limits found in passenger crashes described in the previous chapter. Children are most vulnerable during two significant peaks that closely mirror the general pedestrian data: one from 7:00 to 8:00 and one from 14:00 to 15:00. As most schools start between 7:30 and 8:00 and end between 14:00 and 15:00, the high incidence of pedestrian crashes near schools during this time is clearly related to children walking to and from school.

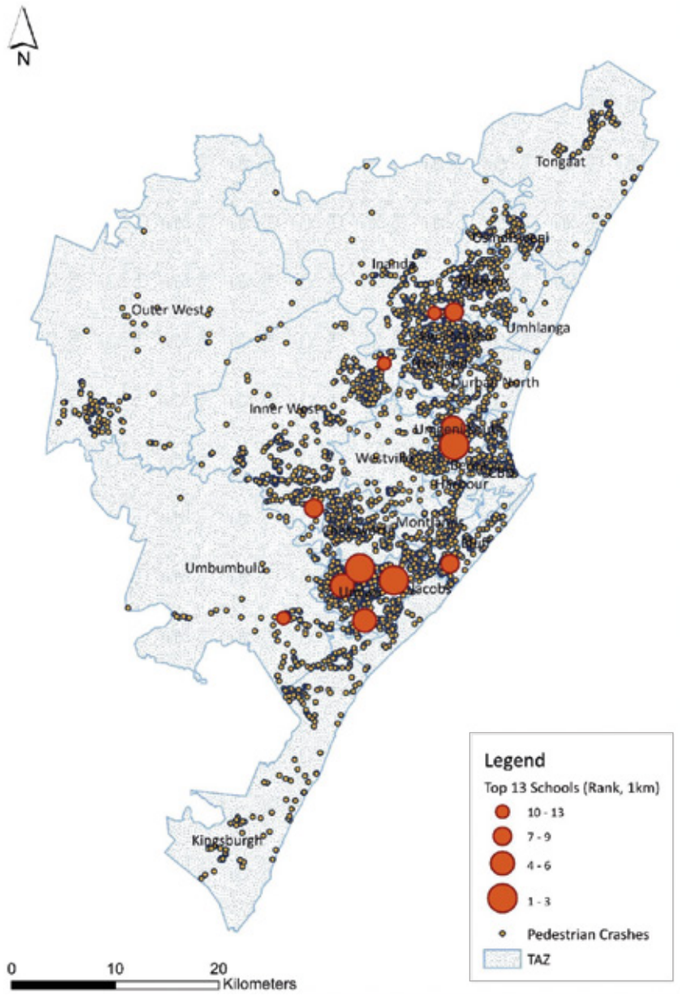


Figure 7–5: Top 13 high-risk schools in eThekwini on TAZ map Data source: eThekwini Municipality, 2011-2017

Figure 0–17 shows the Google Earth image of the school deemed to be most at risk — Inkonkoni Primary. Crashes (or sets of crashes) are shown in red. One hundred crashes occurred at Inkonkoni Primary, involving 104 child pedestrians from 2011-2017, which equates to about 14 children per year. These incidents radiate outwards from the school, including the small residential roads closest to the school and the busier roads such as Sibusiso Mdakane Drive shown below. The extremely high incidence of crashes near each of these identified schools highlights the potential for effective targeted education interventions in these schools. The appendix in the detailed data report shows the Google earth images of all high-risk school areas.

Figure 0–17: Google Earth image of Inkonkoni Primary School Data source: eThekwini Municipality, 2011-2017 and Google Earth Pro (2017)

Childsafe

Since 1991, ChildSafe has maintained a computerised Childhood Trauma Surveillance System of all child injuries encountered at the Red Cross War Memorial Children's Hospital Trauma Unit (Trauma Unit) in Cape Town, South Africa. Given the location of the Red Cross War Memorial Children's Hospital, admitted children come from Cape Town and surroundings. The reader needs to be aware of the fact that the Red Cross War Memorial Children's Hospital generally treats children below the age of 13 years old. Comparison with the RTMC database, therefore, requires caution.

During the three-year period, 2 662 children presented at the Trauma Unit as a result of a road traffic injury (RTI), compared to 183 fatalities in Cape Town, according to the RTMC database (2015-2017). Consequently, for every child fatality in the city, 14 road injuries were presented at the hospital (this excludes children that presented at other hospitals in Cape Town). Of these RTI child patients, 1 830 were pedestrians (69%), 619 were passengers (23%) and 162 were cyclists (6%). The finding with respect to cyclists' injuries is particularly interesting, as child cyclists account for 59 fatalities in South Africa according the RTMC database. This disparity between fatalities and injuries among child cyclists suggests that children are vulnerable to injuries rather than fatalities in cyclists.

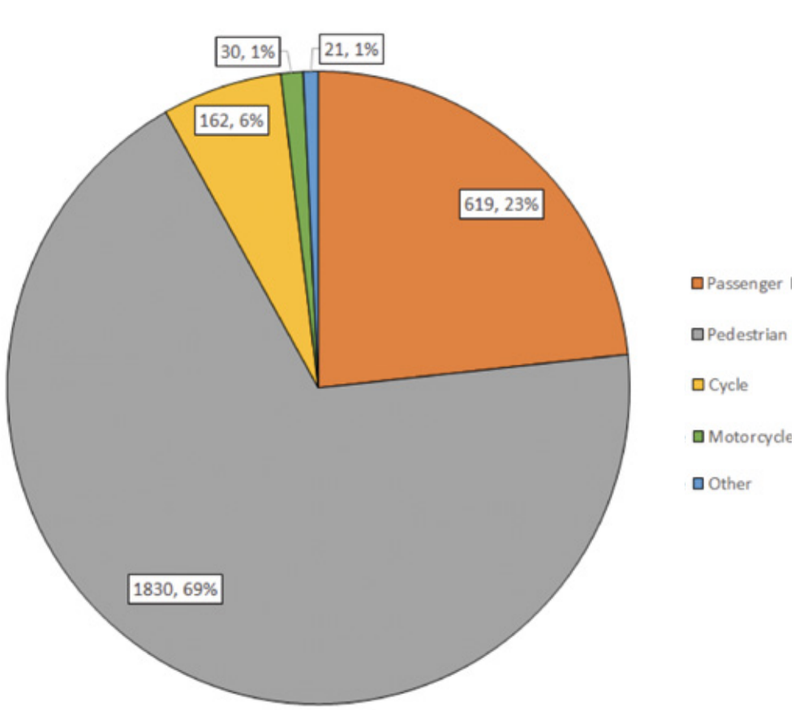


Figure 7–7: Child road injuries by road user group Data source: Childsafe, 2015 – 2017

The international literature (Backett and Johnston, 1997; WHO, 2008) on child road fatalities and injuries suggests that male children are more likely to be injured or killed on the road than female children because of their tendency to take higher risks. Data from the Red Cross War Memorial Children's Hospital relating to RTI child additions show a similar trend, with 1 690 male children (64%) admitted at the hospital, due to a RTI compared to 943 female children.

Figure 7–8 shows child road injuries at the hospital by age group. Children aged five to nine are seen to be the most vulnerable group, with 45.9% of injuries, followed by children aged one to four constituting 35.1% of road injuries. Children aged under one year and 15 to 17 constitute the lowest percentage of road injuries, at 2.9% and 0.5%, respectively. However, as mentioned, this data is skewed, since the Red Cross War Memorial Children's Hospital, generally, treats children aged 12 years and younger.

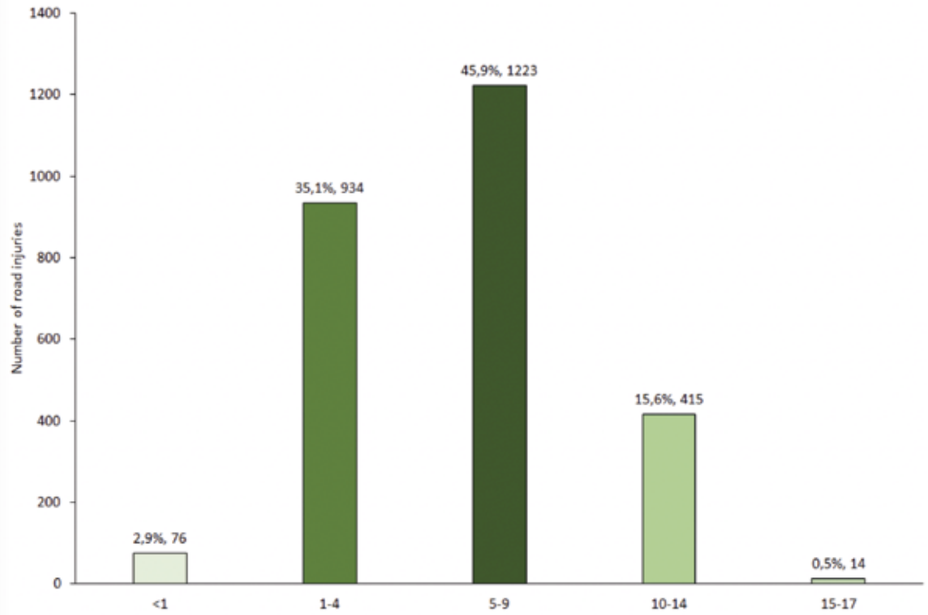


Figure 7–8: Child road injuries by age group Data source: Childsafe, 2015 – 2017

Approximately 65% of child injuries are reported during the weekday at the hospital (Figure 7–9), with a high number of incidents observed on Monday (412 injuries) and Friday (374 injuries). The rest of the injuries — 35% — are observed during the two-day weekend. This trend is lower than the RTMC database, where 42% of child fatalities occurred during the weekend, with Friday also being prominent, while Monday records less fatalities.

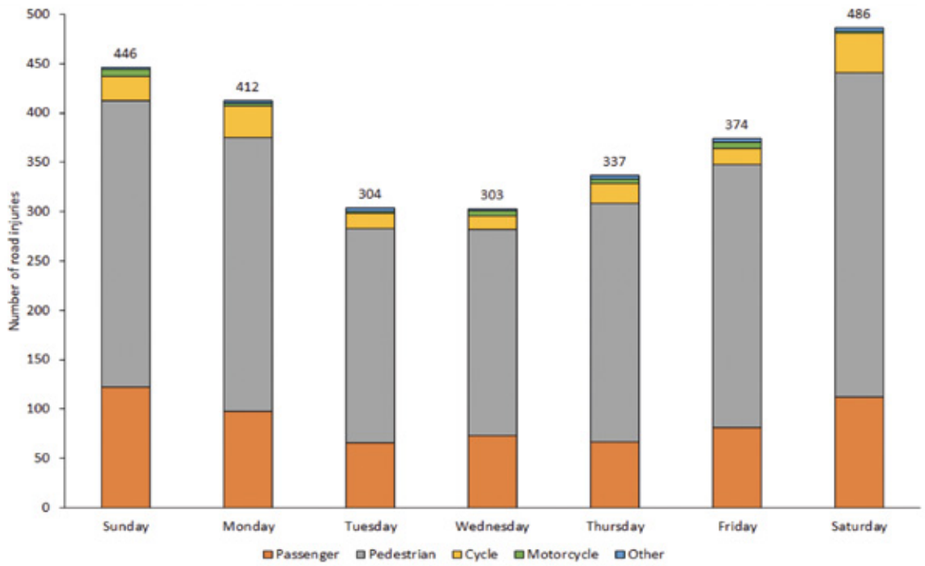


Figure 7–9: Child road injuries by day of the week Data source: Childsafe, 2015 – 2017

According to the Childsafe data with respect to vulnerability by month, child pedestrians are most vulnerable during March, October, November and December, with 39% of pedestrian injuries occurring during that period. Child passengers are more vulnerable in January, February, October and December, when 40% of passenger injuries occur (Figure 7–10).

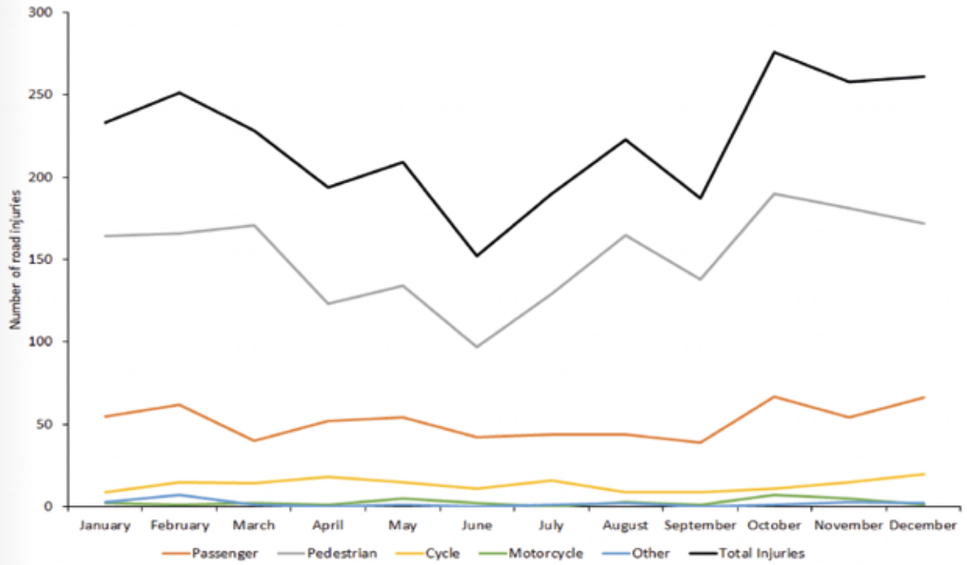
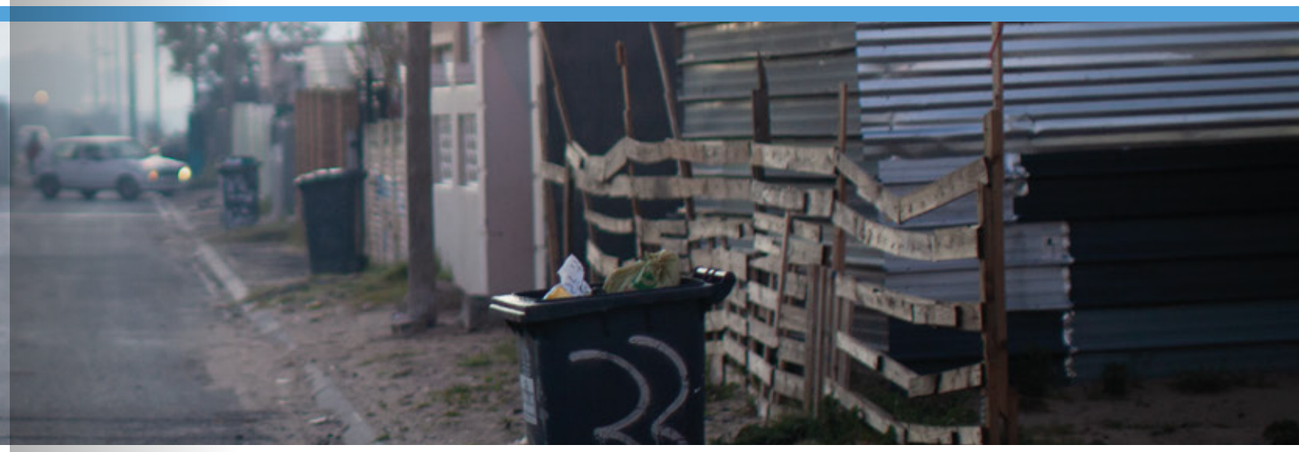


Figure 7–10: Child road injuries by month of the year Data source: Childsafe, 2015 – 2017



Similar to the RTMC data, the Childsafe data was analysed to determine vulnerability by time of the day. Unlike the RTMC data, the hospital data shows that the majority of child road injuries on weekdays occur during the evening period of 17:00-23:00 (Figure 7–11).

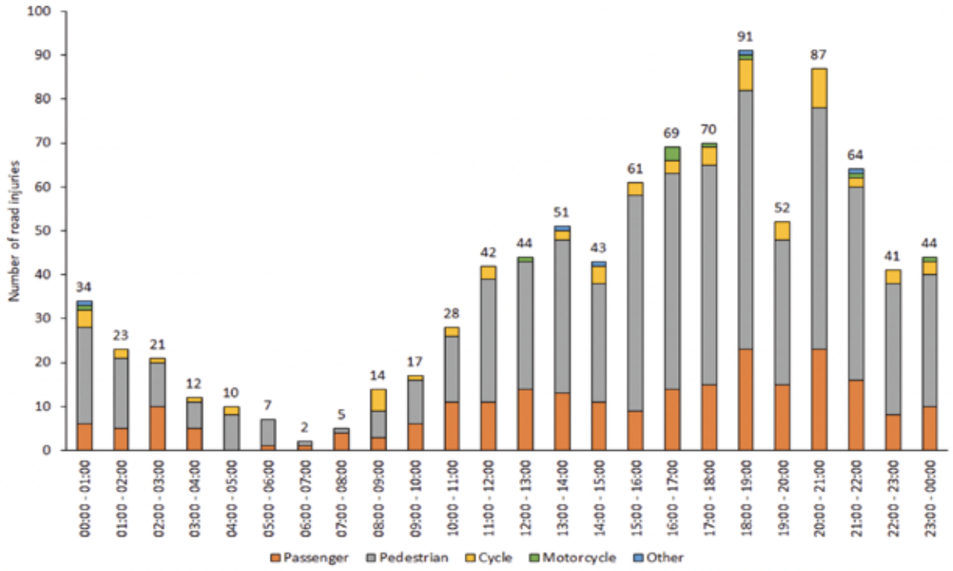


Figure 7–11: Child road injuries by time of the day on weekdays Data source: Childsafe, 2015 – 2017

During this night-time period, visibility on the road is decreased. During the weekends, child road injuries start to peak at 16:00 and continue to 22:00, although a significant decrease in road injuries is observed during the 19:00-20:00 period (Figure 7–12). For both the weekdays and weekends, the data showed that the highest number of child injuries occurred during the 18:00-19:00 period, while the fewest child injuries occurred during the 06:00-07:00 period.

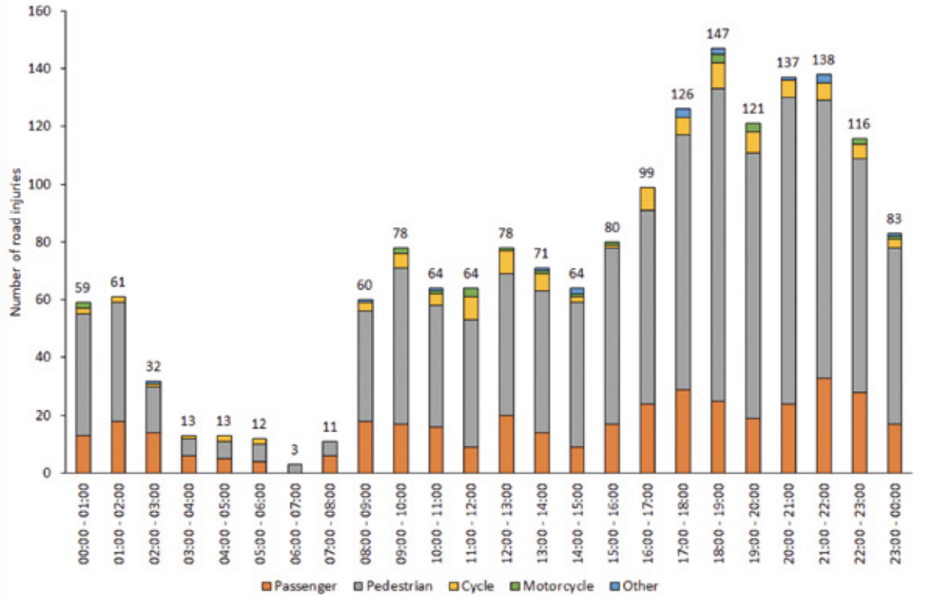


Figure 7–12: Child road injuries by time of day based on weekends Data source: Childsafe, 2015 – 2017

RÉSUMÉ PART II

The second part of this report aimed to understand the current road safety status quo on child fatalities and injuries using the four secondary databases. The first database — 2015-2017 Road Traffic Management Corporation (RTMC) data — provided child road fatality information on a national, provincial and district level. The other three databases were case studies with data from specific locations of the country. Two databases, in relation to the Western Cape Province and the eThekwini Municipality, included location of crashes with the last database obtained from Childsafe, that manages the record of all children treated at the Red Cross War Memorial Hospital in Cape Town.

Road Traffic Management Corporation

Every year approximately 1 300 children are killed on South African roads. The majority of victims of this pandemic are children who walk to and from school and home, accounting for 62% of all child road fatalities. In terms of the provinces, children in KwaZulu-Natal, Gauteng and Eastern Cape make up the majority of these fatalities. This is to be expected because of a relatively higher child population in those areas. Furthermore, child road crashes are also more likely since majority of children lives with only one biological parent, or no parent at all. The risk of child injury is observed to be the highest in Northern Cape, which records a fatality rate of 32.2 per 100 000 child population.

From 2015 to 2017, child road fatalities increased by 22% across the country, which is alarming, considering South Africa's goal of halving road fatalities by 2020, to meet SDG goal 3.6 (OECD, 2015). Weekends are particularly vulnerable periods for children, with 42% of child road fatalities occurring during these two days. During weekdays, children are at greatest risk during periods of walking to or from school and home, while over weekends children are most at risk during the afternoon and evening periods. These findings suggest that after-school activities increase the chances of children being killed on the road as much as journeys to and from school and home.

Furthermore, pedestrians and passengers are at most risk during the months of April, August and December. The April and December period coincides with the festive breaks of Easter and Christmas, when road fatalities are high on South African roads (Arrive Alive, 2017). Lastly, private car vehicles, light duty vehicles (LDVs) and minibus taxis (MBTs) put children at most risk on the road. This finding does not, however, consider the relative risk of the vehicles in terms of road exposure.

Western Cape Geocoded Database

The analysis of the geocoded Western Cape data deduced 16 dangerous zones for children. In these hotspots, more passengers were involved in the crashes than pedestrians. Primary school-aged children (five- to nine-years old) were involved in the road crashes, followed by secondary school-aged children (10- to 14-years old). More male children were involved in crashes than female children. The majority of serious crashes occurred during the weekend, after daylight hours, during weeks in which school was in session.

Three themes exist among the Western Cape hotspots. The most prevalent theme is high-speed straight roads. This could be over-represented in this data set, since many of the data points are clustered around or on major national roadways. However, examining the speed limits and enforcements along these hotspots could have significant impact on the safety of roads for children in the Western Cape. The second theme is T-junctions, and the third, related theme is intersections. A potential intervention to tackle both of these is increasing visibility and signage at such junctions and intersections.

eThekwini Geocoded Database

The analysis of the geocoded eThekwini Municipality data involved determining dangerous zones for child pedestrians and child passengers, while also identifying schools in high-risk areas.

The pedestrian crashes in the eThekwini Municipality were geospatially analysed into the top 15 most hazardous hotspots. Primary school-aged children (five- to nine-years old) are involved in the most accidents, followed by secondary school-aged children (10 to 14 years old). Male children are involved in more accidents than female children. The timing of pedestrian crashes correlates closely with the times children are expected to be walking to and from school. Most often, children were crossing the road more than 50 metres from a crossing when hit by a vehicle. There is a misconception amongst South African drivers that pedestrians are only allowed to cross at intersections or special crossing facilities. This is not the case, as crossing more than 50 metres from an intersection is legal. This misconception is likely contributing to the crossing related fatalities and injuries.

Three themes exist among the pedestrian hotspots. The most prevalent theme is high-use residential areas, where crash characteristics were observed as similar to the combined hotspot characteristics. However, in such locations, cars hit children who were crossing the road within marked crossings. Greater enforcement and visibility of pedestrian using crosswalks is needed, combined with education for children regarding safe street crossing behaviour. Given the residential nature of these hotspots, speed limits could also be reduced to make neighbourhood areas safer for all children.

The second theme is the direct proximity to schools. A potential intervention to address this is graduated speed limits during school arrival and departure times.

The last theme, which matches a theme in the passenger hotspot analysis, describes areas of straight roads that are generally unsafe. Once again, high incidences of crashes along one stretch reiterate the need for reduced speed limits.

A geospatial analysis of the location of weekday pedestrian crashes in relation to eThekwini schools produced a list of the 13 top high-risk schools in the municipality. From 2011-2017, 104 children were involved in crashes within one kilometre of the school deemed most risky. This finding alone illustrates the enormous potential impact of education interventions for children on crossing the road, especially if designated to the highest-risk schools identified in this analysis. Crashes peaked before and after school hours when young learners are known to be walking to and from school.

This analysis also geospatially identified the top 14 hotspots for passengers in the eThekwini Municipality. The passenger crashes affected children of all age groups similarly, with female children involved in marginally more crashes than male children. The timing of passenger crashes correlated with the morning and evening rush hours, as well as a peak around 19:00 as visibility is reduced.

Passenger hotspots can be sorted into two overarching themes: major intersections and straight roads. The theme of major intersections may seem obvious, but the identification of a single intersection with extremely dangerous outcomes for children suggests the need for an intervention, from increasing visibility at identified intersections to increasing the enforcement of identified traffic signals. As found with pedestrian hotspots, due to high speeds, the straight road areas are particularly hazardous.

Children Accident Prevention Foundation of South Africa (Childsafe) Database

Childsafe data reports that from 2015 to 2017, 2 662 children in Cape Town were injured on the road. During the same period, RTMC data showed that 183 children were killed on Cape Town roads. Therefore, for every child road fatality in Cape Town, at least 14 children were injured due to a road traffic crash (RTC). The majority of the road injury victims (69%) are pedestrians, followed by passengers (23%), which is aligned with the RTMC data. The Childsafe database also confirmed the findings of the RTMC data, with respect to the increase in road fatalities. The Trauma Unit reported an average increase of 16% in child road injuries from 2015 to 2017.

In terms of demographics, male children constituted the majority of road injury victims (64%). This finding supports the conclusions from the international literature that male children are more prone to road injuries than their female counterparts due to their tendency to take more risks on the road (Backett and Johnston, 1997; Mabunda *et al.*, 2008; WHO, 2008; WHO, 2015). With regard to the age group, children aged five to nine and one to four are found to be the most vulnerable on the road, constituting of 45.9% and 35.1% of road injuries, respectively. However, this latter finding may be skewed since the hospital generally tends to children aged 12 years and under.

During the course of the week, children are most vulnerable on Mondays and Fridays, but more children are killed on Saturdays (486 children) and Sundays (446 children). A possible reason for this is that speeds are relatively higher during weekends when the road traffic is less. The Cape Town children are also vulnerable during December, which also reflects the RTMC national findings. However, unlike the RTMC national findings, children in Cape Town are most at risk in October. The Childsafe database also showed different findings with respect to vulnerability by time of the day. On weekdays and weekends, the highest number of child injuries occurred mostly during the evening period, while the fewest child injuries occurred during the morning period.

[7] *http://www.expatcapetown.com/south-african-schools.html*

IMPLICATIONS

This study emerged out of the recognition that South African children face various challenges on the road, in regard to road safety. In fact, **child pedestrian injury is the leading cause of injury based deaths for children under the age of 15 years** (Arendse *et al.*, 2012). Therefore, **a better understanding of the current environment is crucial** to providing safer roads, and ultimately, safer environments for children. Consequently, this report presents findings on a series of secondary data analysis with a focus on children as road users and the impact of road traffic crashes (RTCs) on them. The question that emerges from the analysis presented in this report is, **what are the implications** of these findings on the interventions implemented by the country, provinces or local governemnts to improve road safety?

The **first implication** of the study – given the findings that children mostly walk to and from school for 15 minutes or more – is that **children spend a significant percentage of time on roads that generally don't cater for pedestrians** (Vanderschuren and Jennings, 2017; Amend and FIA, 2016). This is especially a challenge for children that live with a single biological parent, or no parent altogether (Statistics SA, 2018), as they are more likely to be left unsupervised on the road. Zeedyk *et al.* (2002) found that unaided children on the road often face difficulties navigating the road due to their limited cognitive abilities. In the Eastern Cape, KwaZulu-Natal and Limpopo, a significant proportion of children live without their biological parents, as compared to other provinces, and based on this factor, children in these provinces are at a higher risk.

The **second implication** of the study – given the findings that approximately 1 300 children are killed on South Africa's road every year and that road fatalities increased by an overall 22% – is that **child road safety is a challenge in South Africa.** A RTMC (2016) study found that the **14 000 road fatalities that impacts all South Africans every year, costs the road network ZAR 142.95 billion every year. Children constitute 9% of these fatalities, and based on extrapolation alone, cost the South African road network ZAR 12.95 billion.** Majority of child road fatalities occur in KwaZulu-Natal, Gauteng and the Eastern Cape. These provinces also cater for most of South Africa's children, hence, this finding is expected. However, in the case of KwaZulu-Natal and the Eastern Cape, the absence of both biological parents may be playing a major role. In terms of risk of child road injuries, Northern Cape, which has a relatively small child population, is found to have the highest child road fatality rate of 32.2 per 100 000 child population.

The **third implication** of the study – given the findings on vulnerability by day of the week, month, time of the day and vehicle type – is that **various factors play a role in child road safety. Weekends are particularly vulnerable periods for children** with 42% of child road fatalities occurring over the two-day period. This is because, during weekends, the traffic is calmer and drivers are more likely to speed on roads. On weekdays, children are observed to be vulnerable during their travel to and from school, while over the weekend, children are vulnerable during the afternoon and evening periods, when visibility on the road is lower. These findings suggest that **children's activities outside school place them at a high risk** on the road as well. Furthermore, child pedestrians and passengers are at **most risk during the month of April, August and December.** The festive breaks of Easter and Christmas fall during the April and December months, when road fatalities are high on South African roads (Arrive Alive, 2017). Speeding and drunk driving are the leading cause of deaths during this period, endangering the lives of children as well. Lastly, **private care vehicles cause approximately half of the nation's child road fatalities.** This finding alone suggests that better education to drivers and better enforcement by officials, can go a long way to better incorporating children's needs as road users.

The **fourth implication** of the study – given the findings that hazardous zones, in both eThekwini Municipality and Western Cape Province, mostly occurred along long stretch straight roads and in residential and school areas – is that **better infrastructure is required in locations where child movement is high, to better incorporate children's needs as road users.** These areas include urban, residential and school areas, where in fact pedestrian movement for all ages is high. An important way to achieve this is the **reduction of speed limits in these locations.** Increased speed impacts the crash severity for all road users.

For car passengers, the likelihood of death is 20 times more in a car travelling at 80 km/hr on impact, rather than a car travelling at 30 km/hr (World Health Organisation, 2004). The risk is higher for pedestrians, who have shown to have a 90% chance of survival when hit with a car travelling at 30 km/hr, but less than 50% survival chance when hit with a car travelling at 45 km/hr.

The **fifth implication** of the study – given the findings that 2 662 children were treated for road related injuries at the Red Cross War Memorial Children's Hospital during the 2015 -2017 period – is that **the cost of child road crashes is extremely high on the health care system.** A study in Jamaica (Violence Prevention Allianca, 2014) found that the direct cost of care given to 1 497 victims of RTCs amounted to US $ 1.4 billion (approximately ZAR 15.4 billion[10]) in 2014, with an indirect cost of US $ 1.8 billion (approximately ZAR 20 billion). While, a similar study is not available in the case of South Africa, the study commissioned in Jamaica provides a noteworthy approximation of treatment costs administered to RTC victims in South Africa (ZAR 13 million per child). **Considering this, it seems crucial that healthcare in South Africa takes a proactive approach to RTCs, such that resources are aimed to preventing road crashes rather the victims of the epidemic.**

[10] *Based on a conversion of USD $ 1 = ZAR 11*

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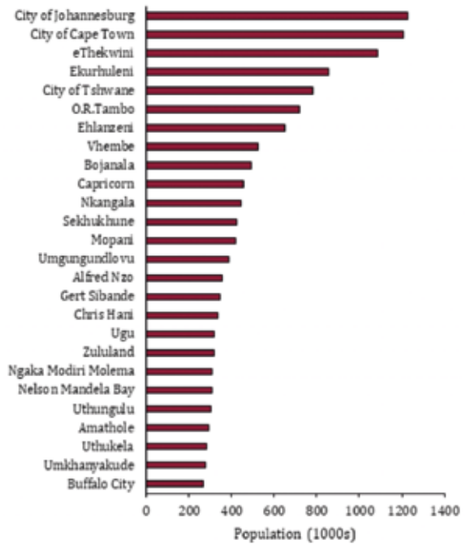
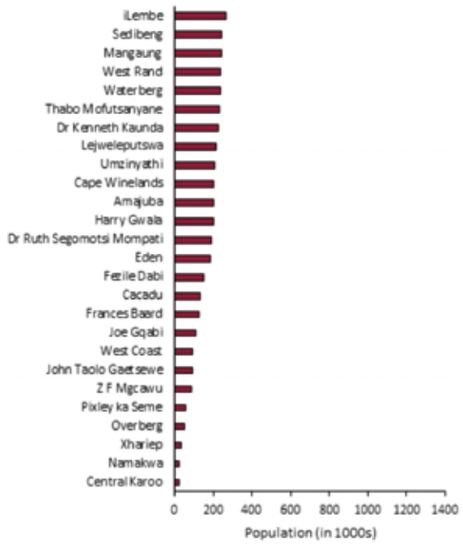
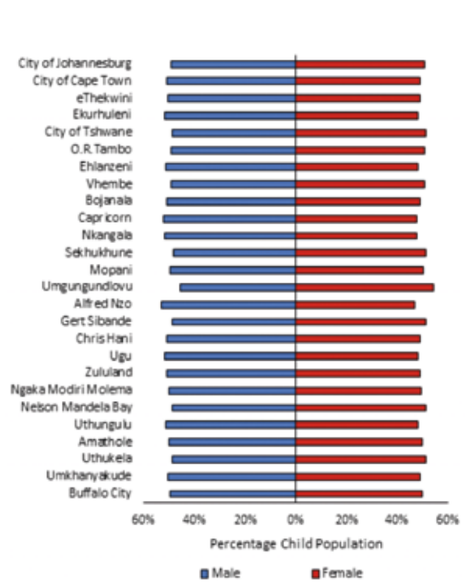
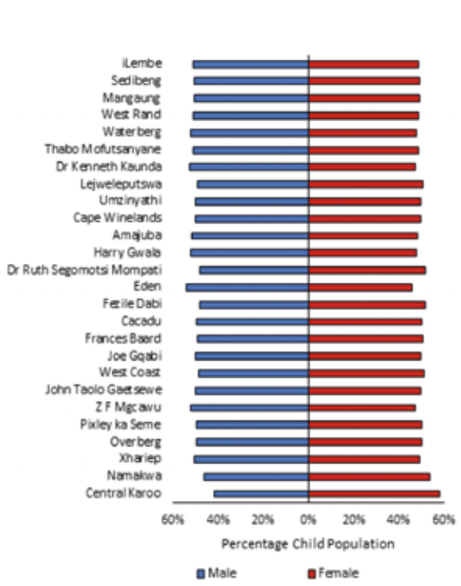
APPENDIX A

Child Population by District Municipality

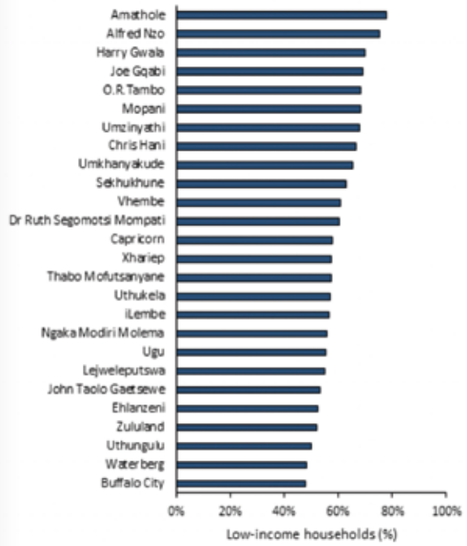


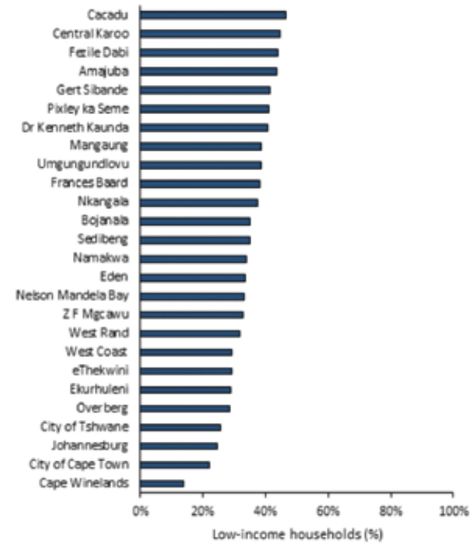




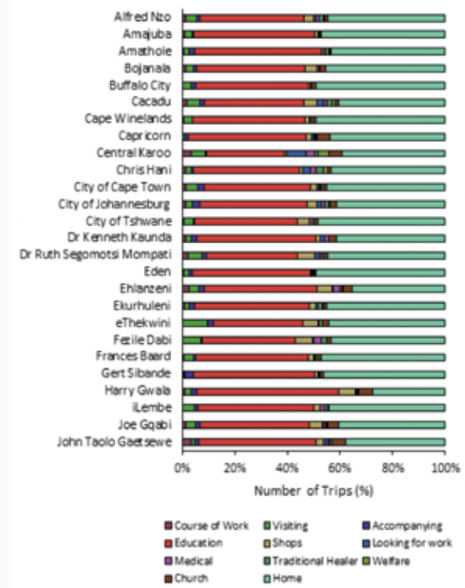


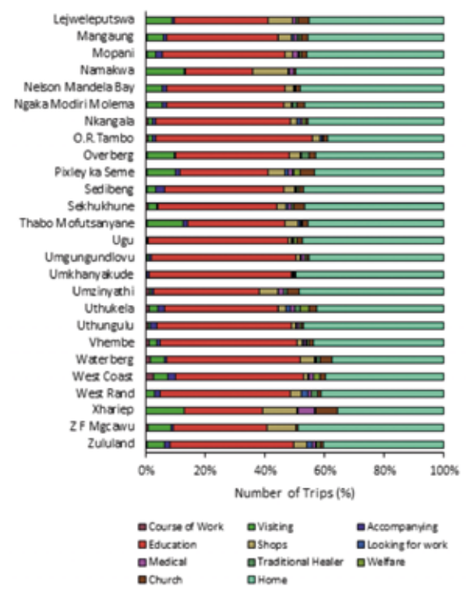
Percentage low-income households by District Municipality



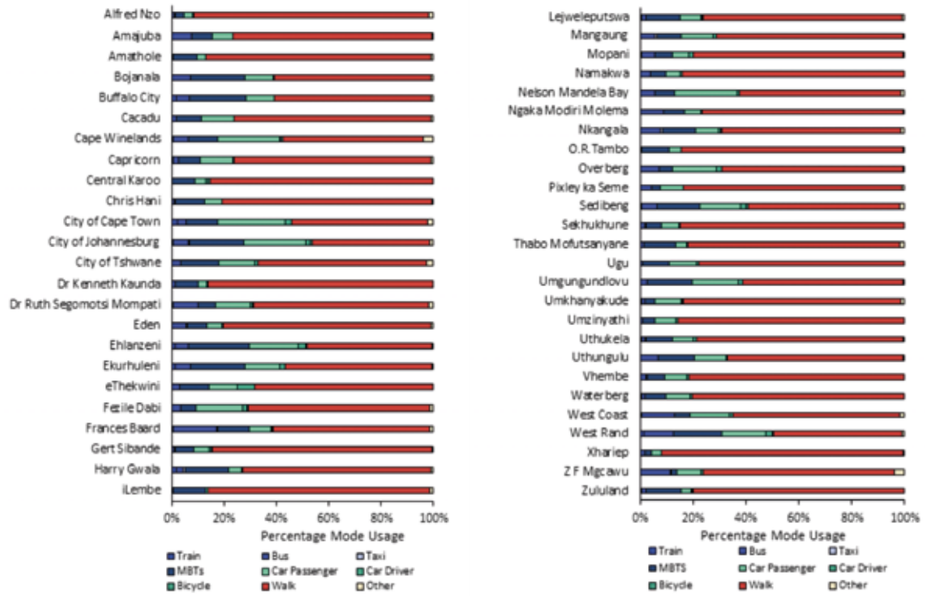


Purpose of child travel by District Municipality





Mode used by children to travel for various purposes by District Municipality



Time to Access Education for Pedestrians by District Municipality

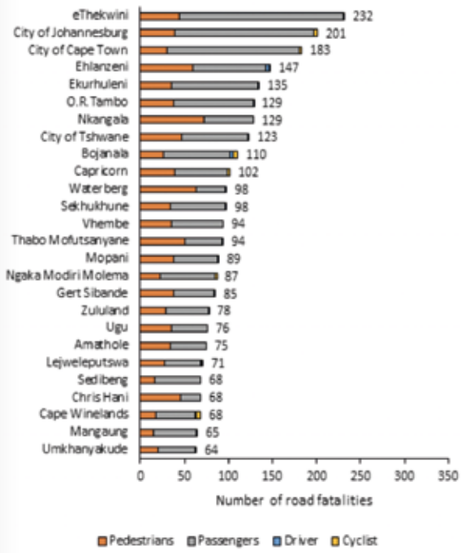
District	Average TT	% Walk>15	District	Average TT	% Walk>15
West Coast	15.0	29%	Vhembe	28.3	65%
Cape Winelands	16.8	34%	Gert Sibande	30.3	66%
City of Cape Town	18.7	40%	Sedibeng	30.2	66%
Central Karoo	20.3	42%	John Taolo Gaetsewe	28.1	66%
Xhariep	21.6	46%	City of Tshwane	28.9	67%
Pixley ka Seme	20.8	50%	Dr Ruth Segomotsi Mompati	27.2	67%
Nelson Mandela Bay	20.6	52%	Capricorn	25.7	68%
Overberg	19.2	52%	Alfred Nzo	31.2	69%
West Rand	25.1	55%	Amathole	32.6	69%
Fezile Dabi	21.5	55%	Bojanala	29.4	71%
Dr Kenneth Kaunda	26.9	55%	eThekwini	31.6	72%
Lejweleputswa	25.9	59%	Ehlanzeni	30.1	73%
Cacadu	24.4	60%	Harry Gwala	33.5	74%
Nkangala	24.7	60%	Uthukela	39.3	76%
Ekurhuleni	26.5	60%	Umgungundlovu	34.1	77%
Frances Baard	25.8	61%	Mopani	31.1	77%
Mangaung	27.3	61%	O.R.Tambo	35.0	78%
City of Johannesburg	27.6	62%	Joe Gqabi	31.6	78%
Namakwa	21.5	62%	Zululand	37.8	80%
Z F Mgcawu	22.7	63%	iLembe	43.2	83%
Waterberg	29.4	63%	Uthungulu	38.6	83%
Buffalo City	25.3	64%	Ugu	40.7	84%
Ngaka Modiri Molema	25.6	64%	Amajuba	33.8	86%
Eden	24.1	65%	Umzinyathi	39.0	86%
Sekhukhune	28.9	65%	Umkhanyakude	49.0	88%

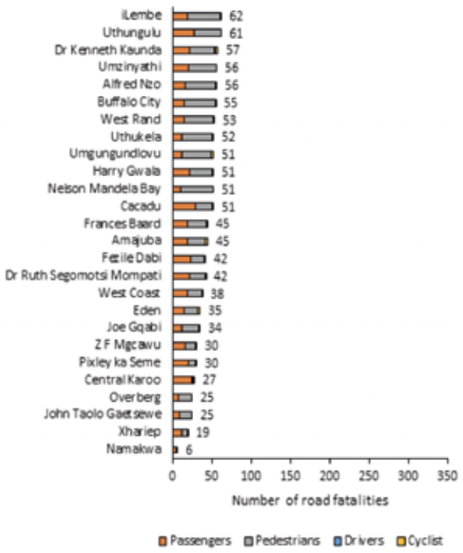
Time to Access Education for Passengers by District Municipality

District	Average TT	% Travel>15	District	Average TT	%Travel>15
Central Karoo	21.1	32%	Capricorn	39.2	80%
Overberg	24.5	45%	John Taolo Gaetsewe	42.7	80%
West Coast	32.4	58%	Harry Gwala	46.1	82%
Lejweleputswa	27.3	59%	Chris Hani	37.7	82%
Cape Winelands	27.5	60%	Gert Sibande	44.3	82%
Fezile Dabi	24.1	63%	Joe Gqabi	48.7	82%
Thabo Mofutsanyane	29.9	65%	Umgungundlovu	43.6	83%
Pixley ka Seme	31.7	66%	Ngaka Modiri Molema	38.2	83%
City of Cape Town	35.9	66%	Uthukela	48.3	84%
Waterberg	36.5	67%	Umzinyathi	40.8	84%
Z F Mgcawu	35.0	69%	Zululand	45.8	84%
Eden	36.3	73%	Amathole	45.7	85%
Johannesburg	40.2	73%	Xhariep	37.2	85%
Namakwa	41.1	74%	eThekwini	44.5	85%
Ekurhuleni	41.3	75%	Vhembe	41.8	85%
Frances Baard	31.2	75%	Bojanala	46.1	86%
Nelson Mandela Bay	36.9	75%	Buffalo City	38.9	86%
Dr Kenneth Kaunda	39.5	75%	Nkangala	44.5	87%
Mangaung	35.9	76%	Alfred Nzo	48.7	90%
Sedibeng	45.9	76%	Ugu	48.6	90%
Mopani	33.9	76%	iLembe	56.7	91%
City of Tshwane	41.2	77%	Ehlanzeni	52.9	92%
West Rand	39.1	78%	O.R.Tambo	50.5	92%
Dr Ruth Segomotsi Mompati	36.0	78%	Amajuba	49.5	92%
Cacadu	38.4	79%	Uthungulu	49.0	94%
Sekhukhune	38.1	79%	Umkhanyakude	48.5	97%

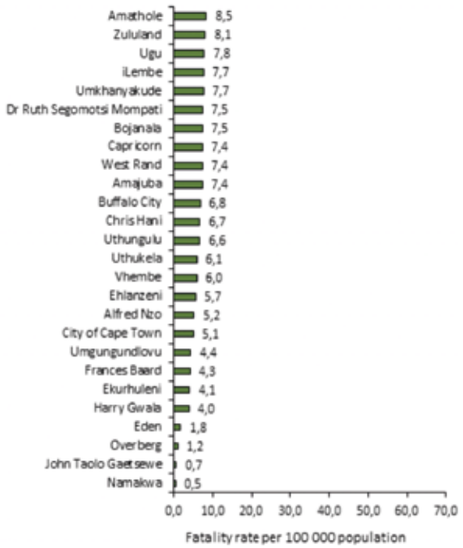
APPENDIX B

Road Fatalities by District Municipality



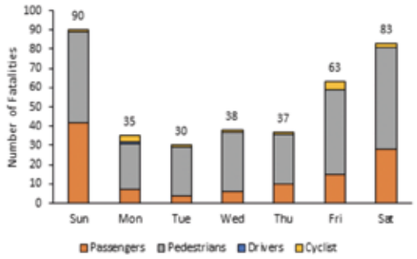


Road Fatality Rates by District Municipality

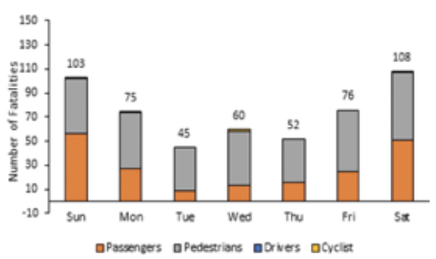


Vulnerability by DAY: Provinces

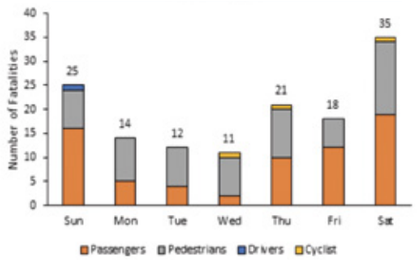
Western Cape



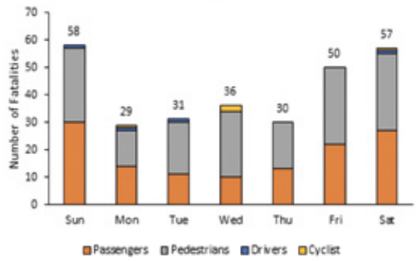
Eastern Cape



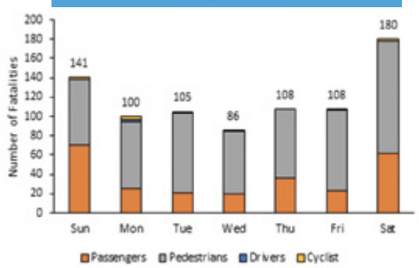
Northern Cape



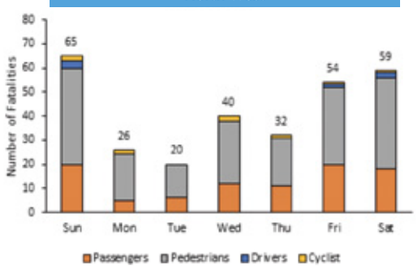
Free State



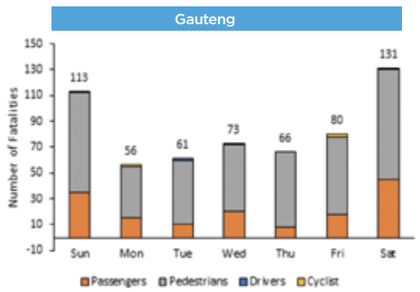
KwaZulu-Natal



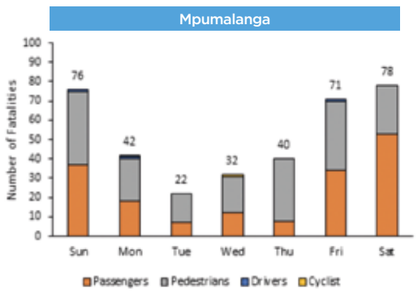
North West



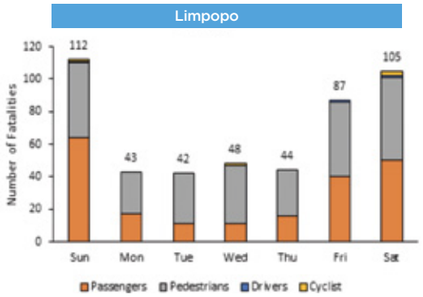
Gauteng



Mpumalanga

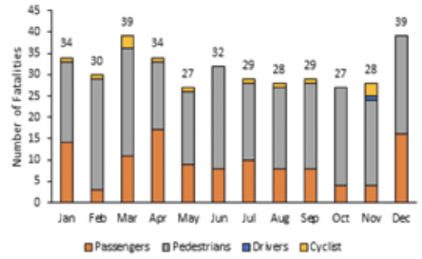


Limpopo

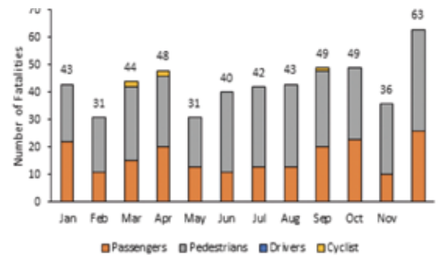


Vulnerability by MONTH: Provinces

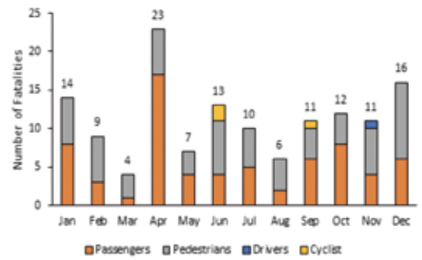
Western Cape



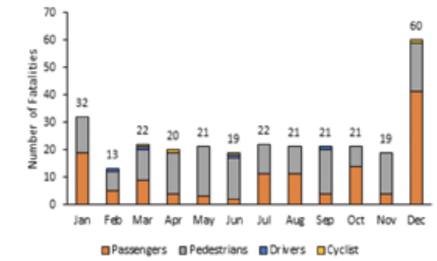
Eastern Cape



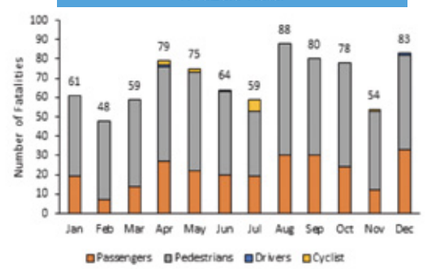
Northern Cape



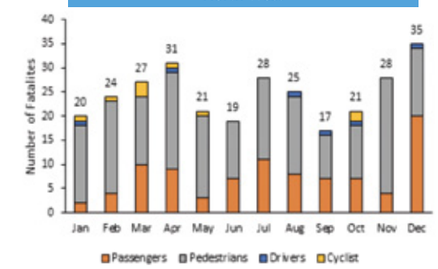
Free State



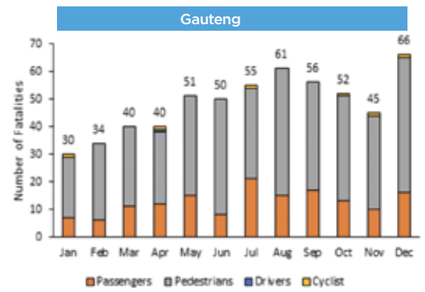
KwaZulu-Natal



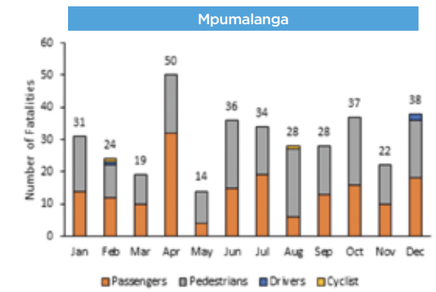
North West



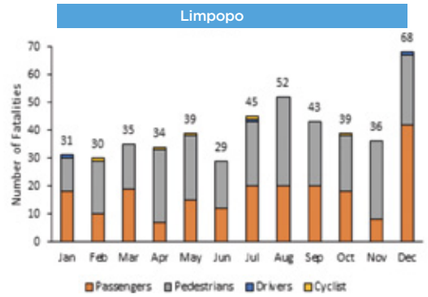
Gauteng



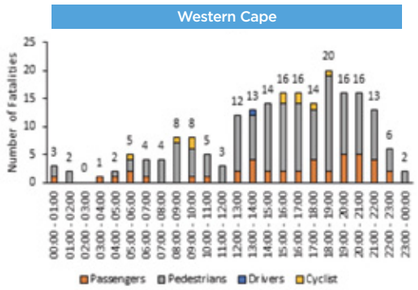
Mpumalanga

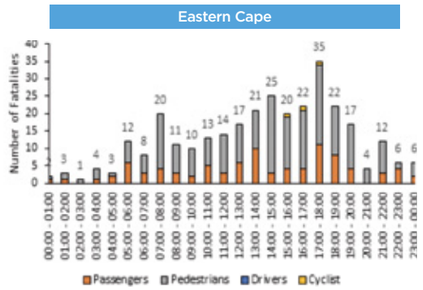


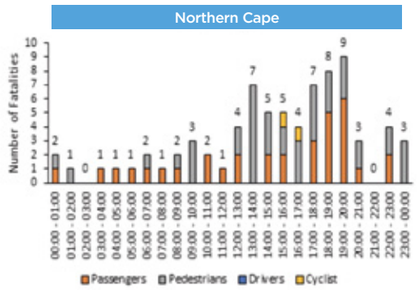
Limpopo

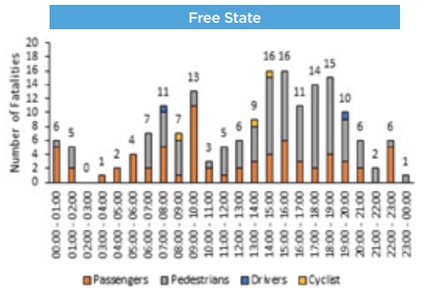


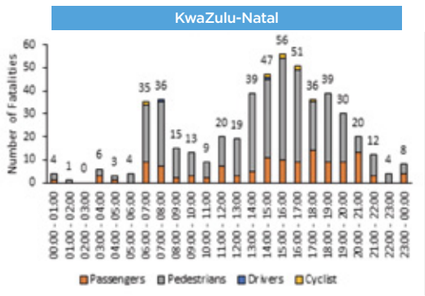
Vulnerability by TIME: Provinces – WEEKDAY

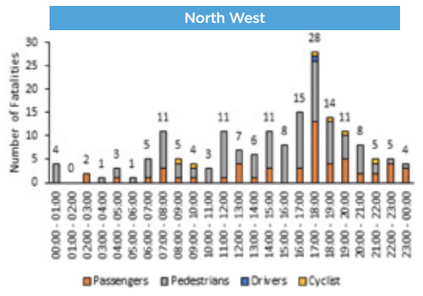


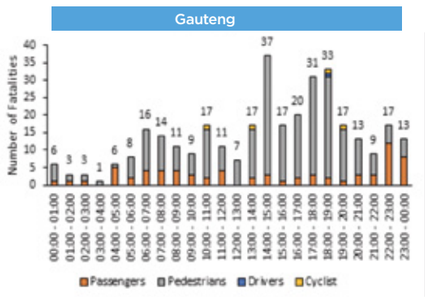


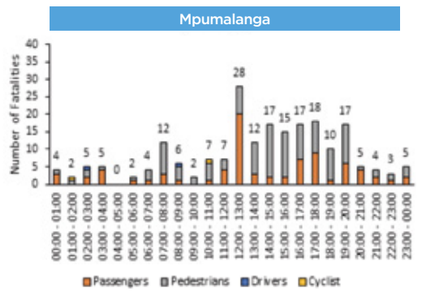


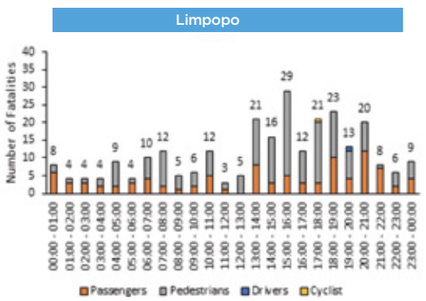




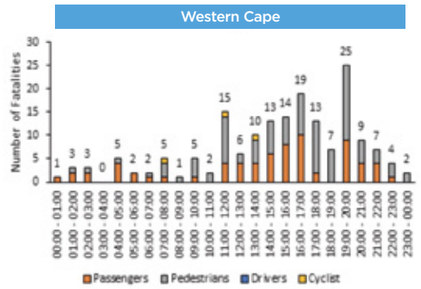


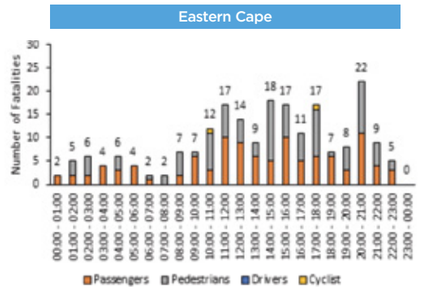


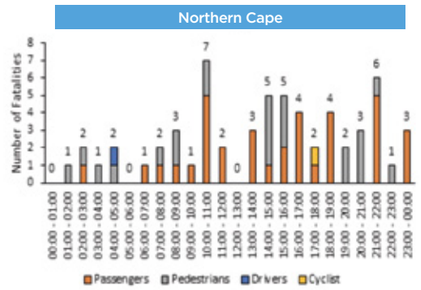


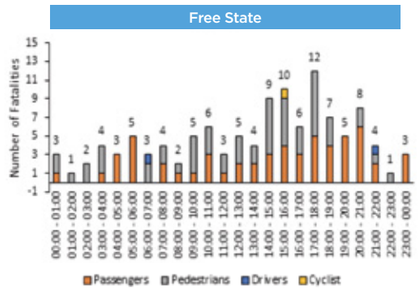


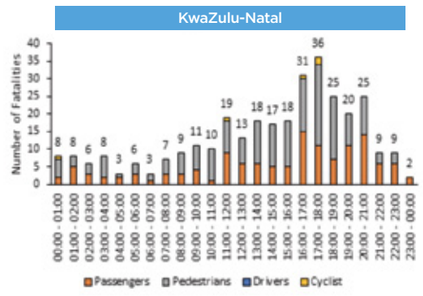
Vulnerability by TIME: Provinces – WEEKEND

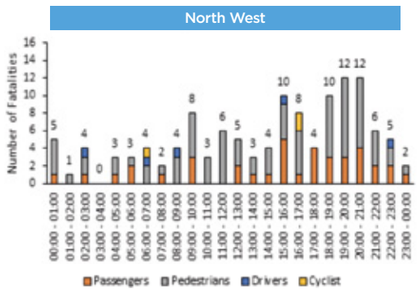


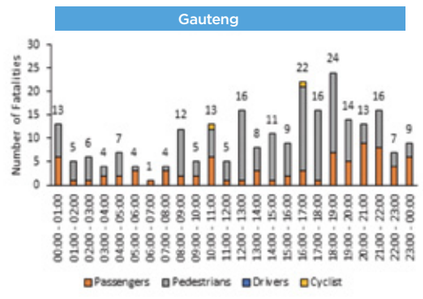


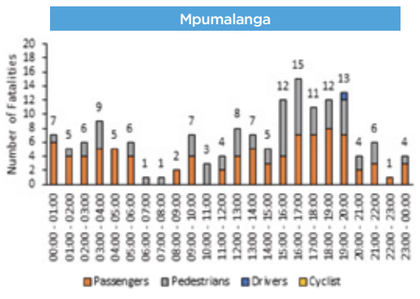


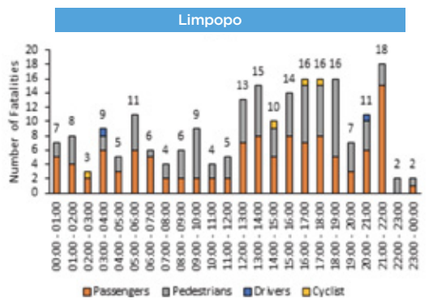




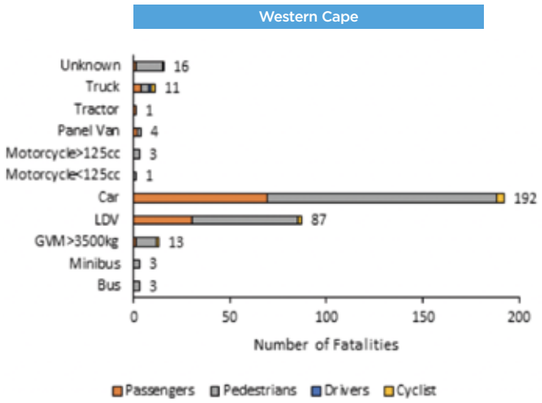


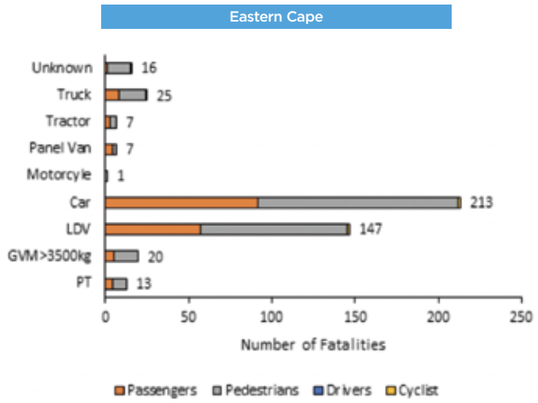


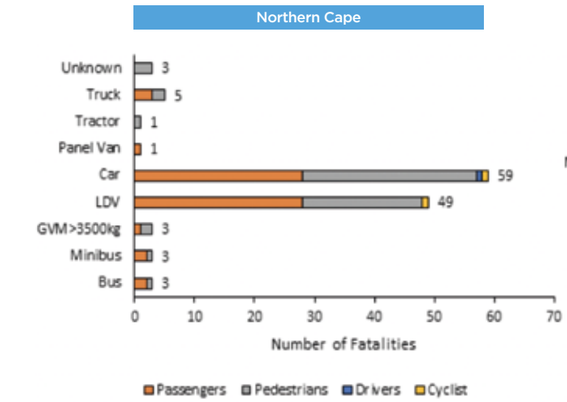


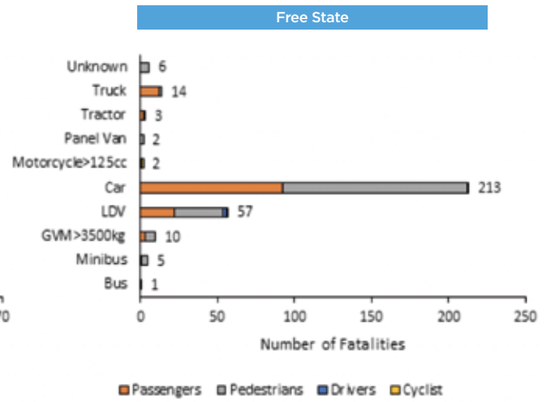


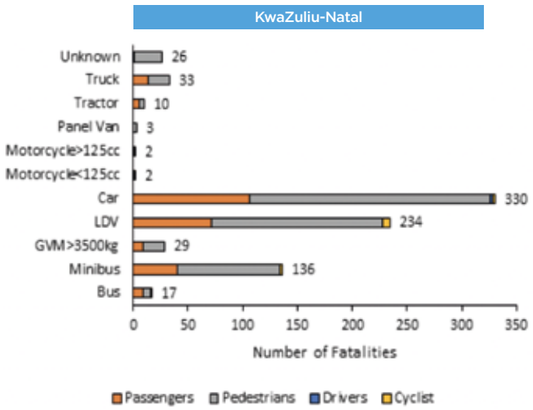
Vulnerability by VEHICLE TYPE: Provinces

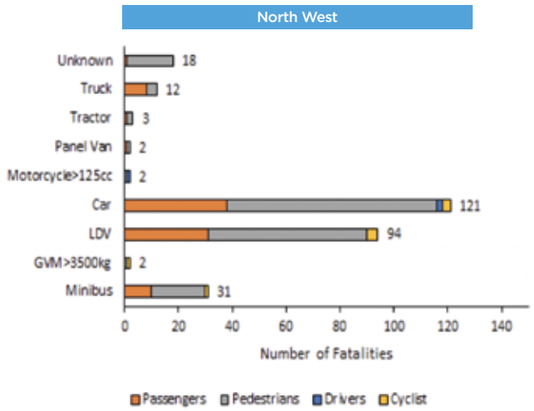


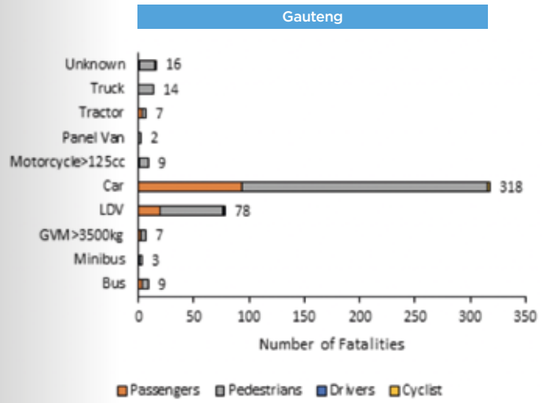


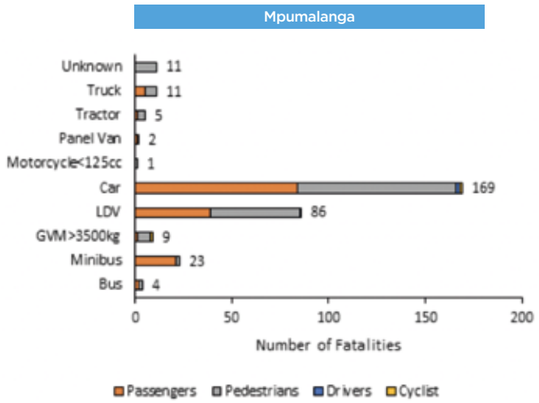


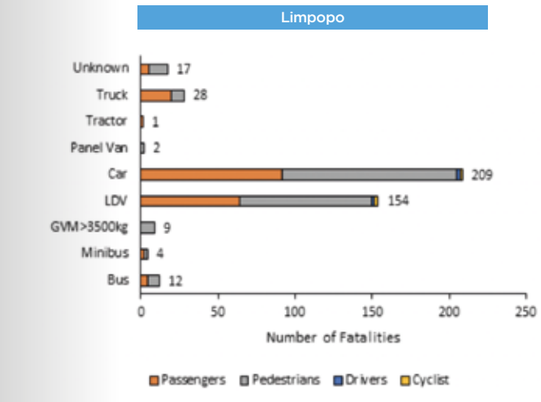












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