# District Safety Plans: Towards a Model for Safer Road-Based Transport Systems in Rural and Urban Settings in the Western Cape

**by**

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## Declaration

I declare that this thesis is, in its entirety, my own original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification. I declare that I was enrolled as a student for the degree of Master of Engineering throughout the period in which this work was developed.

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## Abstract

The development of road safety paradigms around the world which identify traffic injuries as emerging from the traffic system as a whole have proved extremely successful in reducing traffic injury burdens dramatically since their peaks in the 1970s and early 1980s. These benefits have not however been universally shared across the globe, and at this time road safety outcomes in higher income countries are in stark contrast to those continuing to be suffered in middle- and lower-income countries. South Africa in general, and the Western Cape in particular has features of both middle- and lower-income countries. Road traffic injuries, including fatalities, have remained stubbornly high, despite global, national and regional initiatives. The introduction by the Western Cape Government of an evidence-based, vertically and horizontally integrated “District Safety Plan” concept as part of its adoption of Vision Zero provides an opportunity to examine the applicability and efficacy of planning systems that attempt to address the traffic system as a whole in a manner customized to a specific locality. The piloting of this concept in the rural Caledon Traffic District by the Western Cape Government, and subsequent testing within the densely urbanized township of Khayelitsha by the City of Cape Town created an opportunity to further contrast such a mechanism when implemented in differing environments. In addition, the data generated by the implementation of these District Safety Plans created an opportunity to attempt to devise a theoretical predictive model for the design of integrated planning systems aimed at improving safety within the traffic system in a given area. The core study was limited to a six-month post implementation period and was limited to the impact of enforcement and education activities due to this timeframe. Study of the implementation and impact of the plans showed potential for improving road safety outcomes within the traffic systems in both rural and urban areas. However, impact in the rural environment was shown to be higher, notably due to the impact of predictable external shocks in the urban environment, especially civil unrest. The most promising results were shown to be potentially significant impacts on pedestrian fatalities in Caledon: after six months, these were observed to have fallen 63% year on year, and 63.6% when compared to the five-year average. The development of a rudimentary predictive model that scores combinations of law enforcement and education activities showed promise for the future ability of planners to develop minimum thresholds for significant positive impacts by identifying numbers of operations and numbers and types of media activities necessary. Future studies conducted over longer terms could incorporate engineering interventions as well as study the potential impacts of social media.

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## Dedication

This study contains numerous graphs, pie-charts and tables of road traffic fatalities. Behind these numbers are men, women and children who died violent premature deaths. This study is dedicated to them.

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## List of Abbreviations

| Abbreviation | Meaning |
|---|---|
| AR | Accident Report |
| BAC | Blood Alcohol Concentration |
| BrAC | Breath Alcohol Concentration |
| CoCT | City of Cape Town |
| CSIR | Council for Scientific and Industrial Research |
| DRE | District Roads Engineer |
| DRTMCC | District Road Traffic Management Co-ordinating Committee |
| DSP | District Safety Plan |
| DTPW | Department of Transport & Public Works |
| DUI | Driving Under the Influence (of intoxicating liquor or drugs, or driving with a blood or breath alcohol content over the legal limit) |
| EGVV | Elgin Grabouw Villiersdorp en Vyeboom Agriculture Association |
| FMS | Freeway Management System |
| FPS | Forensic Pathology Services |
| Gunya | Gugulethu, Nyanga and Philippi East |
| HIC | Higher Income Countries |
| ID | Identity |
| IPTNs | Integrated Public Transport Networks |
| KLW | Khayelitsha and Lingelethu West SAPS Precincts |
| LMIC | Lower and Middle Income Countries |
| LTS | Land Transport Safety |
| M&E | Monitoring and Evaluation |
| MDMP | Military Decision Making Process |
| MRC | Medical Research Council |
| PAS | Provincial Accident System |
| PTS | Provincial Traffic Services |
| QME | Quality Monitoring and Evaluation |
| RBT | Random Breath Testing |

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| RSM | Road Safety Management |
| RSOS | Road Safety Outcomes Score |
| RTMC | Road Traffic Management Corporation |
| Sanral | The South African National Roads Agency Limited |
| SAPS | South African Police Service |
| TDA | Transport and Urban Planning Authority, City of Cape Town |
| TLE | Traffic Law Enforcement |
| UN | United Nations |
| WCDOH | Western Cape Department of Health |
| WCG | Western Cape Government |
| WHO | World Health Organization |

## Glossary

Additional details are provided in Chapter 1. Definitions and Useful Concepts.

| Term | Meaning |
|---|---|
| Accident Report | A report produced by the SAPS when a collision occurs |
| Blood Alcohol Concentration | The percentage of alcohol present in a blood sample. |
| Breath Alcohol Concentration | The percentage of alcohol present in a breath sample |
| District Road Traffic Management Co-ordinating Committee | Committee responsible for co-ordinating road safety within a particular district or metropolitan municipality |
| Department of Transport & Public Works | Western Cape Government department responsible for transport management and infrastructure, as well as government property and building management |
| Freeway Management System | System for managing traffic flow on a freeway network |
| Forensic Pathology Services | Directorate of the WCDOH responsible for collection and classification of human remains in the event of non-natural deaths |
| Gugulethu, Nyanga and Philippi East | Area of Cape Town collectively known as Gunya |
| Integrated Public Transport Networks | Public transport networks integration non-motorized transport modes with buses, minibuses and trains, as well as scholar and learner transport operations |
| Khayelitsha and Lingelethu West SAPS Precincts | Area of Cape Town collectively referred to as KLW |
| Land Transport Safety | DTPW Directorate responsible for transport operator safety, especially freight, public transport and rail |
| Military Decision Making Process | The process by which a mission is analysed and orders developed for its fulfilment |
| Medical Research Council | National body responsible for research into public health |

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| Provincial Accident System | Database managed by DTPW, collected from Accident Reports |
| Provincial Traffic Services | DTPW's law enforcement directorates encompassing Traffic Law Enforcement and Traffic Training and Development |
| Quality Monitoring and Evaluation | A sub-directorate within Traffic Training and Development responsible for monitoring road safety planning implementation |
| Random Breath Testing | A form of DUI operation involving highly visible, fast-moving patrols supported by marketing activities |
| Road Safety Management | DTPW road safety education directorate |
| Road Safety Outcomes Score | A points system developed to indicate combinations of traffic operations with marketing activity |
| Road Traffic Management Corporation | The national body responsible for co-ordinating road safety in South Africa |
| Safely Home | Road safety campaign of the DTPW aimed at changing road user behaviour |
| Safe Systems | Road safety paradigm incorporating the concept that traffic injuries result from the traffic system as a whole rather than one or several elements thereof |
| The South African National Roads Agency Limited | The national body responsible for the design, building, operation and maintenance of the national road network, including some provincial routes in certain circumstances |
| Transport and Urban Planning Authority, City of Cape Town | Department of the City of Cape Town responsible for transport, roads and related infrastructure matters, including storm water |
| Traffic Law Enforcement | Directorate of the DTPW responsible for law enforcement on national and provincial roads |

| | |
|---|---|
| Vision Zero | Ethics-based road safety interpretation of the safe system, positing that no-one should be killed or injured while using the traffic network |

# Chapter 1: Introduction

## 1.1 Background

### 1.1.1 The burden of disease of road traffic injuries in South Africa and the Western Cape

South African roads are plagued by stubbornly high levels of traffic injury. Estimates of the extent of the problem vary considerably. The Medical Research Council's (MRC) Injury Mortality Survey, published in 2015, estimated that 17 103 people were killed on South African roads in 2009, including 1 521 in the Western Cape (Matzopolous et al, 2015). The Road Traffic Management Corporation (RTMC) published a rolling twelve-month figure of 13 768 road traffic fatalities as of December 2009, including 1 285 in the Western Cape (Road Traffic Management Corporation, 2010). The MRC has yet to publish a more recent Injury Mortality Survey. The RTMC's most recent published figures are for 2017, and state that there were 14 050 fatalities in 2017, including 1 236 in the Western Cape (Road Traffic Management Corporation, 2018). On 22$^{nd}$ February 2018, the Western Cape Department of Transport and Public Works (DTPW) released a media statement stating that 1 319 people had been killed on Western Cape roads in 2017 (Western Cape Government, 2018). This number was based on statistics provided by the Western Cape Department of Health's (WCDOH) Forensic Pathology Services (FPS). Whichever figures are considered, it is apparent that the actual numbers of fatalities (and by extrapolation other injuries) are very high. It is also clear that little progress has been made to significantly reduce actual numbers of traffic injuries. In the absence of an updated Injury Mortality Survey, the best-case national scenario, represented by RTMC figures, is an increase of 2% in fatalities between 2009 and 2017. In the Western Cape, the FPS figures are more positive, with an estimated 13.28% decrease between 2009 and 2017.

These numbers need to be considered in the context of South Africa's undertaking to reduce road traffic fatalities by 50% between 2011 and 2020, in terms of the Moscow Declaration (2009) and the United Nations Decade of Action for Road Safety 2011 – 2020.

The RTMC published numbers for non-fatal injuries for 2015, which included 62 520 serious injuries and 202 509 slight injuries for that year (Roux & Labuschagne, 2016:32). Using these figures, an estimated ratio of serious and slight injuries per fatality can be developed, these being 4.6 serious injuries per fatality and 14.9 slight injuries per fatality.

According to the RTMC's annual Calendar Reports, 93 011 people were killed on South Africa's roads between 2010 and 2016 (see Figure 1.1 below) (Road Traffic Management

Corporation, 2010, 2011, 2012, 2013, 2014, 2015, 2016). Using ratios for serious and slight injuries, an estimate of 427 850 serious injuries and 1 385 864 slight injuries for the period can be developed.

The RTMC's figures for the cost to the economy of road traffic injuries in 2015 was R142 950 584 934, a year in which the RTMC reported 13 591 fatalities, inclusive of a five per cent upwards adjustment to account for under-reporting from an original number of 12 944 (Roux & Labuschagne, 2016:39). The mean unadjusted total of annual fatalities reported by the RTMC between 2010 and 2016 was 13 287, placing 2015's figures at 2.5% below the mean. Adjusting the 2015 cost of crashes upwards by 2.5% leads to an estimated mean cost per annum of R146 524 349 557 for the period 2010 - 2016. This results in an estimated total cost of R1 025 670 446 899 between 2010 and 2016, in 2016 Rand.

In summary, during the period 2010 – 2016 an estimated 93 011 people were killed and over 1.8 million people were injured, at an estimated cost of over R1 trillion, road safety and traffic injuries. In this context, it is important that solid local structures are developed which can address road traffic injury directly. Developing robust and sustainable models which permit deployment of effective road safety plans across multiple environments, despite widely varying circumstances, is thus lent further urgency.

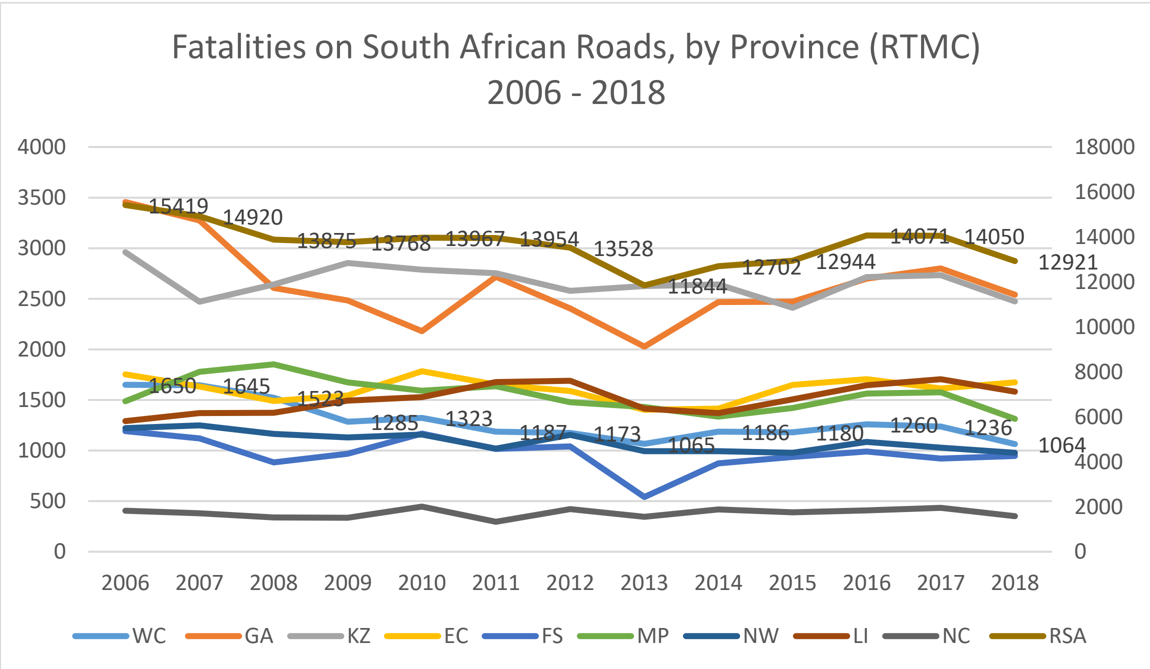


*Figure 1.1 RTMC Fatality numbers by province and nationally, Western Cape and RSA labelled, 2006 – 2018*

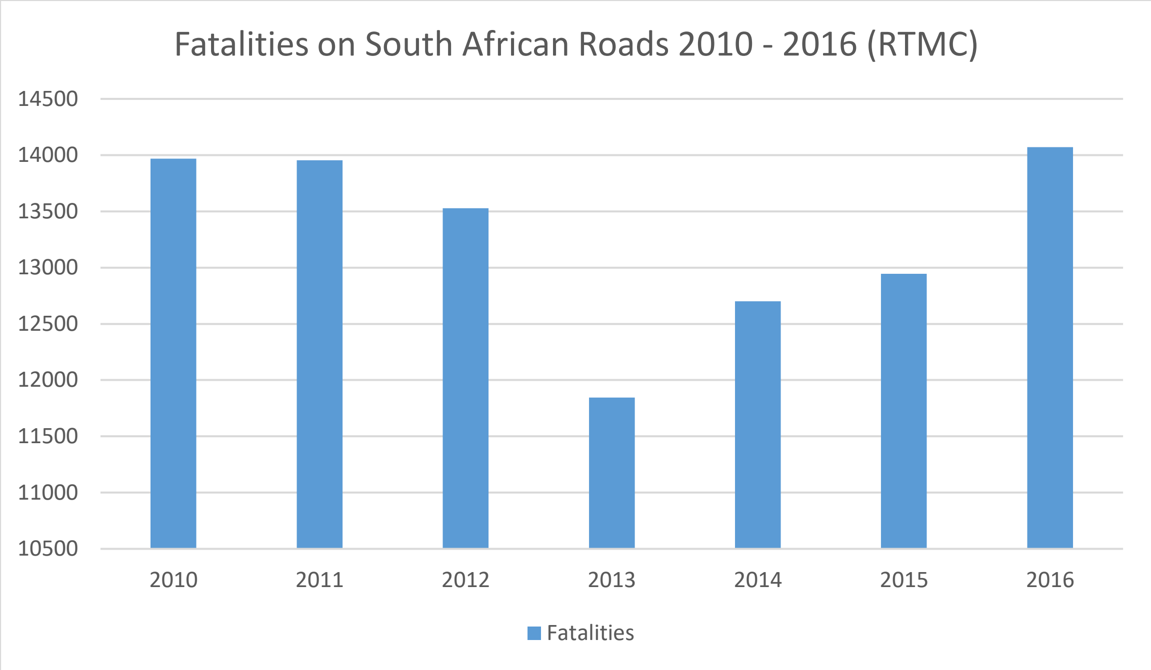


*Figure 1.2 RTMC Road Traffic Report Calendar fatality figures, 2010 – 2016*

### 1.1.2 District Safety Plans (DSPs)

As part of the Department of Transport & Public Works' (DTPW) response to continued high levels of road traffic injury on Western Cape roads, the Transport Management branch identified localised road safety plans as a foundational element of a safe road transport system for the province, and set out to test how such plans could be developed and implemented. These plans were to be founded on the principle of the primacy of the evidence base, and were intended to link and integrate activities by road safety stakeholders across all disciplines, specifically integrating engineering road safety effort with traffic law enforcement and education (and marketing) activities. The plans also aimed to link and integrate activities across all three spheres of government. The plans were termed "District Safety Plans" as they were to be aligned to the operational boundaries, or districts, of the eleven rural Provincial Traffic Centres of provincial Traffic Law Enforcement, a directorate of DTPW, within the Traffic Management chief directorate. The author was responsible for the creation of the concept and the development of the framework for planning and implementation of a pilot District Safety Plan (DSP). Subsequently, the author was tasked with developing and implementing a pilot DSP. The Caledon Traffic Centre was identified as the location of the pilot, and a process to develop and implement a Caledon District Safety Plan was initiated in March 2016. The Caledon DSP was finalised and approved, with implementation commencing on 1 October 2016.

According to figures released for Quarters 3 and 4 2016/17 by DTPW (that is, the first six months of implementation), fatalities in the Caledon DSP area decreased by 41% compared to the same period in 2015/16 (Western Cape Department of Transport & Public Works, 2017). This included a 54% reduction in pedestrian fatalities, and the reduction of child fatalities (ages 0 – 14) from 7 to zero. By comparison, during the same periods, the Vredenburg district (also a coastal area with large agricultural interior, also consisting of three local municipalities) experienced a 10.1% increase in fatalities.

Stemming from these positive results, the author began work on a formalised framework for the development and implementation of District Safety Plans, with a view to creating a road safety system which could be swiftly, effectively and sustainably implemented at the other ten rural Provincial Traffic Centres in the Western Cape.

The results in the Caledon district also formed part of a presentation by the author to the Metro District Road Traffic Management Co-ordinating Committee (Metro DRTMCC). As a result, the Metro DRTMCC resolved to develop a pilot DSP within Cape Town, under the project sponsorship of Heathcliff Thomas, Traffic Chief of the City of Cape Town. The author obtained permission from DTPW to assist the City of Cape Town directly. This initiated the process of implementing a metro-type DSP using the model developed and implemented in the Caledon DSP. This process culminated in the launch of a DSP in the Khayelitsha and Lingelethu West precincts of the SAPS, known as the KLW DSP, on 1st January 2018. These circumstances created a unique opportunity to systematically test the efficacy of a road safety system developed for a rural environment, when applied to an urban environment, and to analyse the data generated via the development of a predictive model for interventions of this nature.

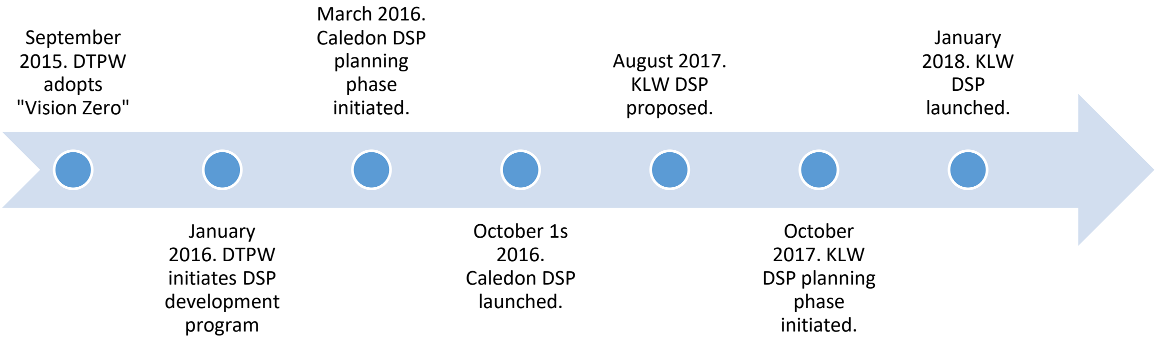


*Figure 1.3 Caledon and KLW DSP development timeline*

## 1.2 Problem Statement

### 1.2.1 Challenges of modelling road safety systems in a heterogeneous environment

While an evidence-based, integrated multidisciplinary approach has long been identified as a pre-requisite for road safety in South Africa[1], the field remains characterised by poor co-ordination of effort at both the strategic and tactical level, alongside limited ability to implement, monitor and evaluate plans effectively. SB Mohlala, in proposing that the Traffic Management System (TMS) model developed in the early 1990s be implemented by the RTMC, states that "there is a problem in co-ordination, implementation, monitoring and evaluation of these road traffic issues in South Africa and that there is a need to address it" (2017). At a national level, Mohlala describes the problem thus:

> There is a lack of an implementation strategy, a management plan, involvement of teams of experts, and a scientific and multi-disciplinary approach of the developed road traffic management models under the TMS in order to advance the UN DoA Road Safety Strategy in South Africa, to reduce road traffic violations and road traffic casualties. Another challenge identified by this paper is that many institutions, especially government institutions, in the RSA do not pay enough attention to the management and implementation of plans and it appears that the steps that have been taken so far to ensure the promotion of road safety have not been adequate.
>
> (2017)

There is, however, little acknowledgement in the literature that the road safety environment is not uniform across provinces, and, within provinces, between different metropolitan, district or local municipalities[2]. Within these geo-political entities, there also exist a multitude of different environments, with particularly stark contrasts existing within a single metropolitan municipality[3]. Academic, private sector and public policy studies are also inclined to overlook influencing factors from beyond the road environment. Significant differences exist in economic development, educational attainment, language, access to health services, crime levels and patterns, access to alcohol and alcohol use patterns, and numerous other indicators from suburb to suburb within urban environments and between municipalities and wards in rural environments. All of these factors and more can potentially

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[1] See for example Pretorius, H.B. (1988). *On Managing the Traffic Safety System: A Multidisciplinary Approach*. M.Sc. (Eng.) (Civil) Dissertation. University of the Witwatersrand

[2] For example, the DSP Evaluations found that while pedestrians made up 35.44 % of 2010-2015 fatalities in the Caledon District Safety Plan area, in Khayelitsha-Lingalethu West pedestrians accounted for 80% of fatalities over the same period.

[3] For example, the Safely Home seat belt compliance surveys, conducted in three waves in 2016, found nearly 80% of drivers in the CBD and 70% of drivers in the Northern Suburbs are buckled, while in Khayelitsha and Mitchell's Plain compliance varied from under 40% to a high of 59% (Lightstone, 2016)

impact upon the road environment, and should be examined when developing effective plans to address road safety. For example, a province-wide press campaign that seeks to explain the relationship between different alcoholic beverages and blood alcohol content may be less effective in Theewaterskloof local municipality in the Caledon district, where literacy is 10.1% lower than the provincial average (Western Cape Government, 2015) or in Bergrivier local municipality in the West Coast district, where there are 32% fewer matriculants than the provincial average (Statistics South Africa, 2011).

Climate also varies greatly across South Africa and the Western Cape. While it is widely acknowledged that wet areas and times of year are subject to heightened crash risk, there is less awareness that dry times of year lead to fires which close roads, hamper visibility and draw heavily on traffic and emergency services, leaving road users exposed to increased risk. The widespread protest action which is a major characteristic of the South African socio-political landscape also draws on traffic resources, while rioting and public violence, as well as other contact crime, impacts on road safety in a similar manner to fires.

The wide variety of responsible government entities and their varying jurisdictions are another piece of the road safety jigsaw puzzle which must be taken into account when attempting to design road safety systems. The South African Police Service (SAPS) have precinct and cluster boundaries that do not align with the boundaries of provincial and municipal traffic services[4]. Department of Health boundaries overlap district and local municipalities. Data collection and assignment occurs at a number of different levels, and operational boundaries which are practical for road safety activities may not always align with how critical datasets are circumscribed[5]. This can hamper monitoring and evaluation if not resolved at the planning stage, and thus undermine implementation and accountability. This kind of dilemma is not limited to the national or provincial context: as Norwegian researchers Elvik and Yaa put it in *The Handbook of Road Safety Measures*:

> The responsibility for developing and implementing road safety measures is usually divided among a number of governmental agencies at the national, regional and local level. An extensive division of responsibility can make it difficult to implement road safety measures in the most cost-effective way.
>
> (2004:155)

[4] For example, the Milnerton cluster of the SAPS has 5 precincts in the City of Cape Town metropolitan municipality, and 4 precincts in the West Coast district municipality, the latter being wholly located within the Swartland local municipality.

[5] For example, the Vredenburg Provincial Traffic Centre covers the main routes of the southern portion of the West Coast district municipality, including the Vredenburg SAPS cluster and the 4 precincts of the Milnerton cluster mentioned above. For practical reasons, the traffic centre's operational area includes the towns of Saron and Tulbagh, which fall within the Worcester SAPS cluster, the Winelands district municipality and the Drakenstein and Witzenberg local municipalities respectively.

A 'one-size-fits-all' approach to implementing a road safety system must thus be approached with caution. Governments, however, have limited resources, and thus plans of universal application, or models which enable efficient deployment of plans across the country relatively easily and quickly are attractive. Resource limits grow increasingly more acute at provincial and district and local municipal level. A balance must therefore be sought between the need to develop models which can be widely deployed efficiently, effectively and sustainably with relative ease (including monitoring and evaluation thereof) and the need to ensure that the specific features and hazard profile of different localities are addressed. The District Safety Plan (DSP) concept was designed in such a way as to attempt to find this balance. The DSP concept was developed to be robust enough for wide yet simple application, while remaining flexible enough to accommodate diverse environments.

In essence, the DSP concept utilizes an approach which develops an intelligence picture of a specified area. The identification of this area is in itself a sub-process which is important in the light of the need to balance the need for practical and implementable planning with the widely varying road safety landscape. The intelligence picture is drawn firstly through collating a wide range of data and reported statistics, especially, but by no means limited to, crash data. Local knowledge, institutional memory and personal views are sought through consultation, then analysed against empirical and statistical sources. The overall analysis is packaged as a formal 'Evaluation', within the strategic road safety context, in an attempt to identify those interventions which are likely to produce the most impact. At the same time, the DSP incorporates a monitoring and evaluation framework designed to ensure it is implemented according to the plan, and that impact, or lack thereof, is monitored over time. It also incorporates a significant informal element, in the form of incentives for local municipalities to take part in the planning and implementation of District Safety Plans: this is done through the provision of strategic resources (ranging from facilitation of issues and engineering intervention, to data and statistics provision) and tactical resources, including localised media campaigns or equipment such as handheld breath alcohol testers, high quality reflective jackets, gloves and traffic cones – items which are highly prized by individual traffic officers.

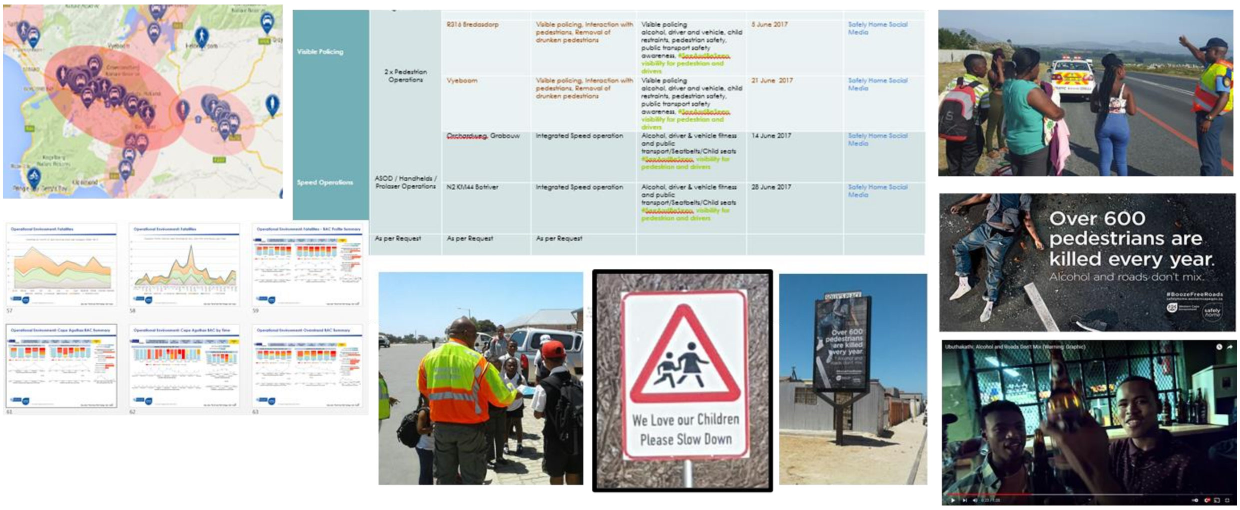



*Figure 1.4 Evaluation to Planning to Implementation, illustration of DSP Concept as Implemented in Caledon*

### 1.2.2 Flexibility within a framework –the efficacy of the District Safety Plan concept as a model for road safety in divergent environments

Given the scale of the road safety crisis in South Africa and the Western Cape, and the difficulties in developing a model for planning and implementing solutions at local level, there is great value in economic and human terms in the successful development of such a model system.

A successful deployment of the same system in both the Caledon Provincial Traffic district and the Khayelitsha and Lingelethu West (KLW) area of the City of Cape Town, two areas which are as dissimilar as is possible, would be a considerable indicator of the potential usefulness of the DSP system for deployment widely across the province and the broader South Africa.

Superficial examination shows the dramatic contrasts between these areas: the Caledon district has a diverse, largely Afrikaans-speaking population of 235 864 spread over an 8 407km² area, with a population density of 28 people per square kilometre. It incorporates hundreds of kilometres of coastline, numerous large and small towns, vast agricultural areas and a range of tourist attractions including sporting events (especially mountain biking), cultural events, whale watching, the southernmost tip of Africa and so on. KLW on the other hand features a homogenous, isiXhosa-speaking population of 254 750 in an area of just 17.61km², resulting in an extraordinary population density of 14 470 people per square kilometre. Its inhabitants live in a dense urban environment, much of it which is informal. There are few amenities, relatively little interaction with outsiders such as tourists, and it is bounded entirely on its northern edge by a high speed national route (the N2, which further east runs through the hills of the Caledon district).

*DSP RBT Operation, 1 July 2017, N2 Dassiesfontein, Caledon District*


*DSP RBT Operation, Jan 2018, Bonga Drive, KLW*

*Figure 1.5 Example photos of DSP operations in Caledon and KLW DSPs*

Study of the implementation of the District Safety Plan concept in these two diverse localities, and the impact on road traffic fatalities, is expected to help to determine the suitability of the District Safety Plan concept as a model for developing a safer road safety environment in South African and the Western Cape. Furthermore, modelling DSP planning data against fatality outcomes can assist road safety planners in establishing targets and the resource requirements to achieve them.

### 1.3 Definitions and Useful Concepts

*Shared competence*. In South Africa, an area of governance that is shared between one or more spheres of government. These are drawn from the role, powers and functions defined in the Constitution of South Africa. Transport is an example of a *shared competence*, meaning that responsibility for road safety vests with all three *spheres of government*.
*Spheres of government.* The Constitution defines three “distinctive, interdependent and interrelated” spheres of government, these being:

1. *National sphere.* National government is based in Pretoria but plays a significant role in local road safety. Elements of the national government having significant direct impact on the road safety environment are: the Department of Transport and its agencies (especially Sanral, the Road Traffic Management Corporation and the Road Traffic Infringement Agency) and the South African Police Services (SAPS). The Department of Justice and Constitutional Development has an extremely powerful

indirect role to play in the road safety environment through the administration of justice.

2. *Provincial sphere*. The Western Cape, having its administrative and legislative seat in Cape Town. The Western Cape Government's Departments of Transport & Public Works (DTPW) is the primary department responsible for road safety, with support from the Department of Health and to some extent the Department of Community Safety. The DTPW is responsible for the Provincial Traffic Services (which encompasses the Traffic Law Enforcement and Traffic Training & Development directorates), Road Safety Management and provincial Transport Infrastructure, as well as managing a range of administrative services with impact on the road environment including public transport contracting (outside the City of Cape Town), driver licensing, vehicle registrations and public transport operator licensing.
3. *Municipal sphere*. The Western Cape consist of 30 municipalities, each with their own Executive Mayor and Council. There is one metropolitan municipality (the City of Cape Town) and five district municipalities (Overberg, Cape Winelands, Garden Route (formerly Eden), West Coast and Central Karoo), as well as 24 local municipalities, all of which are geographically located within one of the district municipalities. In terms of road safety, each municipality has its own infrastructure department which has responsibility for municipal streets. Apart from district municipalities, every municipality in the Western Cape has its own Municipal Traffic Services, ranging in size from approximately 350 traffic officers in the City of Cape Town to two officers in Prince Albert municipality in the Central Karoo.

*Four E's*. A road safety planning concept widely in use globally and in South Africa, notably in the Western Cape. The Four E's are an important element within the DSP program. It was encouraged by the United Nations via the adoption of the Moscow Declaration of 2009 and subsequent 'Global Decade of Action for Road Safety'. There are variants of this concept in use worldwide. The Four E's as adopted in practice by road safety stakeholders in the Western Cape are:

1. *Evaluation*. Road safety policies and plans must be evidence-based. In the DSPs, a detailed Evaluation is compiled and presented as part of the Design phase. Evaluation is ongoing thereafter.
2. *Enforcement*. Traffic law enforcement is a key element of safety on the roads. In the DSPs, project coordination is conducted by Traffic Law Enforcement officers from the relevant provincial traffic centre, and the bulk of the individuals involved in the implementation of DSPs are provincial and municipal traffic officers.

3. *Education*. Road safety education of adults and children includes field education efforts as well as marketing. In the DSPs, both Road Safety Management and Land Transport Safety play roles in education, while marketing is done by Safely Home, largely via the Safely Home Calendar.
4. *Engineering*. Road Authorities play a key role in road safety by such measures as building a safe road environment through road design, setting speed limits and carrying out road safety assessments and implementing their findings. In the DSPs, Sanral, provincial Transport Infrastructure and municipal road engineers all played roles.


*Figure 1.6 The Four E's, South African National Road Safety Strategy, 2011- 2020:10*

*Road Authority.* The department or agency responsible for any given road. For example, Sanral is the road authority for nearly all national routes within the Western Cape, with the exception of small portions of the N1, N2 and N7 where they are within the City of Cape Town or pass directly through certain towns. The DTPW, through the provincial Transport Infrastructure branch, is the road authority for nearly all R routes within the Western Cape, again with some minor exceptions within towns. The local municipality is normally the road authority for municipal streets.

*The South African National Roads Agency Ltd (Sanral)*. Sanral is the Road Authority for national routes within South Africa. Sanral is an agency of the national Department of Transport. As such, Sanral is a critical stakeholder in road safety in the Western Cape, with responsibility for the N1, N2 and N7 highways (as well as the R300). Sanral is also the lead agency of the Cape Town Freeway Management System (FMS), a joint venture by Sanral, the Province and the City of Cape Town.

*Transport and Urban Development Authority.* The City of Cape Town department responsible for transport, including roads engineering.
*Transport Infrastructure*. The branch of the DTPW responsible for the design, construction and maintenance of provincial roads.

*Transport Management.* The branch of the DTPW responsible for traffic management (including Provincial Traffic Services and Road Safety Management), transport operations (such as the rollout of Integrated Public Transport Networks (IPTNs) such as Go George and the management of the Golden Bus Arrow Services contract and including Land Transport Safety) and transport regulation, dealing with driver, vehicle and public transport operator licensing.

*Provincial Traffic Services*. Provincial Traffic Services (PTS) refers to a combination of provincial Traffic Law Enforcement, the directorate of DTPW responsible for traffic policing, and Traffic Training and Development, a directorate of the DTPW consisting of the Gene Louw Traffic College and Quality Monitoring and Evaluation (QME).

*Traffic Law Enforcement*. Traffic Law Enforcement (TLE) is the arm of the Provincial Traffic Services responsible for traffic policing on national and provincial routes within the Western Cape (that is, N routes and R routes). TLE is also empowered to operate on any municipal road or street, although these are the responsibility of Municipal Traffic Services. This authority effectively allows TLE to function freely within the Western Cape province. The service is approximately 500 officers strong[6], including management. The service operates out of 13 provincial Traffic Centres located at strategic points around the province, including two in the City of Cape Town (Brackenfell and Somerset West). The Caledon district, whose DSP is discussed in this paper, is the area of operations of the provincial Traffic Centre located in Caledon, and draws its name from that location.

[6] It is perhaps worth noting that the strength of the service has remained roughly the same since 2001, while the Western Cape population grew an estimated 43.8% between the 2001 Census and 2017 Mid-Year Population Estimate.

*Municipal Traffic Services*. Each local municipality in South Africa is entitled to establish traffic services to conduct law enforcement operations and activities on its roads and streets. The Western Cape has 25 municipal traffic services, including those of the City of Cape Town and 24 local municipalities. These traffic services are often complemented with Municipal Law Enforcement and are a critical component of policing roads in the Western Cape. Outside of the City of Cape Town they are normally poorly-resourced, not well equipped, and often severely constrained in terms of the hours and days of the week on which they can be deployed without incurring overtime costs for municipalities.
*Municipal Law Enforcement*. Municipal Law Enforcement consists of officers with some law enforcement training who are empowered to enforce municipal by-laws. In some instances they can enforce parking offences. In metropolitan municipalities like the City of Cape Town, Metropolitan Police Departments can be formed, which have more extensive law enforcement powers, and 'metro police' officers can also enforce traffic law.

*Road Safety Management*. Road Safety Management (RSM) is a directorate of the DTPW responsible for road safety education and training. RSM conducts awareness interventions and education activities for both adults and children. RSM assists secondary and primary schools with road safety education. In primary schools this often involves the use of Danny Cat (aka Dantjie Kat), a human-size road safety mascot in the form of a cat wearing a distinctive outfit.

*Land Transport Safety*. Land Transport Safety (LTS) is a directorate of the DTPW responsible for identifying transport safety risks within the broad transport environment and implementing plans to mitigate them. This includes areas of mixed jurisdiction, such as level crossings, or of specific concern, such as public transport and freight. LTS occasionally combines activities with Road Safety Management.

*Safely Home.* Safely Home is a behaviour change campaign instituted and run by the DOTPW as part of its broader efforts to decrease road traffic injuries in the province. Safely Home focuses on population level behaviour-change-style marketing efforts which are targeted at the most at risk demographics and locations in the province.

*The Safely Home Calendar*. The Safely Home Calendar is a road safety marketing campaign platform, the primary campaign vehicle of Safely Home. The Calendar consists of monthly themes touching on the highest priority road safety behaviour changes identified by the DTPW, largely as a result of a baseline study conducted in 2010 on behalf of the DTPW by

Prof Marianne Vanderschuuren and Dr Rahul Jobaputra, of the Centre for Transport Studies at the University of Cape Town's Department of Civil Engineering. The Calendar employs a combination of media, using its social media platforms as a base and deploying TV, cinema, outdoor and radio advertising at strategic times. The Calendar themes are integrated into the safety messaging program of the Cape Town Freeway Management System.

| **The Safely Home Calendar** | | |
|---|---|---|
| Month | Theme | Byline |
| March | Personal Responsibility | #BeTheChange |
| April | Personal Responsibility | #BeTheChange |
| May | Distracted Driving | #ItCanWait |
| June | Visibility | #SeeAndBeSeen |
| July | Alcohol (all road users) | #BoozeFreeRoads |
| August | Speed | #SpeedKillsFacts |
| September | Seatbelts | #AlwaysBuckleUp |
| October | Child safety | #SaveKidsLives |
| November | Pedestrian safety | #WalkSafe |
| December | Alcohol (all road users) | #BoozeFreeRoads |
| January | Alcohol (all road users) | #BoozeFreeRoads |
| February | Vulnerable Road Users | #ShareTheRoad |

*Table 1.1 The Safely Home Calendar*

*Quality Monitoring and Evaluation*. Quality Monitoring and Evaluation (QME) is a component of the Traffic Training and Development directorate of the Provincial Traffic Services. QME are responsible for monitoring and evaluating the activities of provincial Traffic Law Enforcement. QME were instrumental in developing the Logical Framework used in the Caledon DSP, and subsequently incorporated in the DSP Implementation Framework.

*Logical Framework*. A table of long-, medium- and short-term outcome indicators and quarterly outputs developed originally for the Caledon DSP to enable monitoring and evaluation of the implementation of the DSP, and to track its progress in achieving its goals (primarily the reduction of road traffic fatalities, especially pedestrians and children under the age of 15, and the social and economic impact thereof). Later implemented in the KLW DSP.

*DSP Implementation Framework*. A document tabulating the process of implementing a District Safety Plan. The Framework is intended to lend itself to applicability to multiple different environments, with varying road safety profiles, and thus key foci are the selection of an appropriate geographic entity for the development of a plan and local intelligence gathering and data compilation preceding the development of a detailed Evaluation of the operational environment.

*Mission Analysis*. A formal element within the Military Decision-Making Process (MDMP) used by many modern militaries, in which an officer must consider what he or she has been instructed to achieve, within an existing defined context, in a careful and precise manner, in order to evolve an effective plan. Mission Analysis helped form the basis of the DSP concept.

*Provincial Accident System*. The Provincial Accident System (PAS) is a database, often termed IPAS, into which 'Accident Reports' (forms completed by the SAPS in the event of a crash) are captured. The DTPW is responsible for capture of data for all areas outside the City of Cape Town, while within the City, the Transport and Urban Development Authority (TDA) captures the Accident Reports. The provision of Accident Reports is dependent on delivery of the completed forms via courier by the SAPS. The database is thus heavily dependent on the effective management of SAPS precincts and clusters.

*'Crash' and 'Accident'.* The word 'accident' has historically been used in English to describe any road traffic incident involving a collision, or crash, of some type. As the World Health Organization has pointed out, this term "can give the impression of inevitability and unpredictability – an event that cannot be managed. That is not the case. Road traffic crashes are amenable to rational analysis and remedial action" (World Health Organization, 2004:2-3). The author uses the more neutral and more efficient term 'crash' throughout this paper. The less neutral term 'accident' is used only when describing the named documents, such as 'Accident Reports', or systems, such as the Provincial Accident System, or similar.

*Vision Zero*. A road safety concept which posits that the transport network should be simply that, and not be a place where significant risk of death or major injury exists. Adoption of Vision Zero equates to accepting that nobody should be killed or injured while using the roads. Vision Zero is often associated with the Safe Systems approach to road safety. Safe Systems thinking focuses on acceptance of the inevitability of human error and the development of an accommodating environment (people, speed, vehicles and roads) to minimize the potential negative consequences of error.

## 1.4 Chapter Overview

*Chapter 1*. Introduction. Considers the overall road safety picture and the role of the DSP within it. Posits the problem statement.

*Chapter 2*. Context and Literature Review. Looks at the subject of road safety studies broadly and covers source documents for the analysis, especially key reports and evaluations referred to.

*Chapter 3*. Method. What has been analysed and how, and with what limitations. The process of developing the DSPs and the DSP Framework is discussed, its implementation in two different environments and the outcomes in terms of fatality numbers. The selection of control areas for study is articulated. Data used is outlined. Ethical considerations are discussed.

*Chapter 4.* Data. Detailed description of the data used, including fatality numbers broken down by key indicators from the Caledon and KLW DSP areas, as well as operations data and media data. Annualized pre- and post-implementation road traffic fatality profiles are presented for the two DSP areas. Descriptive data tables are provided for the FPS data used for fatality profiling and the impact analysis (Chapter 5), and for the operations and media data used in the data model (Chapter 8).

*Chapter 5*. Findings and Analysis of the Caledon District Safety Plan (DSP). Covers the implementation process, challenges and ultimate impact over first six months and one year of operations. Compares Caledon to the control area of the West Coast (South) district.
*Chapter 6* Findings and Analysis of the KLW DSP. Covers the implementation process, challenges and ultimate impact over first six months of operations. Compares KLW to the control area of Gunya.

*Chapter 7*. Compares and contrasts Caledon and KLW. Considers factors which may have independently influenced success or failure which are unrelated to the DSP model. Examines the commonalities in terms of implementation and outcomes, and queries whether or not they can be linked and ascribed to the model.

*Chapter 8.* Examines a theoretical basis for a predictive model for DSP-type road safety interventions, using law enforcement, marketing and fatalities data collected from the DSPs in Caledon and KLW.

*Chapter 9*. Conclusions. Summary of findings, conclusions and further research direction.

# Chapter 2: Context and Literature Review

## 2.1 Introduction – 'The Global Traffic Injury Pandemic'

Globally, road traffic injuries and their prevention have been a subject of analysis and intervention since before the widespread introduction of motor vehicles. Features of road traffic control which persist to this day have origins in other forms of transport, including trains, horses and animal-drawn carriages. The very first road traffic fatality is believed to have occurred on 31 August 1869, with the death of a female passenger travelling on a steam-driven road locomotive in County Offaly, Ireland (British Newspaper Archive, 2013). In language foreboding a linguistic debate far in the future, a medical inquest conducted at the time ruled the death an 'accident', although modern analysis would have deemed both the vehicle and the road involved completely unsafe, both individually and above all collectively. By 1924, the rapid rise of the automobile in wealthier, more advanced nations was matched by alarming increases in deaths and injuries as a result. While numerous examples exist showing that awareness of the issue existed throughout society, including at the very highest levels, the inexorable march of the automobile's rise to supremacy continued unabated through the first half of the twentieth century. A feature spread from The New York Times in November 1924 dramatically captured the image of the car as a death machine (New York Times, 1924). The opening paragraph of the article has often been cited by road safety advocacy movements (see for example Philly Free Streets Day (Kyu, 2016)) and reads as follows:

> THE horrors of war appear to be less appalling than the horrors of peace. The automobile looms up as a far more destructive piece of mechanism than the machine gun. The reckless motorist deals more death than the artilleryman. The man in the street seems less safe than the man in the trench.

NATION ROUSED AGAINST MOTOR KILLINGS

Secretary Hoover's Conference Will Suggest Many Ways to Check The Alarming Increase of Automobile Fatalities.—Studying Huge Problem

*Figure 2.1 New York Times Article: Nation Roused Against Motor Killings, 23 Nov 1924*

The concern was well-founded. In the United States, highway fatalities had risen from 36 in 1900 to 18 400 by 1924 (Federal Highway Administration, 2009).

JANUARY 2009

| YEAR | PUBLIC ROAD MILES 2/ | | | ANNUAL VEHICLE-MILES OF TRAVEL (VMT) ( MILLIONS ) | | | HIGHWAY FATALITIES 3/ |
|---|---|---|---|---|---|---|---|
| | RURAL | URBAN | TOTAL | RURAL | URBAN | TOTAL | |
| 1900 | - | - | 2,320,000 | - | - | 100 | 36 |
| 1901 | - | - | 2,325,000 | - | - | 170 | 54 |
| 1902 | - | - | 2,330,000 | - | - | 310 | 79 |
| 1903 | - | - | 2,340,000 | - | - | 460 | 117 |
| 1904 | - | - | 2,351,000 | - | - | 750 | 172 |
| 1905 | - | - | 2,360,000 | - | - | 970 | 252 |
| 1906 | - | - | 2,370,000 | - | - | 1,240 | 338 |
| 1907 | - | - | 2,382,000 | - | - | 1,440 | 581 |
| 1908 | - | - | 2,395,000 | - | - | 1,850 | 751 |
| 1909 | - | - | 2,410,000 | - | - | 2,590 | 1,174 |
| 1910 | - | - | 2,430,000 | - | - | 3,580 | 1,599 |
| 1911 | - | - | 2,470,000 | - | - | 5,040 | 2,043 |
| 1912 | - | - | 2,515,000 | - | - | 7,390 | 2,968 |
| 1913 | - | - | 2,590,000 | - | - | 10,250 | 4,079 |
| 1914 | - | - | 2,666,000 | - | - | 14,060 | 4,468 |
| 1915 | - | - | 2,745,000 | - | - | 19,530 | 6,779 |
| 1916 | - | - | 2,850,000 | - | - | 25,860 | 7,766 |
| 1917 | - | - | 2,925,000 | - | - | 30,680 | 9,630 |
| 1918 | - | - | 3,000,000 | - | - | 36,980 | 10,390 |
| 1919 | - | - | 3,050,000 | - | - | 44,110 | 10,896 |
| 1920 | - | - | 3,105,000 | - | - | 47,600 | 12,155 |
| 1921 | - | - | 3,160,000 | - | - | 55,027 | 13,253 |
| 1922 | - | - | 3,196,000 | - | - | 67,697 | 14,859 |
| 1923 | - | - | 3,233,000 | - | - | 84,995 | 17,870 |
| 1924 | - | - | 3,243,000 | - | - | 104,838 | 18,400 |
| 1925 | - | - | 3,246,000 | - | - | 122,346 | 20,771 |
| 1926 | - | - | 3,242,000 | - | - | 140,735 | 22,194 |
| 1927 | - | - | 3,257,000 | - | - | 158,453 | 24,470 |
| 1928 | - | - | 3,262,000 | - | - | 172,856 | 26,557 |
| 1929 | - | - | 3,272,000 | 90,311 | 107,409 | 197,720 | 29,592 |
| 1930 | - | - | 3,259,000 | 95,118 | 111,202 | 206,320 | 31,204 |
| 1931 | - | - | 3,291,000 | 100,571 | 115,580 | 216,151 | 31,963 |
| 1932 | - | - | 3,296,000 | 94,151 | 106,366 | 200,517 | 27,979 |
| 1933 | - | - | 3,286,000 | 95,064 | 105,578 | 200,642 | 29,746 |
| 1934 | - | - | 3,309,000 | 103,050 | 112,513 | 215,563 | 34,240 |
| 1935 | - | - | 3,310,000 | 110,241 | 118,327 | 228,568 | 34,494 |
| 1936 | - | - | 3,267,000 | 122,678 | 129,450 | 252,128 | 36,126 |
| 1937 | - | - | 3,245,000 | 132,038 | 138,072 | 270,110 | 37,819 |

*Figure 2.2 Excerpt from Federal Highway Administration MV Traffic Fatalities Table*

Unsurprisingly, the dramatic increases in injuries and loss of life due to road traffic prompted public responses, ranging from the establishment of the first advocacy groups, to the beginnings of the body of scientific enquiry which would form the basis for the interventions which would underpin the reversal of the situation at least in the most advanced nations. In the United Kingdom, for example, a Pedestrians' Association was formed in 1929. The organization was championed by Lord Robert Cecil, known for winning the 1937 Nobel Peace Prize for his contribution to the League of Nations. The organization advocated for measures such as the establishment of a driving test and the reinstatement of speed limits These measures introduced in the 1934 Road Traffic Act, and later studies would confirm the importance of prominent champions in driving road traffic reforms aimed at lowering deaths and injuries.

Studies of traffic injuries and fatalities began to emerge at the same time, often seeking to predict predisposition to involvement in crashes through the lens of psychology. As early as

1922, TW Forbes, writing in the US Journal of Consulting Psychology, established relationships between 'accident-proneness' and capacity for re-education amongst both old and young drivers (1922:143-148).

Traffic fatalities continued to increase, with the US Federal Highway Administration reporting more than 30 000 annual deaths for the first time in 1930 and over 40 000 for the first time in 1963. This slowing in the onslaught coincided with the development of early analyses of traffic safety research. WH Glanville, for example, studied the increases in traffic fatalities in the United Kingdom in the context of rises in automobile numbers and increases in traffic flow (1955). While leaning towards a medical audience (Glanville's paper arose from a talk given to the Informal Seminar on Operations Research at The Johns Hopkins University in the United States in 1954), Glanville also examined speeds and stopping times, pedestrian crossings, motor-cycle helmet wearing and road surfaces. By 1964, the body of road safety study had grown considerably. In that year, FA Haight published a review of approximately 250 publications on road safety published between 1915 and 1964, described as being "on various topics but with a focus on mathematical modelling and methodologically and statistically oriented papers" (Hagenzieker et al, 2014).

Exponential increases in the volume of research undertaken around the world were to follow.

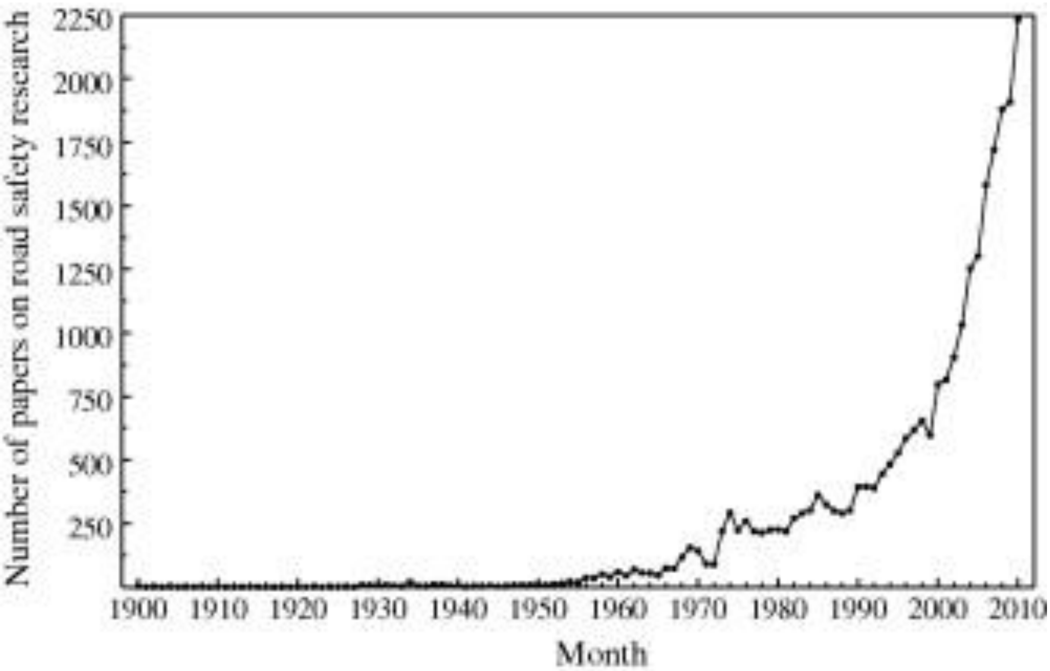



*Figure 2.3 Annual number of journal articles on road safety research in the period 1900 – 2010 (Hagenzieker et al, 2014)*

The rise of scientific analysis of the road traffic problem in the 1960s and ‘70s bore significant fruit. Traffic fatalities in the developed world were to peak by the beginning of the 1980s, with US highway fatalities reaching 51 093 in 1979, declining to 43 945 by 1983, a figure at which they hovered for the remainder of the 20$^{th}$ century (Federal Highway Administration, 2007).

The early stages of this period of enquiry can be characterized by attempts to understand the cause of a particular crash, ascribing the incident to one of an increasingly well-defined set of environmental factors. During this period, the concept of ‘E’s’ emerge, these being Enforcement, Engineering and Education, now expanded in the modern lexicon to include Evaluation and Emergency Response. Crashes and crash severity were often identified as the result of a deficiency in one of these fields. Technical improvements in vehicle safety and roads engineering were to emerge in the wake of such studies.

Recognizing the inadequacy of causal analyses seeking a single explanation for a highly complex set of phenomena, the Haddon Matrix (Haddon, 1972) sought to place injury trauma events at the nexus of a number of causal factors, in order to better understand and prevent them. Haddon’s model consists of personal attributes, vector or agent attributes and environmental attributes, assessed before, during and after an injury event, and has been applied to numerous environments where injuries may occur, from roads to workplaces to playgrounds. Its value in the road safety environment cannot be underestimated.

A simple example of a Haddon matrix as applied to the road traffic environment is below.

| **Phase** | **Personal attributes / Human factors** | **Agent or vector attributes / Vehicle and equipment factors** | **Environmental attributes / Environmental Factors** |
|---|---|---|---|
| **Pre-injury/ Pre-crash** | Education<br>Distracted driving<br>Impaired driving | Roadworthiness<br>Braking Systems<br>Lighting | Engineering<br>Intersection design<br>Signage / interpretability |
| **Injury/ Crash** | Seatbelt use<br>Child restraint use | Restraints<br>Airbags | Medians<br>Wire-rope barriers |

| | | | |
|---|---|---|---|
| **Post-injury/Post-crash** | Societal factors, willingness to assist, first aid education | Fire prevention Emergency egress (esp public transport) | Post-crash response, especially emergency medical and rescue services |

*Table 2.1 Sample Haddon Matrix applied to the road traffic environment*

More recently, road traffic injuries have been increasingly ascribed to being the product of the road traffic system as a whole. This development follows considerable improvements in road traffic safety in the developed world resulting from technical improvements in a wide range of areas, including, for example, the introduction of compulsory seatbelts in vehicle manufacture and the legislation to mandate their use.

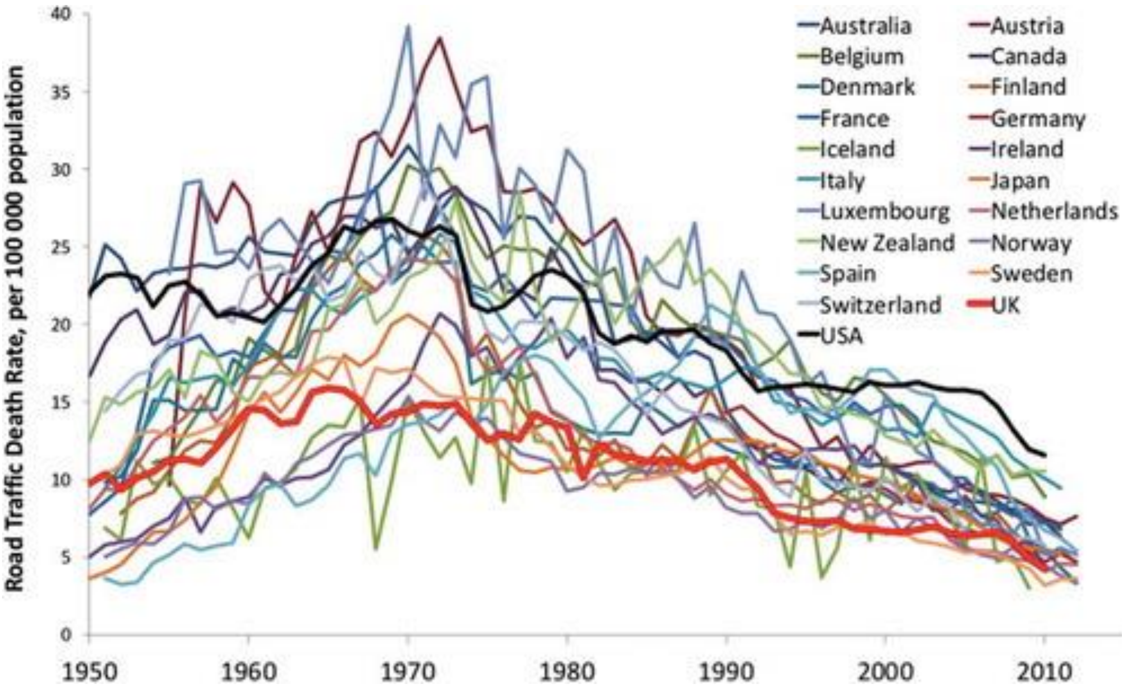



*Figure 2.4 Road traffic deaths in developed countries (Bhalla, 2019)*

The emergence of what is now known as the 'safe systems approach' was to occur in the period from roughly 1985 to the present. The Organization for Economic Co-operation and Development, in a 1997 report titled *Road transport research: Outlook 2000* described the timeline of road safety development, which was adapted by Hagenzieker et al as follows:

| | 1900–1920 | 1920–1950 | 1950–1970 | 1960–1985 | 1985/1990–Now |
|---|---|---|---|---|---|
| Crash | Chance phenomenon, bad luck | Road devils, accident prone drivers | Road user or vehicle or road | Multi-causal approach | Result of integral road system |
| Research | What | Who | How: the cause | How: which causes, technical improvements | Multi-dimensional, economic analysis |
| Measures | On an ad hoc basis | Educate, punish | Choice from the three E's | Technical solutions for vehicle & road | Adapt road system to road user |

*Figure 2.5 Time periods and their characteristic road safety paradigms (Hagenzieker et al, 2014)*

The ‘safe systems’ approach has been articulated in a variety of ways. For example the concept of making the traffic system inherently safe was positioned as “advancing sustainable safety” in the Netherlands, identifying “functionality of roads, homogeneity of masses and/or speed and direction, predictability of road course and road user behaviour by a recognizable road design, forgivingness of the environment and of road users and state awareness of the road user” as the key levers of a future road traffic system in which traffic injury could virtually be eliminated (Wegman et al, 2008). In Sweden, researchers and road safety practitioners emphasized the ethical element of integrated traffic system design, captured in the development of *Vision Zero*, essentially in the simple idea that no-one should be killed or injured while using the road network (Tingvall & Haworth, 1999).

The advances achieved in the developed world, however, have not been realized elsewhere. Road traffic deaths, at around 1,2 million per annum globally, have remained stubbornly high, with lower income countries accounting for the bulk of the fatalities, as this infographic from the World Health Organization makes clear.

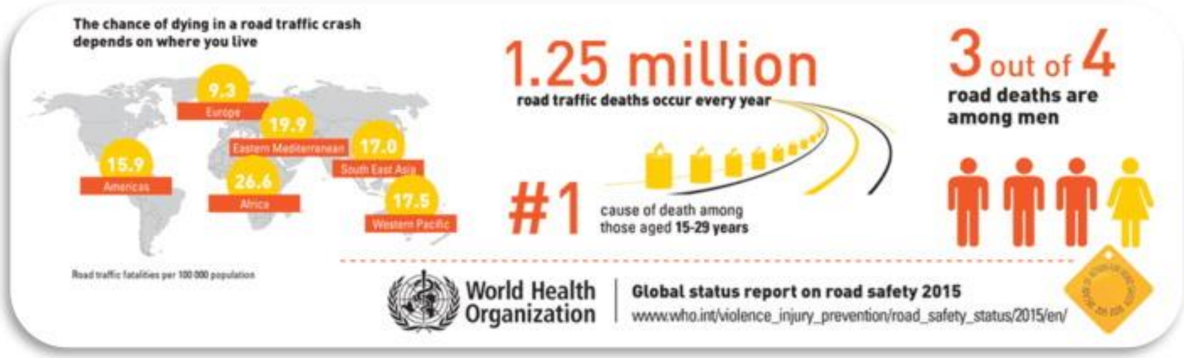



*Figure 2.6 Infographic on road traffic injuries, WHO 2015*

Global efforts to reduce the burden of road traffic injuries have included the Moscow Declaration of 2009, by the UN General Assembly, which ushered in the first Decade of Action for Road Safety, under the auspices of the World Health Organization. While the period that followed has seen significant improvements in many developed nations, the ability of lower income countries to achieve the goals of the Decade of Action (and the subsequent Sustainable Development Goals set in 2015) has been limited. The problem has been cited thus:

> When it comes to low- and middle-income countries, the response could be to analyze road safety problems and design road safety strategies, using the experiences of HIC and thus speed up progress compared with HIC in the past. This is an interesting perspective because of the enormous knowledge resources

> accessible to the countries that need to make improvements. However, LMIC cannot simply 'copy and paste' solutions from HIC—they need tailor-made solutions, adapted to local conditions and circumstances.
>
> (Wegman, 2017)

It is from this context that the need for the creation of localized systems for road safety develops. This study is developed within this continuum of road safety systems analysis, with strong emphasis on the South African environment. International concepts are indeed drawn upon, particularly in analysing the basis of the District Safety Plan model. The study is heavily dependent on official reports on the status of road safety, notably those of the RTMC, and the reports and evaluations (including several developed by the author) for the Western Cape Department of Transport & Public Works. The reports and evaluations used have been limited to those made public by DTPW, and include material dealing directly with the District Safety Plan program, specifically the Caledon and KLW DSPs themselves, as well as research conducted on related topics which are not directly part of the DSP program.

## 2.2 Broad Theory Base

The theoretical basis for the analysis rests on a view that evidence-based, integrated interdisciplinary planning and implementation, combined with robust monitoring and evaluation, can result in sustained improvements in road safety within a defined environment.

Versions of this view has been put forward by numerous authors both internationally and nationally. Norwegian researchers Elvik and Yaa's *Handbook of Road Safety Measures* considers the efficacy of "Organisational Measures", specifically including two features of District Safety Plans: "2. Systems for resource allocation for safety purposes, including incentive systems for local authorities. 3. Formalising responsibility for introducing road safety measures and detailed planning of measures" (2004).

These are considered in the context of Dutch and Austrian initiatives to implement these measures. While Elvik and Yaa's study lacks sufficient data to fully assess these measures, the Austrian initiative 'Action minus 10%' was linked to a 5% reduction in injury crashes within the first four months of the program.

Closer to home, researchers such as HB Pretorius (1988) and SB Mohlala (2016) have posited that multidisciplinary approaches which utilise scientific or evidence-based techniques to develop intervention plans, and which link this approach to systematic monitoring and evaluation will yield positive results for road safety in South Africa.

### 2.3 Conclusion

Like Elvik and Yaa, Pretorius and Mohlala's analyses are limited by lack of critical data in some aspects, and also the absence of access to controlled test cases of an organisational model implemented in widely diverse environments. The District Safety Plans implemented in Caledon and Khayelitsha-Lingelethu West in the Western Cape provide two such test cases, which can furthermore be compared to one another in an effort to establish the efficacy of the DSP concept as a model for developing impactful road safety interventions in the kind of widely varying contexts existing in South Africa and the Western Cape.

It is hoped, therefore, that this study may make some contribution to the theoretical base, as well as draw from it.

# Chapter 3: Method

## 3.1 Research Design

The five streams of research consist of:

1. Observation of the planning process of the District Safety Plans (DSPs). The author led the process in both the Caledon district and in Khayelitsha-Lingelethu West (KLW).


*Figure 3.1 The author presenting the DSP Concept during the Caledon DSP planning phase, 2016*

2. Overview of the evidence base used in the planning process, ie the 'Evaluation' phase of the DSPs. The Evaluations used were compiled by the author and consist of presentations of relevant statistics and intelligence, which highlight areas of interest and provide recommendations.
3. Analysis of traffic fatality data pre- and post-implementation (of the DSPs in Caledon and KLW) as well as DSP operation statistics and marketing campaign data. Ethics clearance was obtained to study Forensic Pathology Services data for the purposes of this research paper.
4. Analysis of external factors which may impact fatalities, notably pre-existing trends and road safety activities conducted outside of the scope of the DSPs.
5. Development of a predictive model for the outcome of DSP type interventions, by combining data from traffic operations, road safety activities and marketing campaigns, and comparing with fatalities over time.

## 3.2 Research Instruments

Research instruments employed were as follows:

1. The author's own notes and observations of the planning processes

2. The author's analysis of the raw Forensic Pathology Services data using the Microsoft Excel desktop application for the purposes of the Evaluations, and for purposes of ongoing monitoring and evaluation of the DSPs.
3. The author's analysis of the raw Forensic Pathology Services data using the Microsoft Excel desktop application specifically for the purpose of this research paper, including validation of previous findings and analysis of control areas.
4. The capture of traffic law enforcement operation data, and Safely Home education and marketing schedules into an Excel database, for both Caledon and KLW, and the subsequent creation of a theoretical model for developing a road safety outcomes score for comparison with fatalties.
5. No surveys or observation of the road environment other forms of empirical research, apart from the capture of operational and media data, were carried out specifically for this research paper.

### 3.3 Data

1. Various DSP-related data and statistics supplied in the Evaluations carried out during the development of the Caledon and KLW DSPs.
2. Data obtained pertaining to operations (for Caledon) conducted by Provincial Traffic Services, in conjunction with the municipal traffic services of Overstrand, Theewaterskloof and Cape Agulhas and (for KLW) City of Cape Town Traffic Services. This included data pertaining to numbers of operations planned, broken down by operation type, and numbers of operations conducted. This was captured for each month of the period of operation.
    i. It should be noted that, unlike Provincial Traffic Services, in which road safety education is carried out by civilian officials or via the Safely Home campaign, the City of Cape Town Traffic Services has its own road safety education program carried out by uniformed traffic officers, which was deployed extensively within the KLW DSP, especially with regards to pedestrians. The operations conducted by these officers were counted as traffic operations, broken down by the same operation types.
3. Data obtained through advertising media schedules produced by Safely Home, covering national TV and radio, regional radio, community radio, community buses, local taverns, local petrol stations, as well as road safety education interventions where not carried out by traffic services.
4. Forensic Pathology Services fatality data.
    i. This data is de-personalised prior to upload to a secure server to which the author has been granted access by the Forensic Pathology Services.

The use of the data is governed by a formal data sharing agreement signed by the author and Ms Vonita Thompson, Director: Forensic Pathology Services. See also 3.7.5 Data Management, under 3.7 Ethics below.

ii. The data is filtered for official circumstances of death. This field must be 'Road Traffic Incident' for the record to be considered in this analysis.

iii. Data used was extracted a minimum of 30 days after the end date of the periods under consideration, to account for injury deaths which occur some time after the incident.

iv. In order to identify the location of a road traffic fatality, and whether or not it falls within a DSP area, or whether or not it falls within an area identified as a control area for analysis of the DSPs, the data is filtered by SAPS precinct where the culpable homicide case associated with the record is registered. For example, the SAPS precincts falling within the Hermanus-Caledon Cluster of the SAPS have boundaries contiguous with those of the three municipalities within the Caledon district, and thus fatalities associated with those precincts are analysed. The KLW DSP is contiguous with the SAPS precincts of Khayelitsha and Lingelethu West, which are two precincts within the Khayelitsha Cluster. While GPS records, or accurate addresses of the actual crash location would be preferable, these records are inconsistently available, and where they are available, they refer to the point of body recovery, rather than the location of the crash. This means that the GPS location is often a medical service area, due to the victim having died in an ambulance or a hospital, after having been transported from the crash scene. Nonetheless, GPS mapping of fatalities forms an important element of the DSP Evaluations, although it cannot be relied upon for monitoring and evaluation of the implementation and impact of the plans, and was not used in this research paper.

v. Data analysed for the central element of this study was limited to six months post implementation of the DSP in the respective areas. This limitation reflects the fact that at the original time of writing, only data for the first six months of operations in the KLW DSP were available.

Data analysed were FPS records containing Crime Administration System (CAS) numbers associated with the following SAPS precincts:

| DSP | Control Area | DSP | Control Area |
|---|---|---|---|
| Caledon<br><br>Cape Agulhas<br>Theewaterskloof<br>Overstrand | West Coast (South)<br><br>Bergrivier<br>Saldanha Bay<br>Swartland | Khayelitsha – Lingelethu West<br><br>Wholly within City of Cape Town | Gunya<br><br>Wholly within City of Cape Town |
| Bredasdorp | Darling | Khayelitsha | Nyanga |
| Caledon | Eendekuil | Lingelethu West | Gugulethu |
| Gans Bay | Hopefield | | Philippi East |
| Genadendal | Laaiplek | | |
| Grabouw | Langebaan | | |
| Hermanus | Malmesbury | | |
| Kleinmond | Moorreesburg | | |
| Napier | Piketberg | | |
| Riviersonderend | Porterville | | |
| Stanford | Redelinghuys | | |
| Struisbaai | Riebeeck West | | |
| Villiersdorp | Saldanha | | |
| | St Helena Bay | | |
| | Vredenburg | | |

*Table 3.1 SAPS precincts included in the fatalities data analysis*

## 3.4 Identification of Control Areas

### 3.4.1 Limitations on identifying control areas

Control areas for comparative analysis had to be chosen from within the Western Cape, both to reduce the presence of external factors, ensure homogeneity, and to ensure availability of comparable data; FPS data is restricted to the Western Cape. Furthermore, control areas had to share their external boundaries with SAPS precincts, in order to follow consistent allocation of FPS records to a specific area.

While being similar to the DSP areas, the control areas are not perfect mirrors, but do reflect the most applicable option available.

The term 'Gunya' has occasionally been applied to government studies and interventions by both government and non-government actors in this area[7]. 'Gunya' has been adopted for the control area for the KLW DSP, and its boundaries are defined by the SAPS precincts of Gugulethu, Nyanga and Phillipi East.

### 3.4.2 Criteria for identifying control areas

Control areas were identified which are as geographically and demographically similar as possible to the DSP areas, and which have similar fatality profiles in terms of road user types of victims.

1. Geographically similar to the DSP area:
    i. The West Coast (South), like the Caledon district, consists of three local municipalities. In both cases, two of the municipalities are strongly coastal, and one strongly agricultural. In the case of Caledon, Theewaterskloof is land-locked, while in that of West Coast (South), Swartland has some coastline with limited activity. The coastal municipalities have strong tourism and holiday-making features, while the agricultural municipality has a focus on some key crops (notably orchard fruits in Theewaterskloof and wheat in Swartland) which are largely supplied to the City of Cape Town, or exported via its harbour. Both areas abut the City of Cape Town, and are linked to it by both a major regional route near the coast and a major national route inland.
    ii. The Gunya area consists of three SAPS precincts, rather than two (like KLW), but is a similar size to KLW. It is separated from KLW by the R300 highway, and like KLW is bounded on its northern edge entirely by the N2 highway. Like KLW, the Gunya area is a densely-populated urban area (Gunya slightly more so, see Table 3.3 below), with large elements of informality.
    iii. Table 3.2 below illustrates the geographical comparison between the two pairs of areas.

[7] See for example the Violence Prevention Through Urban Renewal (VPUU) program: vpuu.org.za

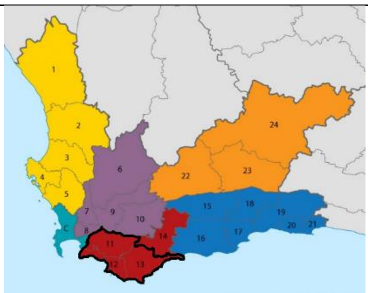
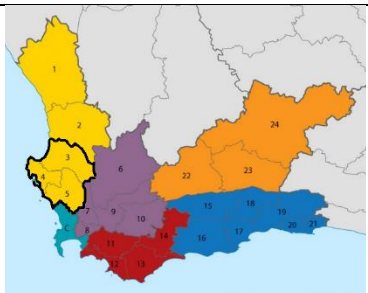
| Map | | Physical Characteristics | | |
|---|---|---|---|---|
| Caledon DSP | West Coast (South) Control | | CD | WCS |
|  |  | Area (km$^2$) | 8 407 | 10 134 |
| 11 – Theewaterskloof | 3 – Bergrivier | | | |
| 12 – Overstrand | 4 – Saldanha Bay | | | |
| 13 – Cape Agulhas | 5 – Swartland | | | |
| | | | | |
| KLW DSP | Gunya Control Area | | KLW | Gunya |
|  |  | Area (km$^2$) | 17.61 | 22.3 |

*Table 3.2: Maps and geographical characteristics of the DSP areas and control areas (Statistics South Africa, 2012)*

2. Demographically similar to the DSP area:
    i. Both the Caledon district and the West Coast (South) are fairly diverse areas (Caledon more so), predominantly Afrikaans-speaking with a coloured majority, 51% and 63% respectively. When white and coloured populations are considered together, these groups make up 70% and 80% of the populations respectively. Population density is similar, with the West Coast (South) being slightly larger than the Caledon district in both area and population. Median household income was noted to be higher in the West Coast (South) area.
    ii. KLW and Gunya are both very densely populated areas which are highly homogenous in that both have very large black majorities which are preponderantly isiXhosa-speaking. Gunya was found to be slightly more densely populated. KLW was found to have a somewhat higher median household income, and wealth was unevenly distributed across wards,

unlike in Gunya, where all wards had the same median household income (R30 000 per annum).

iii. Table 3.3 below illustrates the demographic comparison between the two DSP areas, and the control areas identified for assessment (ibid).

| Characteristic | Caledon | West Coast (S) | KLW | Gunya |
|---|---|---|---|---|
| Population | 222 260 | 274 852 | 235 880 | 341 724 |
| Population density per sqkm | 26.4 | 27.12 | 13 394 | 15 323 |
| Afrikaans speakers (%) | 65% | 80% | - | - |
| IsiXhosa speakers (%) | - | - | 91.4% | 84.88% |
| Black (%) | 27% | 18.6% | 99% | 95.4% |
| Coloured (%) | 51% | 63% | - | - |
| White (%) | 19% | 17% | | |
| Household income pa (median estimates) | R30 000 | R57 300 | R44 802 | R30 000 |

*Table 3.3. Demographic characteristics of the DSP areas and control areas*

3. Have similar road safety fatality profiles in terms of types of road user killed in the area.
    i. In both Caledon and West Coast (South), the majority of fatalities are vehicle occupants, with some variation across categories.
    ii. In both KLW and Gunya, the vast majority of fatalities are pedestrians.
    iii. The road safety profiles of the two DSP and two control areas are illustrated in Figure 3.4 below.

| | Caledon | West Coast (S) | KLW | Gunya |
|---|---|---|---|---|
| Fatalities 2012 – 2016 | 309 | 378 | 207 | 311 |
| Cyclists (%) | 8 (2.5) | 5 (1.3) | 0 | 3 (1) |
| Drivers (%) | 63 (20.4) | 102 (27) | 16 (7.7) | 22 (7) |

| | | | | |
|---|---|---|---|---|
| Motorcyclists (%) | 20 (6.4) | 13 (3.4) | 3 (1.4) | 2 (0.6) |
| Passengers (%) | 78 (25.2) | 133 (35.2) | 21 (10) | 22 (7) |
| Pedestrians (%) | 121 (39) | 121 (32) | 164 (79.2) | 262 (84.2) |

*Table 3.4 Road traffic fatalities by type, DSP areas and control areas*

### 3.5 Limitations

In addition to the limitations in location data, and restriction to six months of post-implementation analysis, as described above, a further limitation in this analysis is the availability of reliable non-fatal injury data. The Provincial Accident System (PAS, with the data access application often referred to as IPAS) is the statutorily maintained database of traffic crashes in the Western Cape. SAPS precincts are obliged to submit Accident Reports (ARs) which must be completed whenever a crash of any reportable kind occurs, including 'fender benders', which account for the vast majority of ARs submitted by SAPS to DTPW. As a repository of injury data, PAS has occasionally been found to be unreliable in that large discrepancies exist between its fatality reporting and the data generated by Forensic Pathology Services, including under-reporting of up to 75% in some instances (Western Cape Department of Transport & Public Works, 2017). See figure 3.2. FPS data is largely deemed reliable in that it references an actual cadaver in the morgue, and the circumstances of death of that individual have been deemed by a qualified mortician to be a 'Road Traffic Incident'.

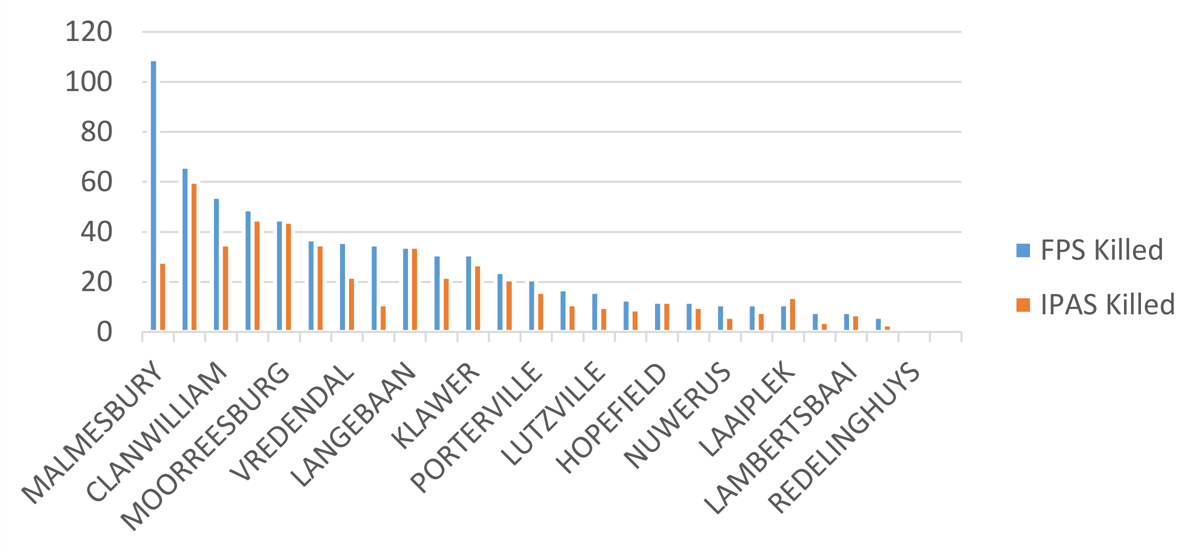



*Figure 3.2 West Coast district traffic fatalities, FPS vs PAS by SAPS precinct, 1 Jan 2010 – 31 Dec 2015 (ibid)*

Furthermore, lengthy backlogs exist in the capturing of PAS data. No prioritization of incident severity is carried out, either at SAPS or at DTPW/ TDA, and thus fatalities and injuries captured are accorded the same priority for capture on the system as 'fender benders'. Hundreds of minor non-injury collisions occur daily, each producing an AR which is accorded the same priority for capture as a crash in which severe injuries and even fatalities occurred. This can result in delays of 18 months or more in the capture of a particular incident on the system. Where injuries occur, the AR is often further delayed as it is kept in the case docket during investigations, which can last for several years. For the Caledon and KLW DSPs, up to date PAS data was not available at the time of writing – neither injury nor non-injury crash data. This paper is thus limited to the fatalities data provided by the Forensic Pathology Services. Future evaluation of PAS data, once it is available for the periods under review, in the areas studied in this paper, may prove useful in further testing the paper's conclusions, although its use must be treated with caution for the reasons described above.

### 3.6 Implementing District Safety Plans, and the DSP Implementation Framework

The Caledon DSP was a pilot project, created upon the instruction of Adv Kyle Reinecke, the Deputy Director General of Transport Management, who has stated that he conceived the idea independently and confirms that no other similar systems inspired it. As such, the methodology was designed from first principles. No existing frameworks for similar systematic implementation of evidence-based planning was found[8].

[8] For example, while the Department of Community Safety was found to have produced "Community Safety Plans" at District Municipality level, these were found to have simply consisted of a community meeting followed by the establishment of a list of tasks. No intelligence preparation, data analysis,

The Mission Analysis process, a step within the Military Decision-Making Process (MDMP) framework used by many modern militaries, was adapted to form the initial basis of the plan[9]. Extensive consultation with Transport Management, especially Provincial Traffic Services, and Transpcommunityort Infrastructure took place. This led to the development of a project plan which was implemented in the Caledon district and thus was to form the basis of the DSP Implementation Framework. This Framework was used in the development of the KLW DSP, and thus the two DSPs were developed using the same methodology, with some minor variations to account for metropolitan circumstances. These are noted within the Framework, which was updated during the KLW planning process. The Caledon DSP, being the pilot, notably took nine months from inception to implementation, while in KLW this timeline was approximately six months in total.

The following table very briefly summarises the development of a DSP, as described in the DSP Implementation Framework. Further detail can be obtained in the Framework document.

| Phase | Activity | Description |
|---|---|---|
| Pre-Design<br><br>*Pre-Design activities do not need to follow a particular chrono-logical order* | Determine operational boundaries of the DSP | Identify an area based on need for intervention, homogeneity and practical scope. |
| | Develop planning schedule | Create schedule of meetings and workshops in line with the implementation framework. |
| | Identify the project co-ordinator | An experienced official based in the area, who has a network of established contacts within the stakeholder base. |
| | Identify roles and responsibilities | Especially Enforcement, Education and Engineering Team Leaders who will co-ordinate production of plan in response to Evaluation. |
| | Prepare preliminary fatalities analysis | This presentation is to inform workshop discussions, and includes a five-year analysis of fatalities by SAPS precinct, road user type, demographics, time and day, Blood Alcohol Concentration and spatial analysis. |

implementation planning or monitoring and evaluation was found to have been conducted, and there is little evidence that these plans were followed through.

[9] A useful resource for further reading on the Military Decision-Making Process, Mission Analysis and other elements of military planning which influenced the DSP Implementation Framework, such as Intelligence Preparation of the Battlefield, is the United States Army's Field Manual 101-5, Chapter 5. Various editions of this manual are available in full or part online. A useful version of Chapter 5 with internal hyperlinks can be retrieved here: http://www.au.af.mil/au/awc/awcgate/army/fm101-5_mdmp.pdf

| | | |
|---|---|---|
| | Develop a project stakeholder database | Used to co-ordinate across different spheres of government, departments and road safety disciplines, and ensure all elements represented. |
| | Set up project WhatsApp group | Excellent tool for stakeholder consultation and management during planning phase, and for co-ordination and information sharing during implementation. |
| | Conduct pre-meetings with key stakeholders | Can consist of presentations to regional bodies and meetings with key individuals. This serves to share information and to generate buy-in. |
| Design<br><br>*Design activities must follow a chrono-logical order, with ex-ception of Prin-cipals engage-ment* | Workshop 1: Introduction to DSP for core stakeholders (implementers) | This session serves to introduce the concept of the DSP, especially evidence-based decision making and integrated planning. It also captures local intelligence. It can be combined with Workshop 2. |
| | Workshop 2: Introduction to DSP for all stakeholders (including non-implementers) | This workshop follows the same format as Workshop 1, but incorporates a wider group of non-implementing stakeholders. Can be combined with Workshop 1 in certain circumstances. |
| | Evaluation | A detailed Evaluation of the DSP area is compiled in presentation format, using multiple data sources and local intelligence. |
| | Workshop 3: Evaluation presentation (can include non-implementers) | The Evaluation is presented to the stakeholders. Stakeholders break into 3 discipline-based groups: Enforcement, Engineering and Education and begin development of practical response to Evaluation, which may include additional breakaway meetings. |
| | Workshop 4: Presentation of 'E-plans' | The responses to the Evaluation are presented by the teams as 'E-plans' (Enforcement, Education and Engineering) and are then interrogated by the full group and integrated with one another. |
| | Workshop 5: Integrated plan presented | Presentation of the near-final plan, once integration across E-plans has been agreed. The plan includes co-ordinating instructions and monitoring and evaluation. The Logical Framework is produced at this point. |
| | M&E Plan finalised | The M&E plan is finalised in response to the final agreed plan and the Logical Framework is populated and shared with the implementation stakeholders. |
| | Principals engagements | Meetings and correspondence with leadership such as mayors and municipal managers, or SAPS cluster commanders is completed to create support for plan. |
| | Plan approval | The plan is taken through a sign-off process |

| | | |
|---|---|---|
| Imp-lemen-tation | Launch | The plan is launched. This can be accompanied by a formal event, either at the start of activities or once plan has been in place for some time. |
| | Ongoing management of the plan | Planning follows quarterly cycles, and sessions for planning and monitoring and evaluation must be held regularly to match this cycle. Sustained implementation depends upon conduct of these regular sessions, and upon quarterly completion of the logframe, together with the production of an M&E report whose findings must be acted upon. |

*Table 3.5. Summary of the DSP planning process, as used in Caledon and KLW DSPs, and captured in the DSP Implementation Framework*

## 3.7 Ethics

This research involves the use of legally protected medical records, specifically data collected by FPS technicians in the course of responding to a traffic fatality, and thereafter morticians at Forensic Laboratories in the course of analysing the circumstances of death. These records in their full form are highly sensitive personal records. The use of this data has been approached with the highest possible level of respect for the integrity of the data and by extension for the persons and next of kin of the deceased, although these are not known to the author. No personally identifiable data was used, and data such as name, date of birth or ID number was removed from the data by FPS prior to upload to the shared server used for data transfer to the author. For further details on this aspect, see 3.7.5 Data Management, below.

Ethics clearance was applied for and received through the Research Ethics Committee of the University of Stellenbosch. Nevertheless, due to the highly sensitive nature of this data, the following points should be noted:

**3.7.1** At the time of writing the author had worked extensively in the field of road safety for eight years, and has spent considerable time analysing road traffic fatalities data from 2014 to present, along with other injury and Emergency Medical Services data. The author has spent hundreds of hours accompanying law enforcement and emergency services in the field. The author is extremely sensitive to the requirement of absolute respect for the privacy of injured persons, especially the deceased, as well as the right to privacy of survivors and next of kin.

**3.7.2** The author has password-protected access to the relevant data, subject to strict conditions developed by the Department of Health which take into account the ethical considerations involved. See 3.7.5 Data Management below for further details.

**3.7.3** No potential risks emerged during the analysis. Only high-level statistics are used in this paper, and no data is recorded within it.

**3.7.4** The burden of disease of road traffic injury is substantial, as Chapter 1 above illustrates. Any research which contributes positively to the body of knowledge and best practice in this field has the potential to ultimately save lives, reduce injuries and bring down the burden of disease.

**3.7.5** Data Management:

i. The author conducts analysis of fatalities data in the line of his work on behalf of the Western Cape Department of Transport and Public Works (DTPW). The author has done so for more than four years, under various data sharing arrangements.
ii. The data is made available to the author via a secure central server, and is subject to strict controls in terms of portability, access, confidentiality, prohibition of linking records with any personally identifiable information, and sharing of the data.
iii. The terms of the data sharing arrangement are included below as Appendix A. These are the terms which have been applied in this analysis.
iv. Further information regarding this arrangement can be obtained from the Director: Forensic Pathology Services, Ms Vonita Thompson (vonita.thompson@westerncape.gov.za). Director Thompson has provided the author with a letter of support for this research paper.
v. No data was accessed or studied which the author does not have access to in the normal line of his work on District Safety Plans.

# Chapter 4: Data Used in the Analysis.

## 4.1 Introduction

While by no means representing the entirety of the traffic injury problem, analysis of road safety outcomes of necessity focuses on fatality data, such incidents being the most costly in human and economic terms. In the Western Cape's road safety context, the fatality data produced by the Department of Health's Forensic Pathology Services is an invaluable resource for planning and monitoring of road safety interventions. This is due both to the richness of the data, but is made especially so due to the inconsistent and often inexplicable figures produced by the alternative sources, these being the RTMC and the PAS. These limitations have been traversed in 3.5 above.

This chapter describes the FPS data in detail, and also covers other data sources used, especially data gathered from operational reports and from media schedules.
FPS profiles of the DSP areas are provided for the years from 2010 to the closest calendar year of implementation, followed by comparative post-implementation profiles up to 2018. Profiles for Caledon are thus 2010 to 2016 and 2017 to 2018, while the profiles for KLW are 2010 to 2017 and 2018.

## 4.2 Forensic Pathology Services (FPS) Data

The FPS data used in the analyses contained in this paper is broadly described as single entries per individual fatalities, describing official categorizations, including mortuary record numbers, SAPS CAS number, demographic details, location details and other relevant information. The information is initially captured by FPS technicians responsible for the removal of remains from crash scenes or medical service areas, and is captured for record-keeping in terms of legislation, rather than for data analysis and/or intervention design. This has important ramifications for analysing the data in that many fields are incomplete or inconsistently completed, making many elements of the data unusable for analysis purposes. Conversely, many fields are consistently and accurately completed – confidence in this dataset has been cemented since its adoption as a standard by provincial road safety authorities in 2010 by its consistency with numerous SAPS Accident Reports, CCTV footage (especially as captured by the Freeway Management System) media reports and traffic officer reports, as well as next-of-kin and survivor interviews conducted by the author. The data is exported and verified as far as is possible by FPS technical staff before being posted to the password-protected shared server for collection by authorised individuals or systems. A table of the fields made available by FPS is provided below, together with a sample value and description of use cases for that field.

It should be noted that at the time of the Caledon and KLW DSP Evaluations, FPS still provisioned BAC, or post mortem blood alcohol content, for fatality records where this was known. Provisioning of BAC data was halted in August 2017 due to a variety of concerns over data integrity and delays occurring at national forensic laboratories over which FPS could exert no influence. The data had been incomplete and could only be used as indicative of broad trends under caveat. Despite the limited scope of use, it was found to be consistent with other fields within the FPS data, and with other sources of data and information, and helped confirm the profiles developed for the DSPs in the Evaluations.

FPS, as the ethical and legal custodian of the data requested that BAC data previously provisioned not be used for external analysis purposes, and it is therefore omitted here.

| Field | Sample Value | Name | Use by Author | Notes |
|---|---|---|---|---|
| Forensic Lab | Salt River | Forensic Laboratory | Not used. | Refers to the mortuary where the deceased was received. Deceased may be received at mortuary closest to incident or closest to medical service centre. |
| Reference Number | DOTP/2018/1359 | Forensic Lab Reference Number | Not used. | Unique ID for deceased's remains. |
| Police Station | Villiersdorp | SAPS Precinct where case is recorded. | Used to identify location. | Uniquely consistent means of identifying the broad location of a fatality, as case must be recorded in the precinct in which the incident occurred. |
| Case Number | 115/11/2018 | SAPS CAS number. | Rarely used. Not used in this analysis. | Unique id for an incident and can be used to identify numbers of victims associated with a single incident. |
| Hospital | <blank><br><br>Or<br>George Hospital | Medical Service Area where body is recovered | Rarely used. Not used in this analysis. | Most fatalities occur at incident site. Where body is recovered from a medical service area, this is not always recorded in this field. |
| Dateinjury | 2018/05/11 | Calendar date on which | Used to identify date of incident. | This field is further broken down for research |

| | | | | |
|---|---|---|---|---|
| | | incident occurred. | | purposes into: Year, Month, Day (of week). |
| timeinjury | 02:32 | Time at which incident occurred | Used to identify the time of the incident. | Often used to breakdown fatality occurrence into dayparts for analysis purposes. |
| Datedeath | 2018/03/30 | Calendar date on which death occurred | Not used.. | A 30 day reporting hold is applied to a given period for deaths attributable to the Road Traffic Incident as determined by the coroner. |
| Timedeath | 23:40 | Time at which death occurred | Not used. | See above. The use of injury date and time more accurately positions the incident for analysis. |
| Race | Black | Population group of deceased. | Used for demographic analysis. | High value for identifying demographic trends. |
| Sex | Male | Gender of deceased. | Used for demographic analysis.. | High value for identifying demographic trends. |
| Age | 10 | Age of the deceased. | Used for demographic analysis.. | For road safety purposes, individuals younger than 15 are categorized as children, while those 15 and older are categorized as adults. |
| Age Description | Years | Years or months descriptor for Age | Used for demographic analysis. | Individuals 12 months or older are categorized in years. Ages 0 – 11 months are re-categorized as 0 years for analysis purposes. |
| Allegedcoddescr | Pedestrian | Alleged circumstances of death description | Not used. | Initial identification of road user type prior to post mortem. Generally, the alleged COD description aligns to the official COD, but a small percentage of records change. |
| Allegedcodcat | Road Traffic Incident | Alleged circumstances | Not used. | Initial identification of un-natural death category prior to post mortem. |

| | | | | |
|---|---|---|---|---|
| | | of death category | | Generally, aligns to the official COD category, but a small percentage of records persist with COD categories which do not apply and such records must be filtered prior to analysis. |
| Officialcoddesc | Driver | Official circumstances of death description | Used to identify road user type. | High value for identifying road user trends. |
| Officialcodcat | Road Traffic Incident | Official circumstances of death category | Used to filter data to ensure only confirmed Road Traffic Incident records are used in analysis. | Critical for ensuring data integrity. |
| Latitude | -32,707667 | Latitude of body recovery | Used with caution internally, eg for identifying hotspots. | Provision of GPS co-ordinates is incomplete and FPS request these co-ordinates are not used in published analyses. They often reflect medical service areas rather than incident locations. They are nonetheless useful for hotspot identification. |
| Longitude | 22,607778 | Longitude of body recovery | Used with caution internally, eg for identifying hotspots. | Provision of GPS co-ordinates is incomplete and FPS request these co-ordinates are not used in published analyses. They often reflect medical service areas rather than incident locations. They are nonetheless useful for hotspot identification. |
| Provinceinjured | Western Cape | Province where body is recovered. | Not used. | Redundant in context. |

| | | | | |
|---|---|---|---|---|
| Towninjury | Hermanus | Town where body recovered. | Used rarely. Not used in this analysis. | Subject to issues regarding collection of body at medical service area, among other inconsistencies. SAPS Precinct preferred. |
| Suburbinjury | Fisherhaven | Suburb where body recovered. | Used rarely. Not used in this analysis. | As above. |
| Sceneinjur | Road/Street/Highway | Type of area where body recovered | Not used. | Inconsistently completed. Often completed for medical service area. |
| Vehicletype | Sedan | Type of vehicle involved | Used rarely. Not used in this analysis. | Inconsistently completed and unclear in cases where more than one vehicle is involved. |
| Roadtype | Highway - N route | Type of road where incident occurred | Used rarely. Not used in this analysis. | Inconsistently completed. Often completed for medical service area. |
| Speedlimit | 80 | Speed limit where incident occurred | Used rarely. Not used in this analysis. | Inconsistently completed. Often completed for medical service area. |
| Numberofvictims | 3 | Number of victims in incident | Used rarely. Not used in this analysis. | Not consistent for number of fatalities (ie other injuries included occasionally), and inconsistently completed. |
| Numberofvehicles | 2 | Number of vehicles involved in incident | Used rarely. Not used in this analysis. | Inconsistently completed. For example, numerous records indicate zero. |
| Driverposition | Inside vehicle cabin | Position of deceased when found, if driver. | Not used. | Inconsistently completed. Possibly redundant because of COD Description and Body Position field. |
| Passengerposition | <blank> | Position of deceased when found, if passenger. | Not used. | Rarely completed. Possibly redundant because of COD Description and Body Position field. |

| | | | | |
|---|---|---|---|---|
| Pedestrianposition | <blank> | Position of deceased when found, if pedestrian. | Not used. | Rarely completed. Possibly redundant because of COD Description and Body Position field. |
| Bodyposition | Outside vehicle | Position of deceased relative to vehicle. | Used rarely. Not used in this analysis. | Inconsistently completed. |
| Weatherconditions | Clear Night Time | Weather Conditions at time of body recovery. | Used rarely. Not used in this analysis. | Subjectively and inconsistently completed. Often completed for medical service area. |
| Roadcondition | Good Dry | Road conditions at time of body recovery. | Used rarely. Not used in this analysis. | Subjectively and inconsistently completed. Often completed for medical service area. |
| Incidentstreet | N2 Highway | Street where incident occurred. | Used rarely. Not used in this analysis. | Subjectively and inconsistently completed. Often completed for medical service area. |
| incidentsuburb | Botrivier | Suburb where incident occurred. | Used rarely. Not used in this analysis. | Subjectively and inconsistently completed. Often completed for medical service area. |
| Date Incident Logged | 2018/05/25 | FPS system logging date | Not used. | |
| Time Incident Logged | 18:55 | FPS system logging time | Not used. | |

*Table 4.1 FPS Data fields and descriptions*

### 4.3.1 Pre-Implementation Fatalities Profile from FPS Data, Caledon DSP Area, 2010 - 2016

FPS data was analysed during the Caledon DSP planning process, and captured in the Evaluation which formed the initial foundation of the plan. FPS data was continuously analysed and reported on throughout the implementation of the pilot and beyond, on a quarterly basis. For the purposes of this study, the Evaluation and reports generated during the planning and implementation of the DSP were referred to but not used as definitive, and the raw data were re-evaluated. While minor discrepancies were found, the profile of fatalities was overwhelmingly consistent with that of the Evaluation and subsequent reports. Figures from the re-analysis are presented here.

Data analysed for the Caledon DSP area were filtered by the SAPS precincts in the Hermanus – Caledon cluster, which aligned to the Caledon Traffic Centre area of responsibility. See Table 3.1, above.

Fatalities data for the Caledon DSP area for 2010 to 2016 displayed a profile consistent with the original Evaluation conducted in terms of the DSP planning process. The profile was as follows:

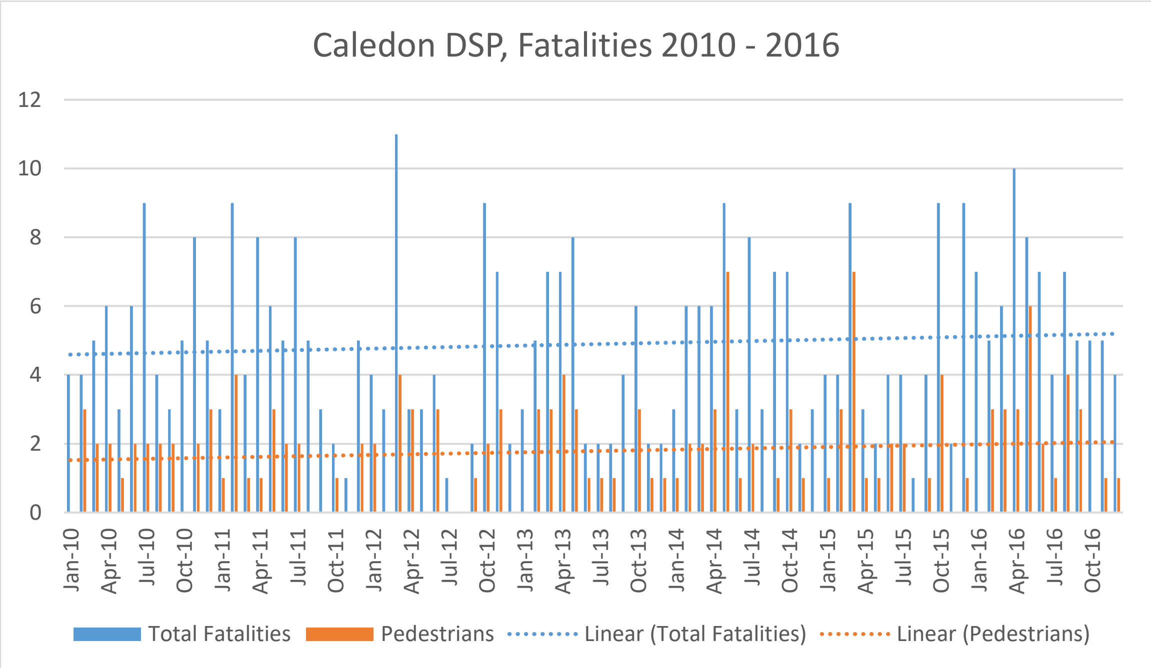



*Figure 4.1 Caledon DSP Fatalities by Month, Jan 2010 - Dec 2016*

Wide fluctuations in monthly fatalities were found, with high of 11 fatalities in April 2012 and a low of zero in August 2012 recorded. Overall, fatalities were found to be increasing, driven by gradual increases in pedestrian fatalities.

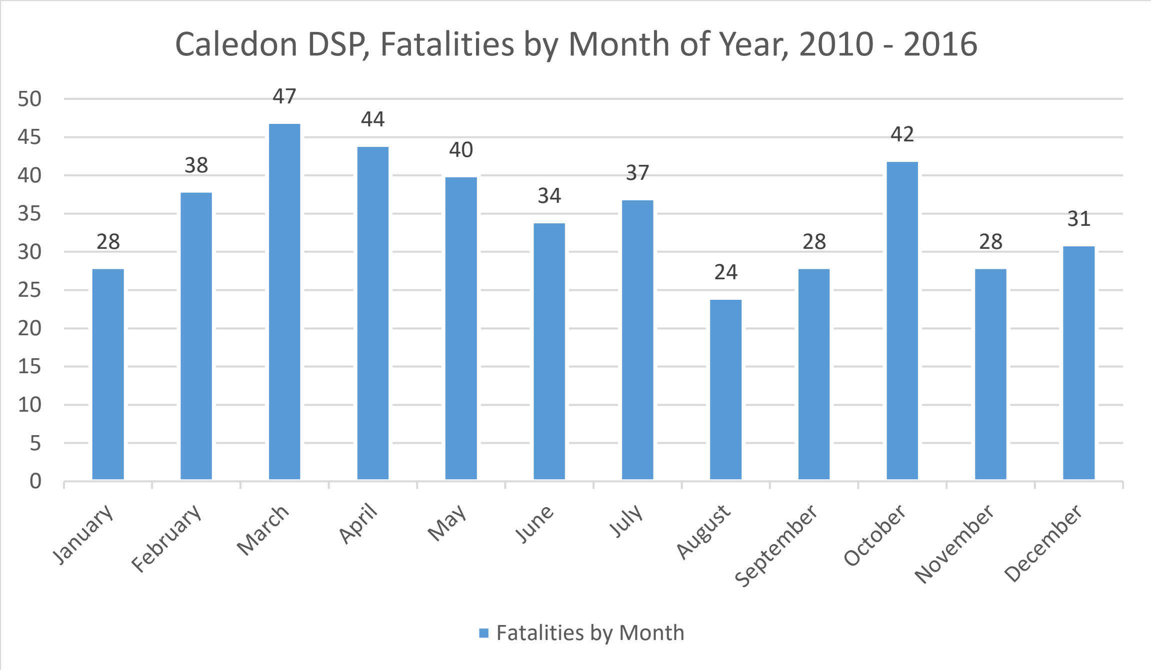



*Figure 4.2 Caledon DSP Fatalities by Month of Year, 2010 - 2016*

In line with the original Evaluation, fatalities were found to coincide more with months associated with increased economic activity, notably harvesting (March, April, May) and planting (October), rather than 'traditional' road safety activity periods such as the December and January Festive Season.

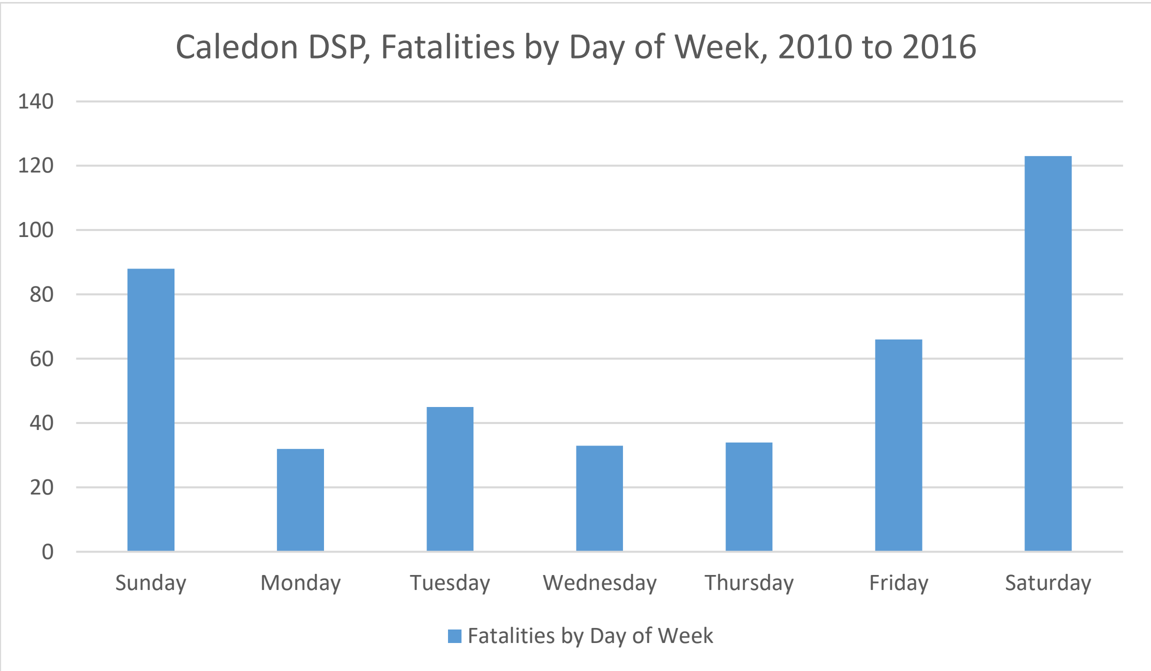



*Figure 4.3 Caledon DSP Fatalities by Day of Week, 2010 – 2016*

The overwhelming preponderance of fatalities occurring over weekends was consistent with the original Evaluation findings, and points to the role played by alcohol in traffic injury in the region.

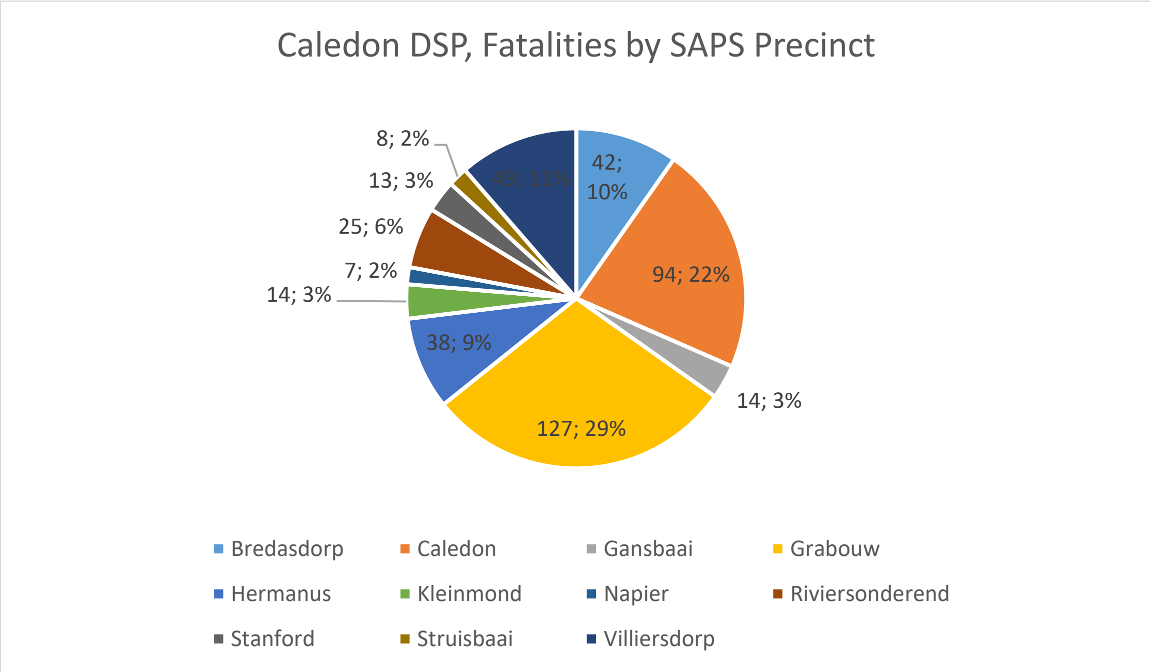



*Figure 4.4 Caledon DSP Fatalities by SAPS Precinct, 2010 – 2016*

In line with the original Evaluation, Grabouw was identified as the epicentre of fatal traffic injury in the region, with significantly more fatalities than the larger town of Caledon.

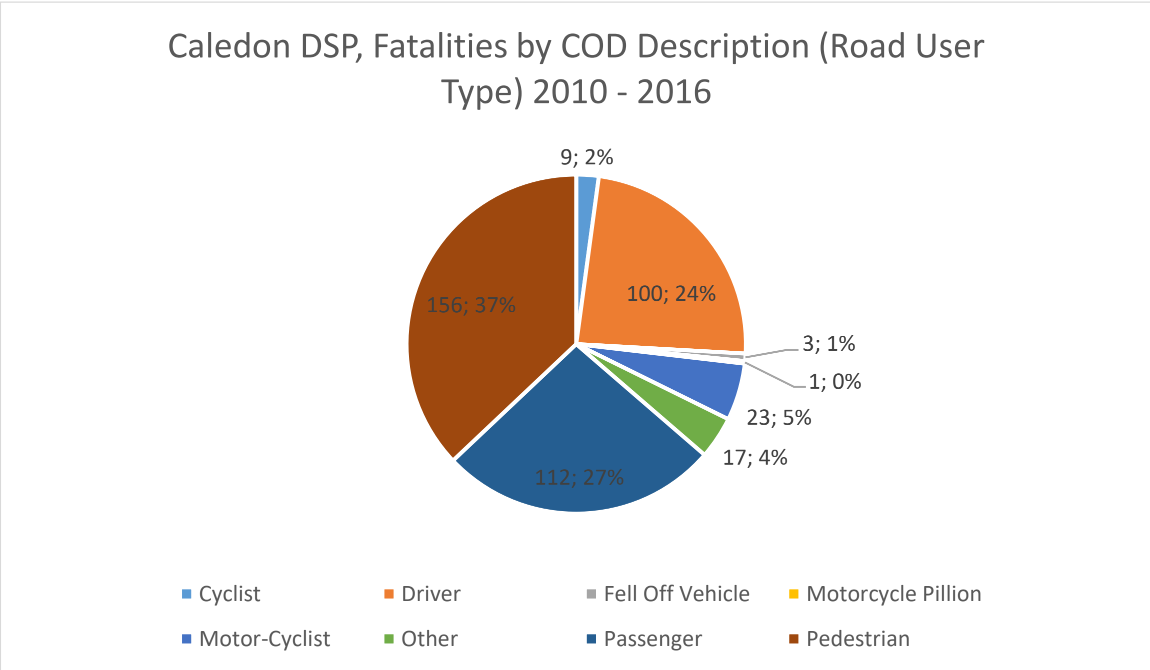



*Figure 4.5 Caledon DSP Fatalities by Road User Type, 2010 - 2016*

Further profiling of regional fatalities revealed that pedestrians, at 37% of fatalities, made up the largest single portion of traffic fatalities, supporting the original Evaluation's conclusion that pedestrians should be prioritized within the DSP.

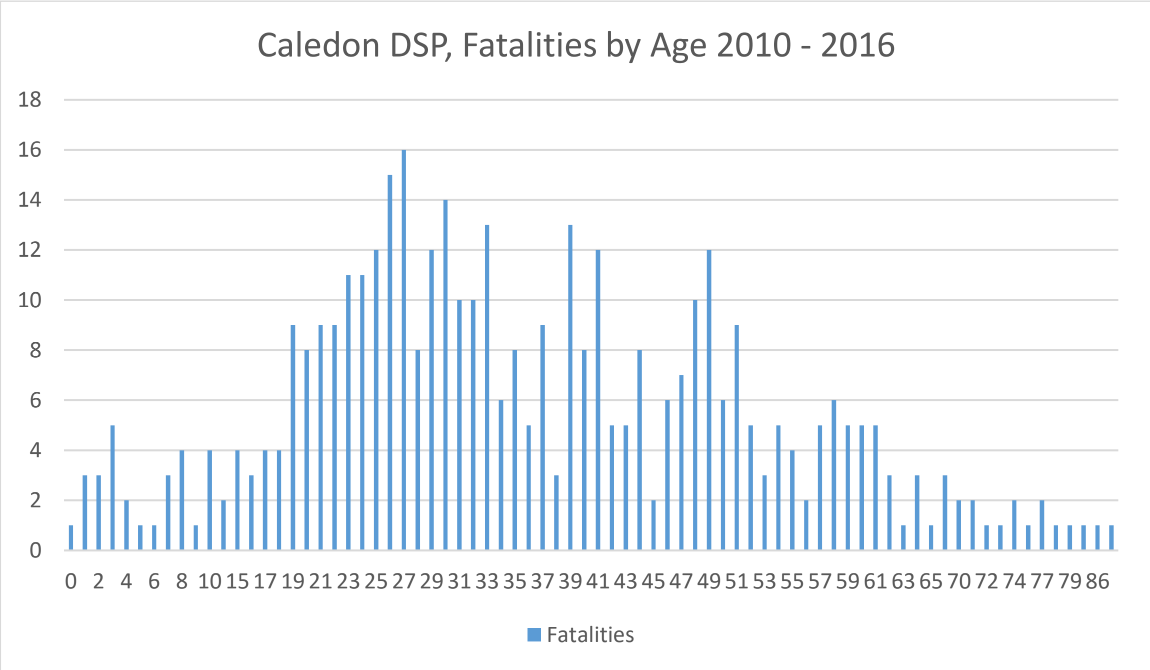



*Figure 4.6 Caledon DSP Fatalities by Age in Years 2010 – 2016*

Age profiling of traffic fatalities showed concentration among adults aged 19 to 35, consistent with the Evaluation and its conclusions regarding targeting of road safety awareness campaigns carried out in terms of the DSP.

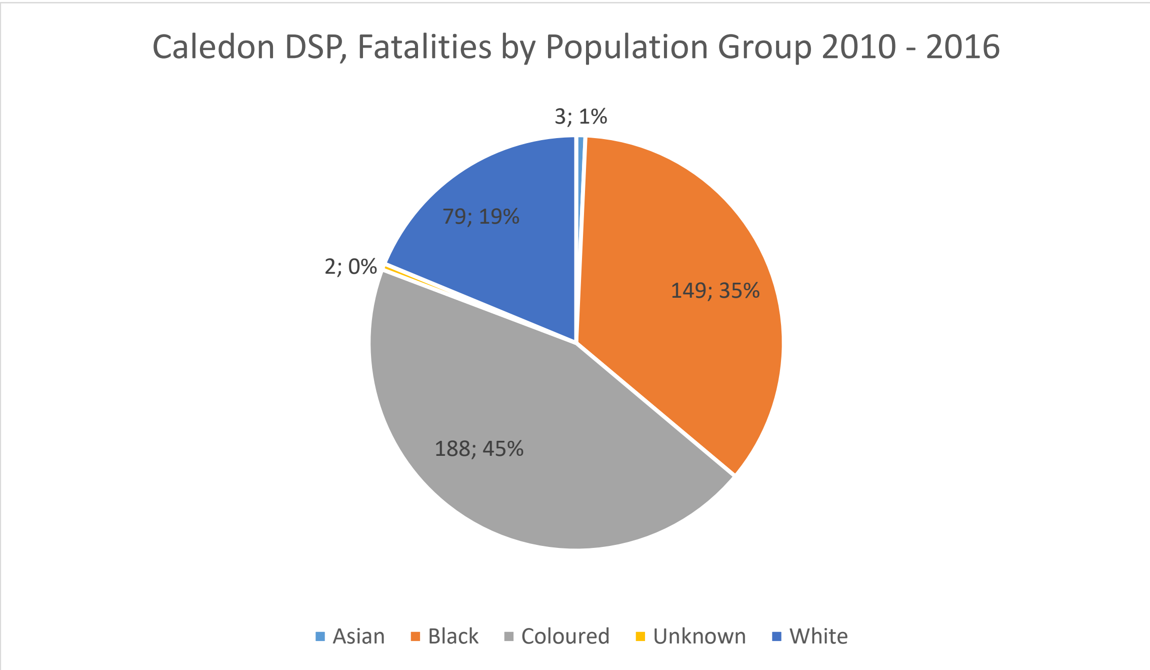



*Figure 4.7 Caledon DSP Fatalities by Population Group 2010 – 2016*

Fatality profiling by race showed disproportionate representation of blacks relative to 2011 population (27% at 2011 Census), with whites proportionately represented (19% of 2011 Census) and coloureds slight under-represented (51% of 2011 Census). Large and rapid population increases in the Western Cape between the 2001 and 2011 censuses may, however, indicate that these figures may not be reliable indicators of a discrepancy between representation in traffic fatalities and actual population numbers at the time.

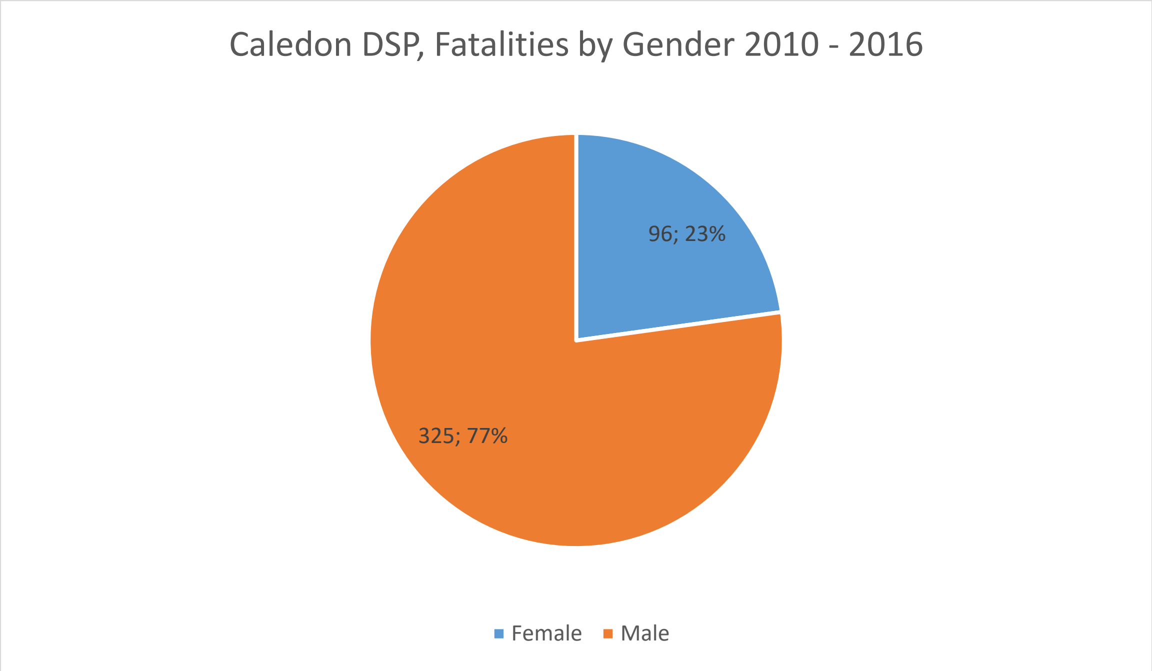



*Figure 4.8 Caledon DSP Fatalities by Gender, 2010 – 2016*

Less than one quarter of fatalities of all types were female, consistent with the Evaluation. In summary, a traffic fatality profile of the Caledon DSP area from 2010 and 2016 aligned closely with the original Evaluation. The Evaluation's recommendations of shifting resources towards targeting male pedestrians at peak weekend times in hotspot areas, especially Grabouw, were re-affirmed by the analysis.

### 4.3.2 Post-Implementation Fatalities Profile from FPS Data, Caledon DSP Area, 2016 – 2018

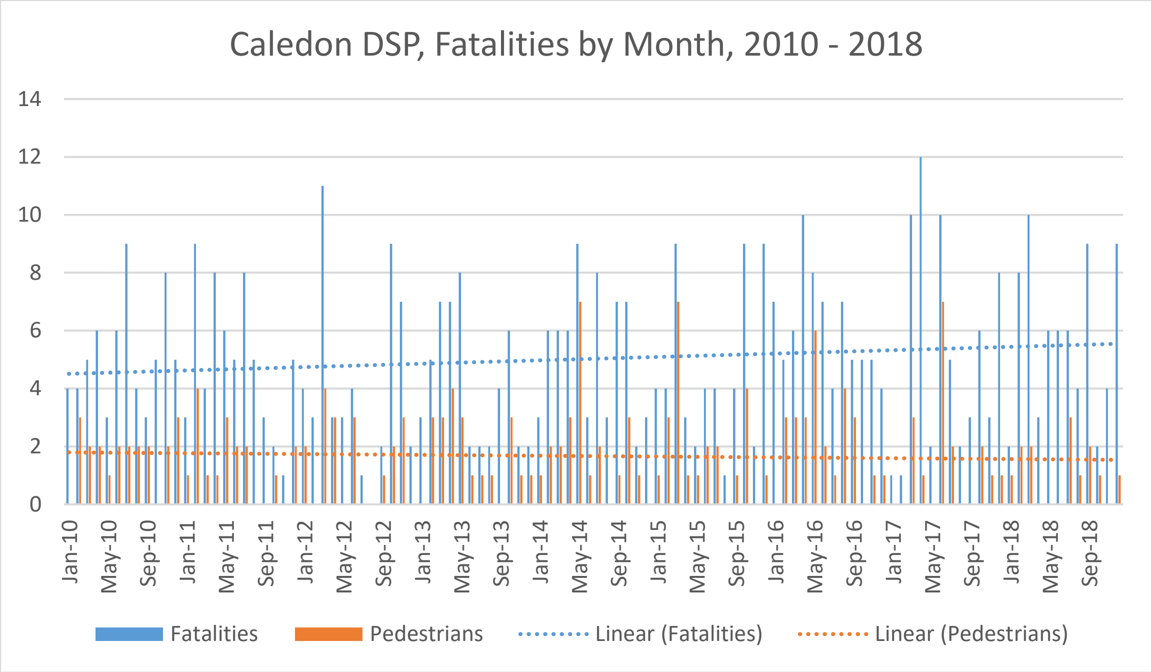



*Figure 4.9 Caledon DSP, Fatalities by Month, 2010 to 2018*

When the overall fatality profile by month was extended to include 2017 and 2018 data, ie post DSP implementation data, it was observed that while overall fatality trends remained negative, ie inclining upwards, pedestrian fatalities had experienced a reverse in the gradual upwards trend.

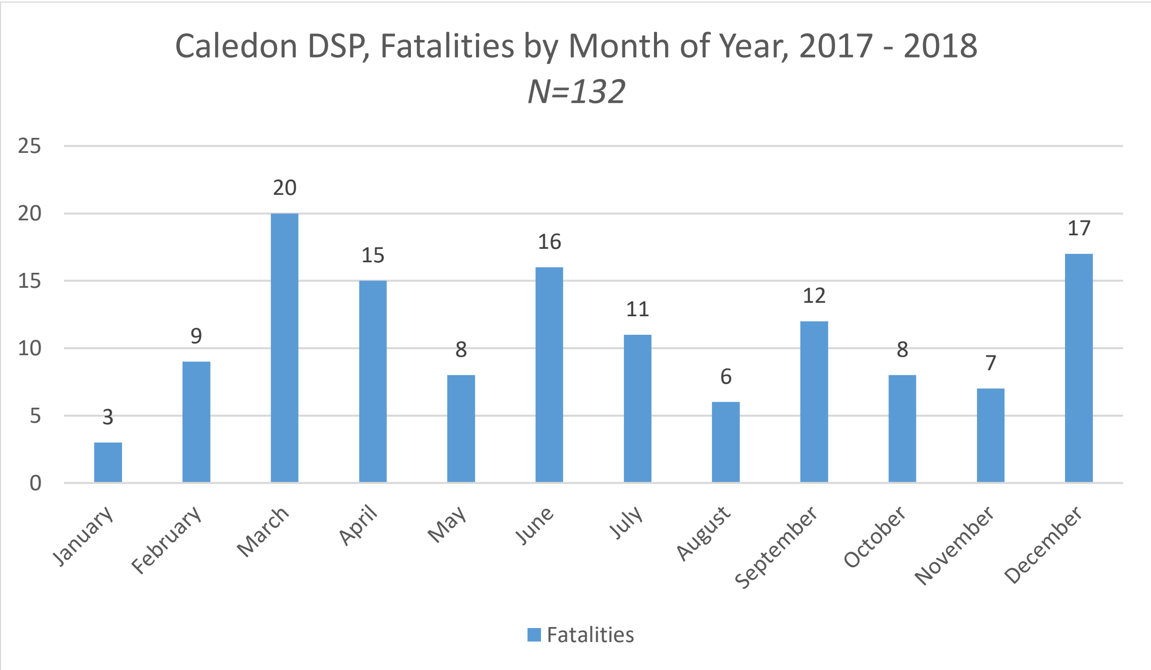



*Figure 4.10 Caledon DSP, Fatalities by Month of Year, 2017 to 2018*

Considerable disruption to the pattern displayed in the profile for 2010 to 2016 is evident, notably the significant low in fatalities in January, and the rise of December in prominence, while October and May fatalities appear to have declined significantly.

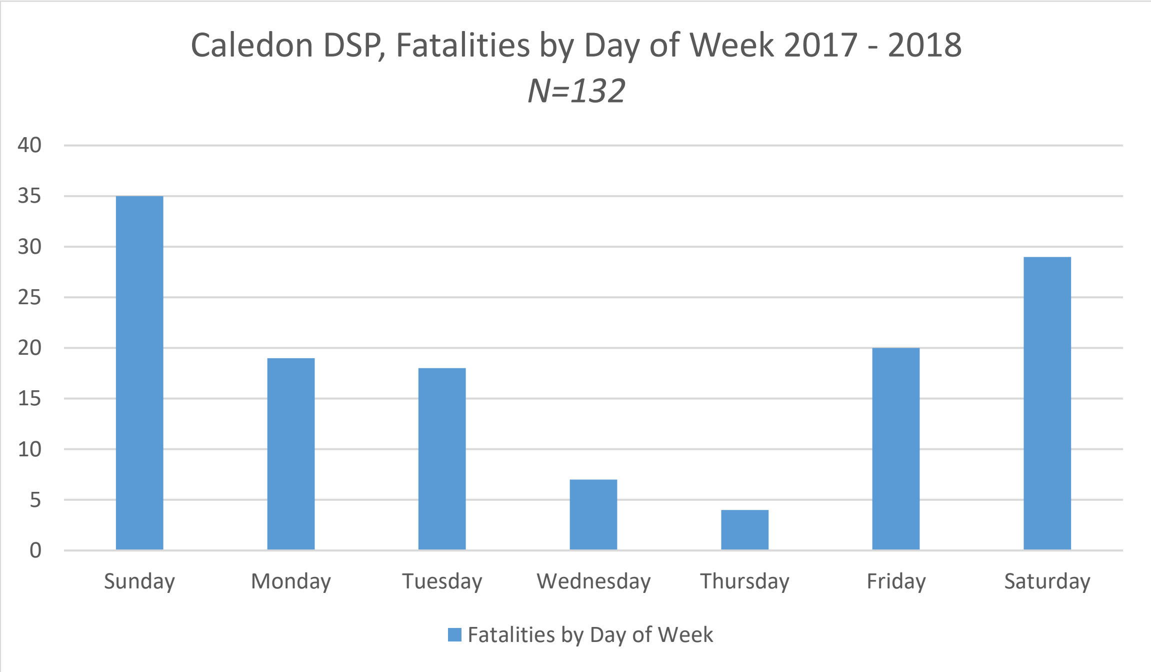



*Figure 4.11 Caledon DSP, Fatalities by Day of Week, 2017 to 2018*

Again, significant changes to the previous 2010 to 2016 profile were evident, with Sunday replacing Saturday as the most significant day of the week for road traffic fatalities.

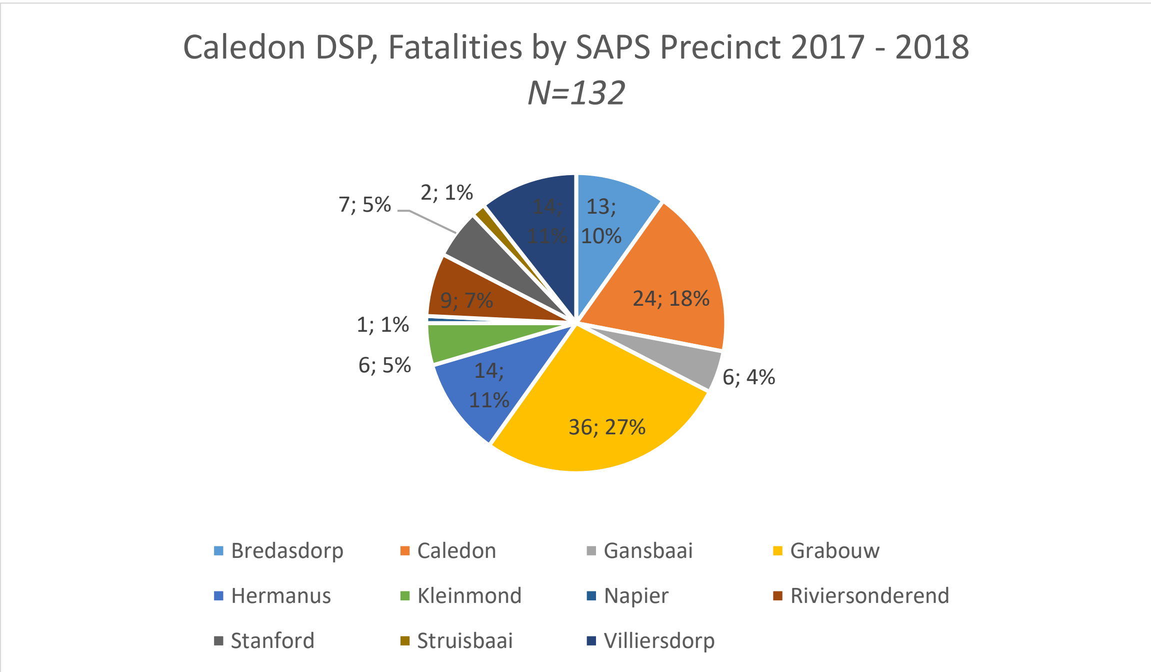



*Figure 4.12 Caledon DSP, Fatalities by SAPS Precinct, 2017 to 2018*

While overall share of the fatality burden was spread slightly more evenly, the overall distribution profile remained stable.

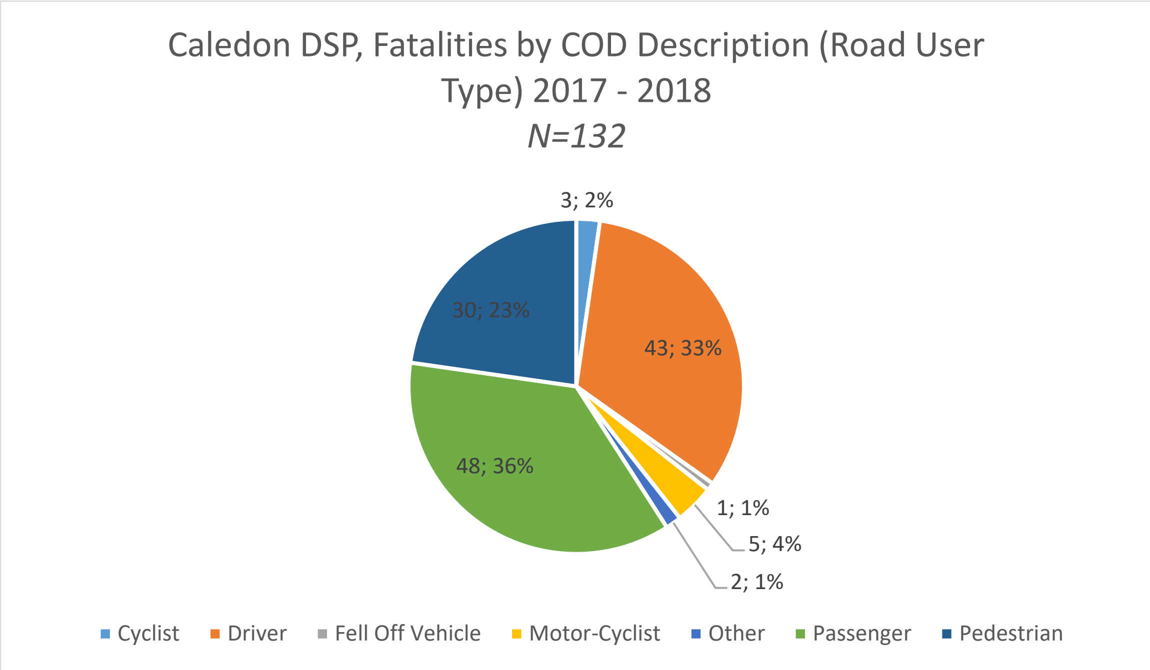



*Figure 4.13 Caledon DSP, Fatalities by Road User Type, 2017 to 2018*

The profile of traffic fatalities by road user type in 2017-2018 differed greatly from that of 2010-2016 in that the proportion of pedestrian fatalities dropped from 37% to 23%. Both driver and passenger numbers absorbed the shift, strongly indicating that the region had become safer for pedestrians.

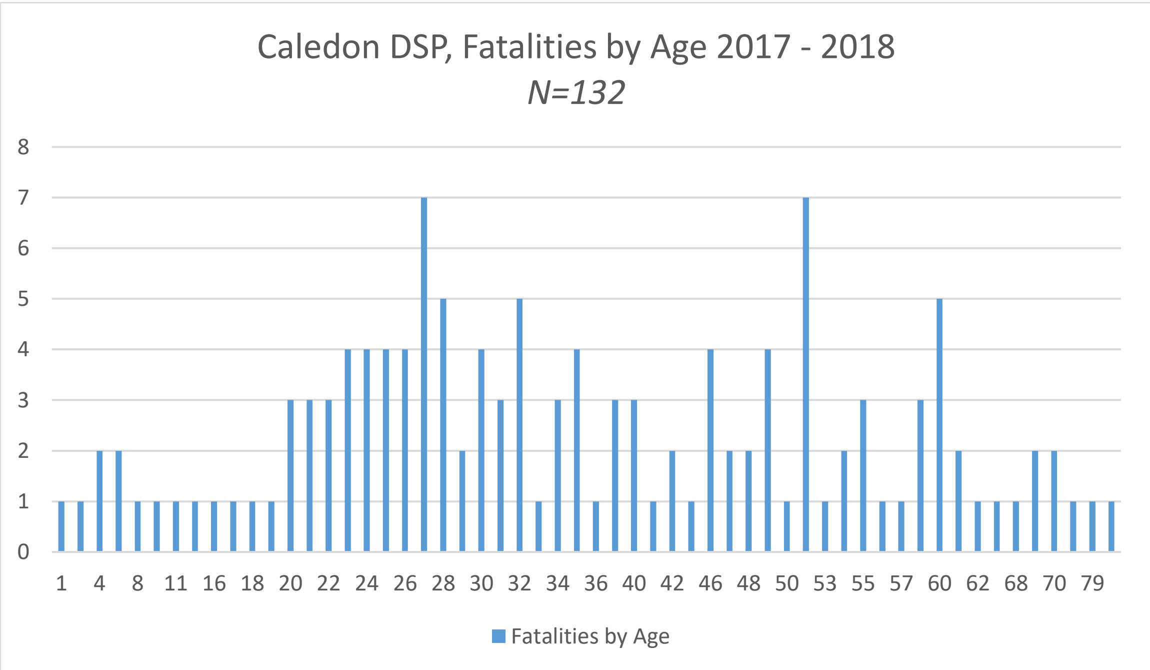



*Figure 4.14 Caledon DSP, Fatalities by Age, 2017 to 2018*

No significant changes in age profile of fatalities were observed.

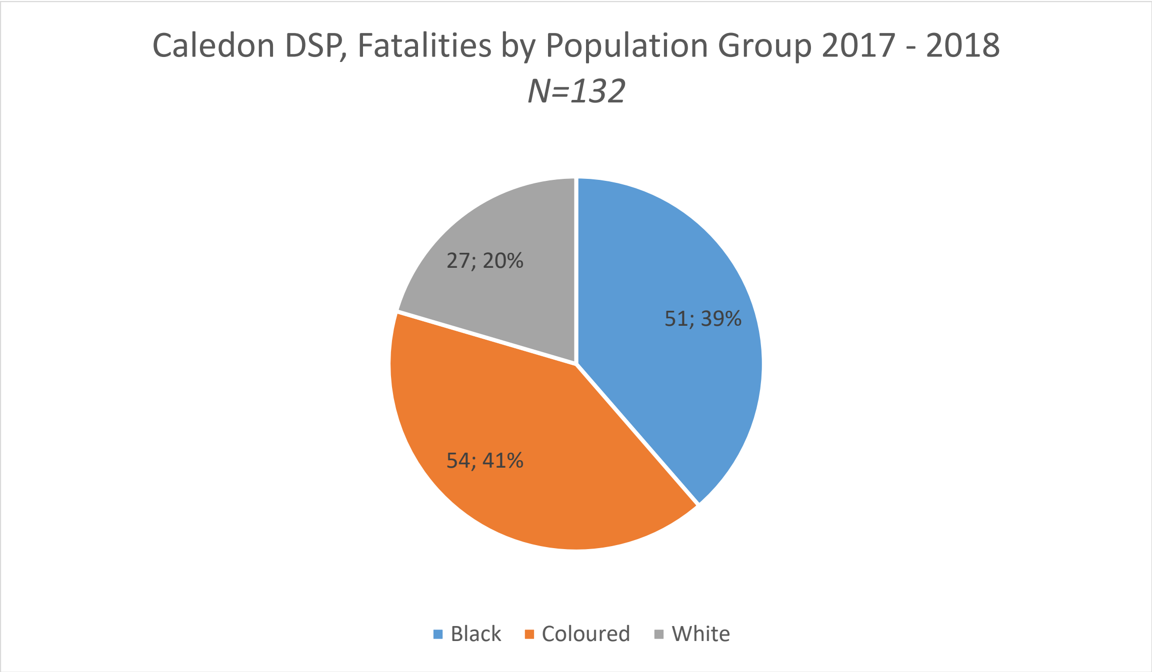



*Figure 4.15 Caledon DSP, Fatalities by Population Group, 2017 to 2018*

While the data show a pronounced upward trend in the proportion of fatal traffic injuries suffered by black people, the absence of new census information prevented meaningful analysis.

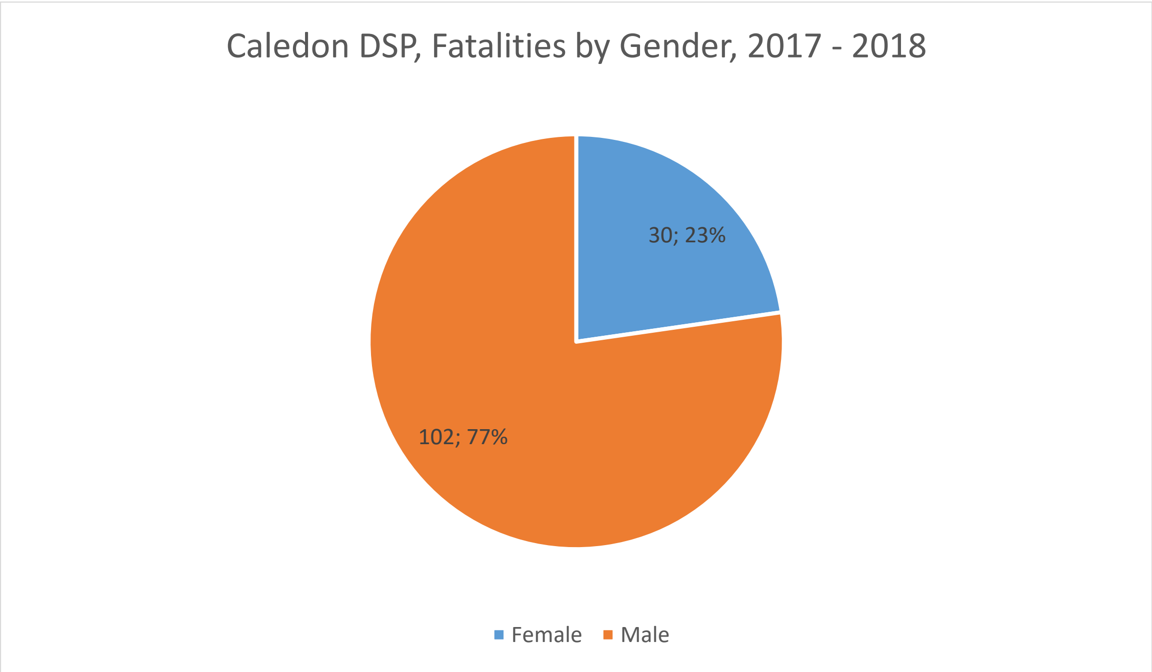



*Figure 4.16 Caledon DSP, Fatalities by Gender, 2017 to 2018*

No change was found in the gender distribution of fatalities between the 2017 – 2018 profile and the 2010 to 2016 profile.

### 4.3.3 Pre- and Post-implementation Profiles Comparison Summary

Comparison between fatality profiles from 2010 to 2016 and 2017 to 2018 suggest that a change in the road safety environment occurred. Most significantly, fatalities appeared less concentrated in the autumn months, with lower proportions of pedestrian deaths, accompanied by a shift from fatalities peaking on Saturday to peaking on Sunday. These shifts are in line with the focus of the original Caledon DSP as implemented and broadly speaking appear to indicate that some level of impact was achieved.

### 4.4.1 Pre-Implementation Fatalities Profile from FPS Data, KLW DSP Area, 2010 – 2017

FPS data was analysed during the KLW DSP planning process, and captured in the Evaluation which formed the initial foundation of the plan. For the purposes of this study, the Evaluation and reports generated during the planning and implementation of the DSP were referred to but not used as definitive, and the raw data were re-evaluated. While minor discrepancies were found, the profile of fatalities was consistent with that of the Evaluation. Figures from the re-analysis are presented here.

Data analysed for the KLW DSP area were filtered by the Khayelitsha and Lingelethu West SAPS precincts in the Khayelitsha cluster, part of the Area South operations area of the City of Cape Town Traffic Services. See Table 3.1, above.

Fatalities data for the KLW DSP area for 2010 to 2017 displayed a profile consistent with the original Evaluation conducted in terms of the DSP planning process. The profile was as follows.

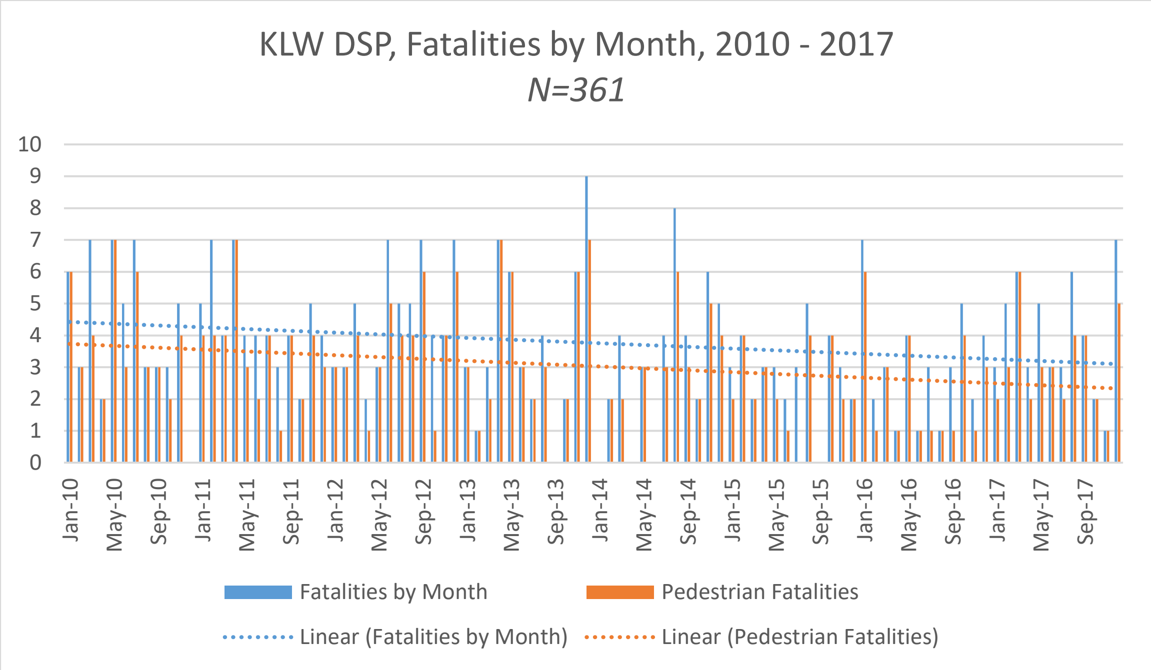



*Figure 4.17 KLW DSP, Fatalities by Month, 2010 to 2017*

In line with the original Evaluation, the KLW fatalities profile showed an overall decreasing trend, although increased numbers of fatalities were observed in the months preceding implementation of the DSP.

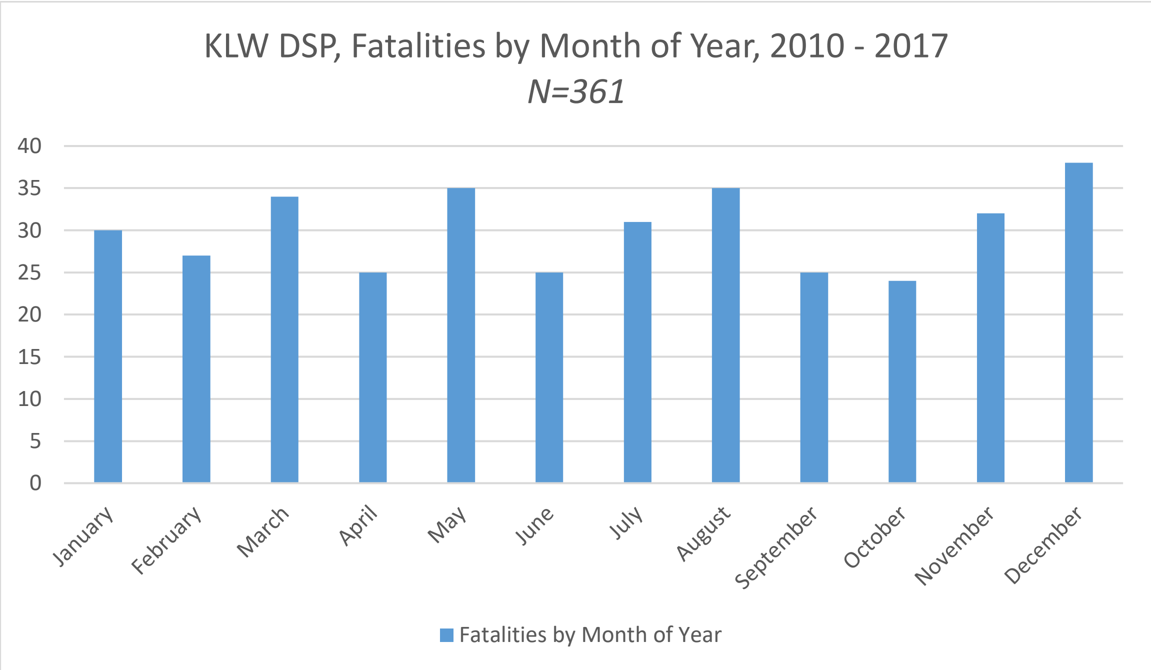



*Figure 4.18 KLW DSP, Fatalities by Month of Year, 2010 to 2017*

Besides a high in December and low in October, little evidence of a cycle of fatalities within the course of the year was observed in KLW. Where highs or lows were experienced viewed over the period as a whole, when examined at annual level, no pattern was evident. For example, while December, with 37 fatalities between 2010 and 2017, represented an apparent peak, it was found that December fatalities ranged from a low of 0 in 2015 to a high of 9 in 2013.

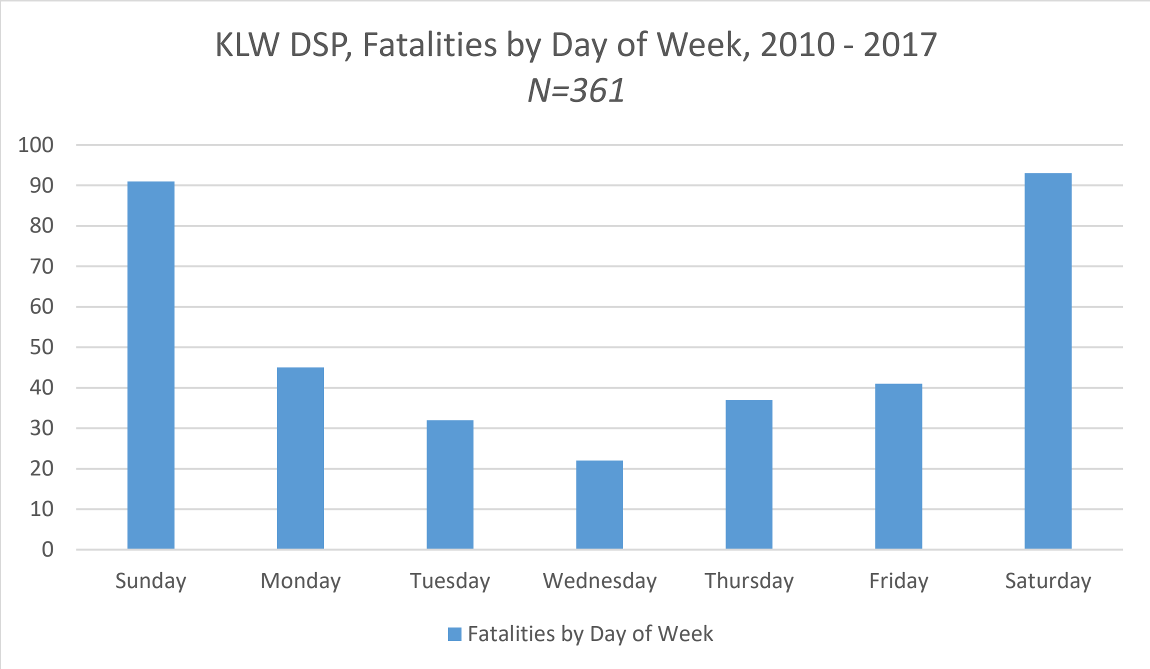



*Figure 4.19 KLW DSP, Fatalities by Day of Week, 2010 to 2017*

Fatalities were found to exhibit highly pronounced peaks over weekends, particularly Saturday and Sunday nights. Postmortem BAC data included in the original Evaluation supported a view that alcohol was largely responsible for these peaks. It was observed that more fatalities occurred on Mondays than Fridays, which was ascribed to early morning collisions possibly associated with weekend alcohol use.

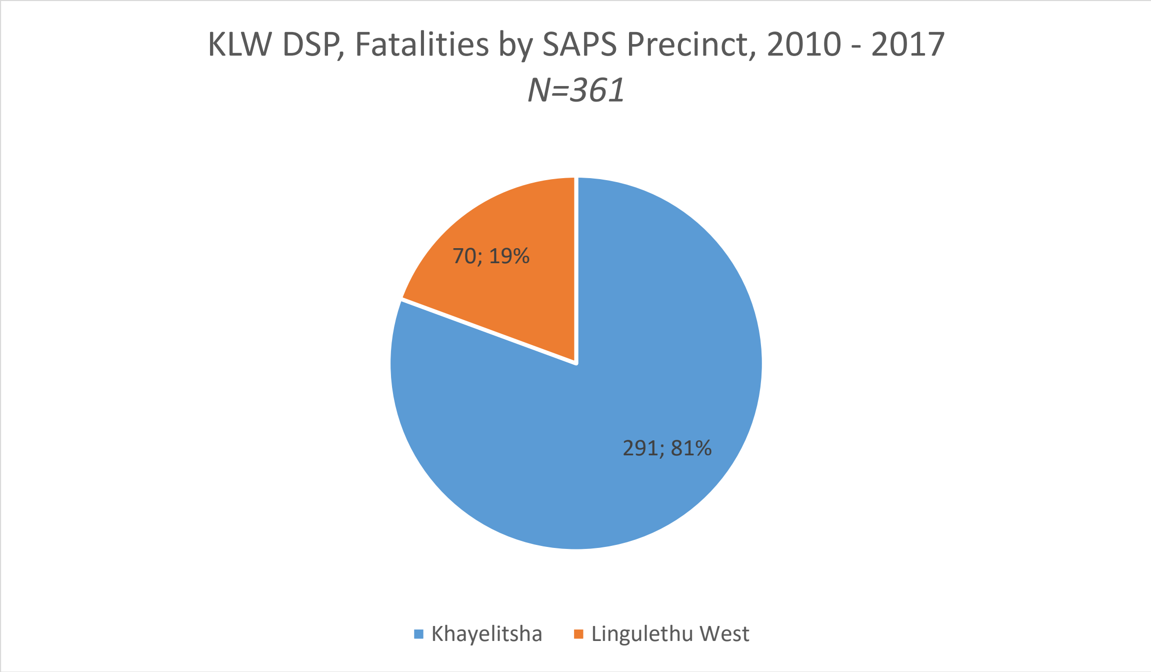



*Figure 4.20 KLW DSP, Fatalities by SAPS Precinct, 2010 to 2017*

Predictably, the majority of fatalities occurred in the larger and more densely populated Khayelitsha precinct.

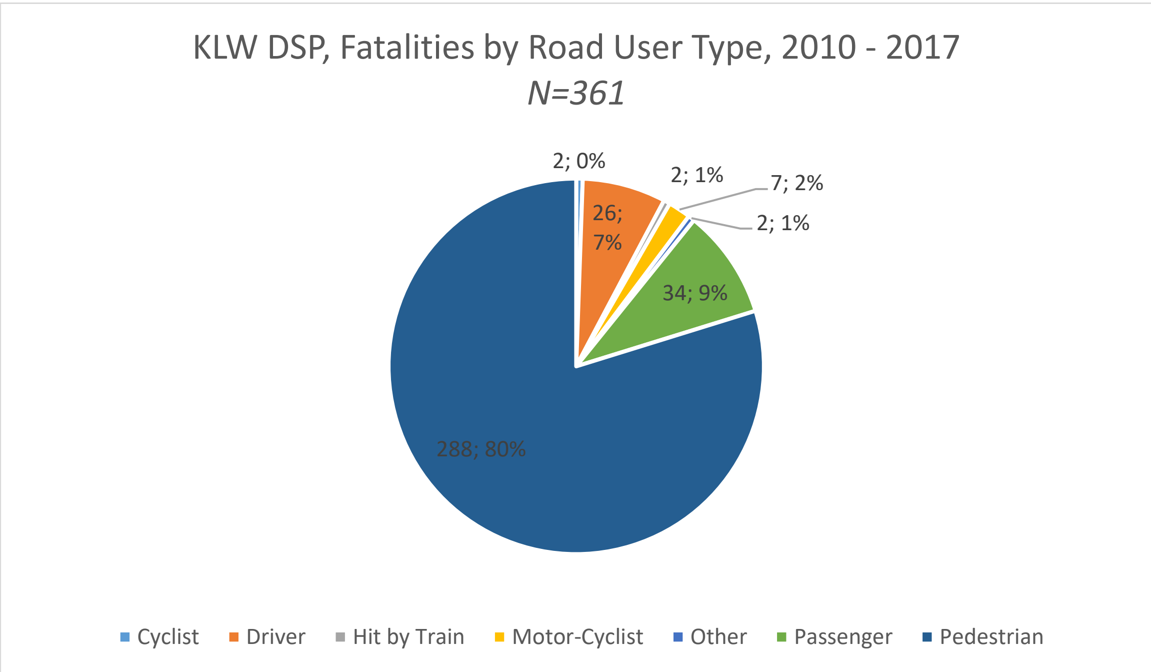



*Figure 4.21 KLW DSP, Fatalities by Official COD Description (Road User Type), 2010 to 2017*

Pedestrians were overwhelmingly the largest group of road users fatally injured, in line with the original Evaluation, and in line with the original observations made during the deliberations leading to the establishment of the DSP.

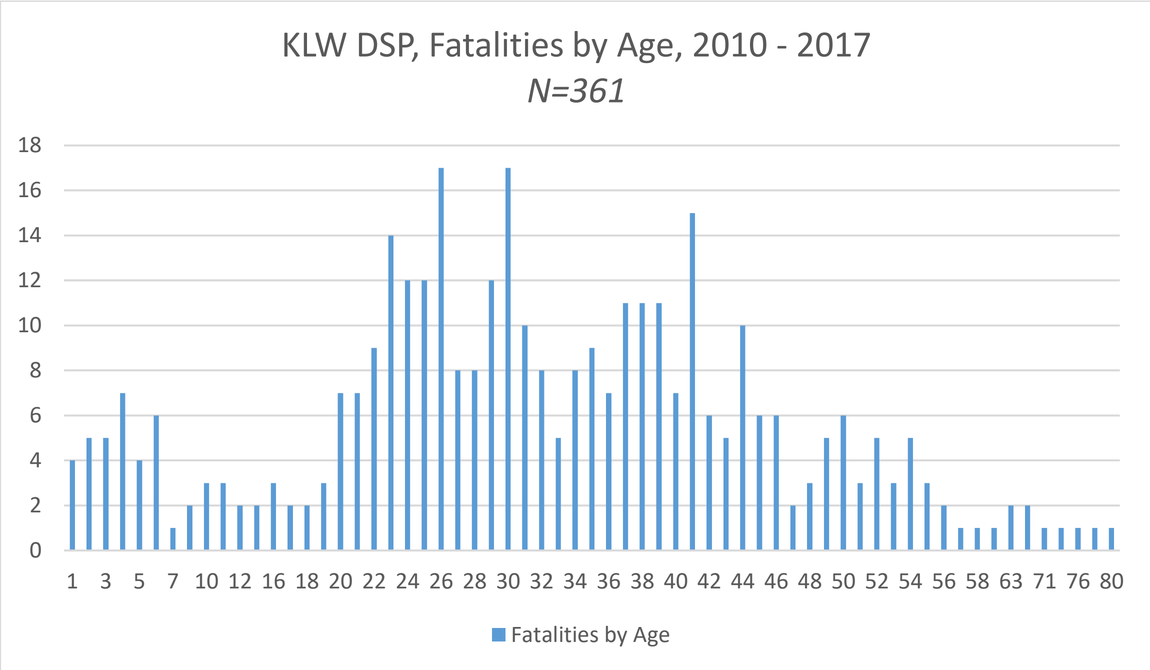



*Figure 4.22 KLW DSP, Fatalities by Age, 2010 to 2017*

Fatalities distribution by age did not differ significantly from the original Evaluation.

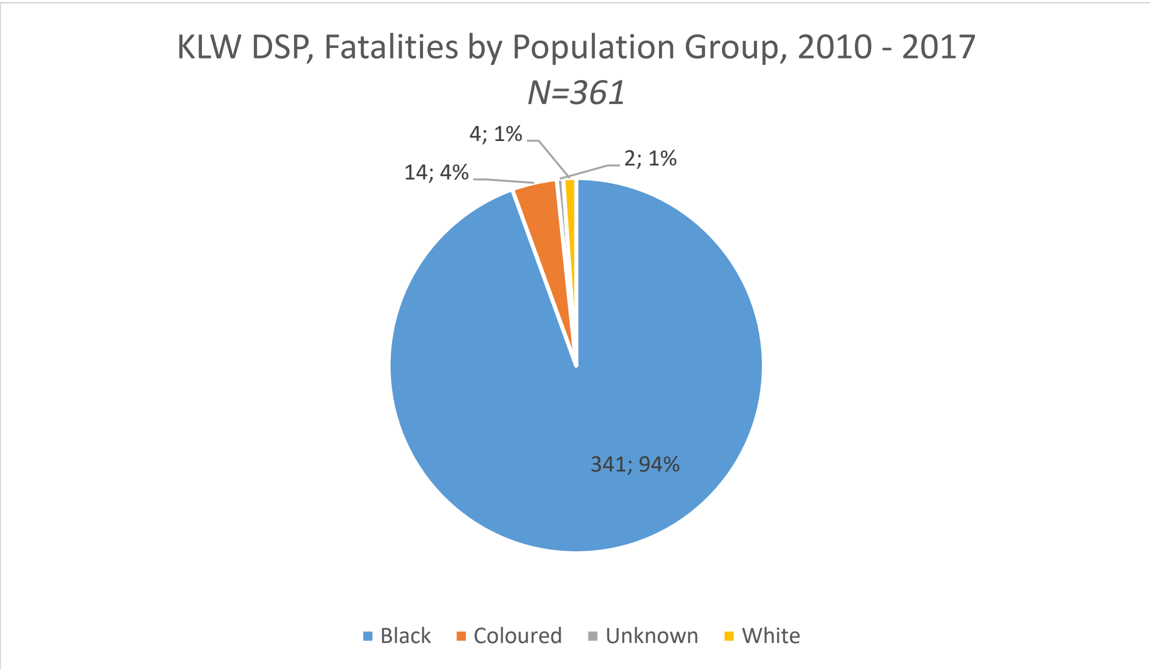



*Figure 4.23 KLW DSP, Fatalities by Population Group, 2010 to 2017*

Fatalities distribution by age showed predictable alignment with the demographic profile of the area and did not differ from the original Evaluation.

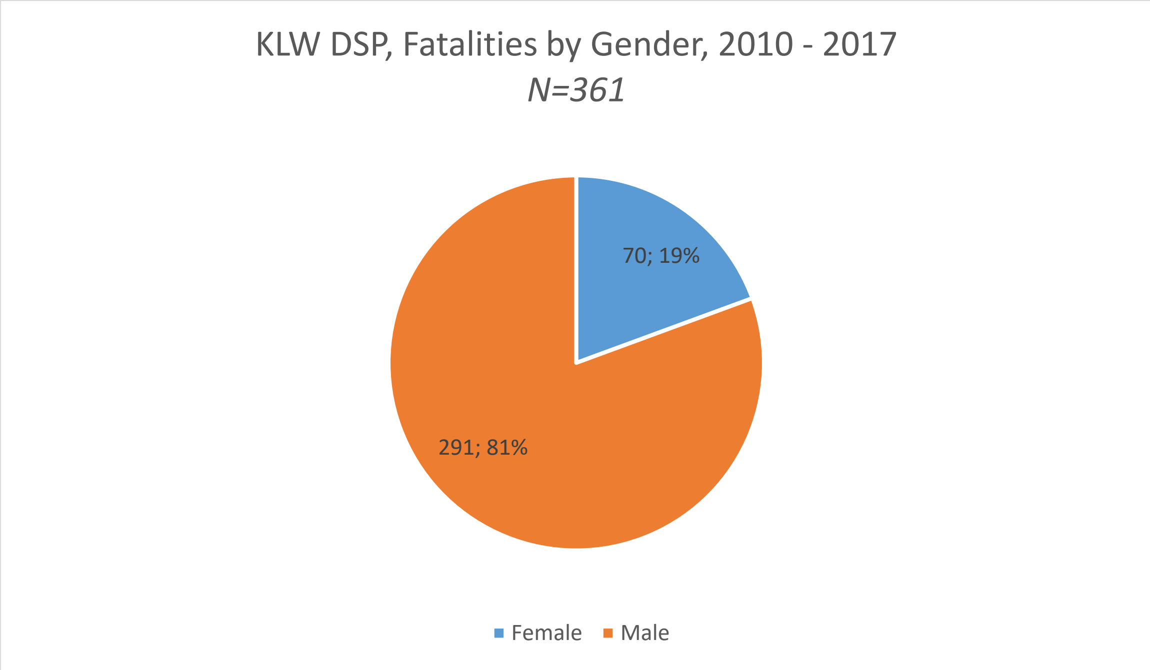



*Figure 4.24 KLW DSP, Fatalities by Gender, 2010 to 2017*

Fatalities profiled by gender showed an overwhelming preponderance of males, in line with the original Evaluation.

### 4.4.2 Post-Implementation Fatalities Profile from FPS Data, KLW DSP Area, 2018

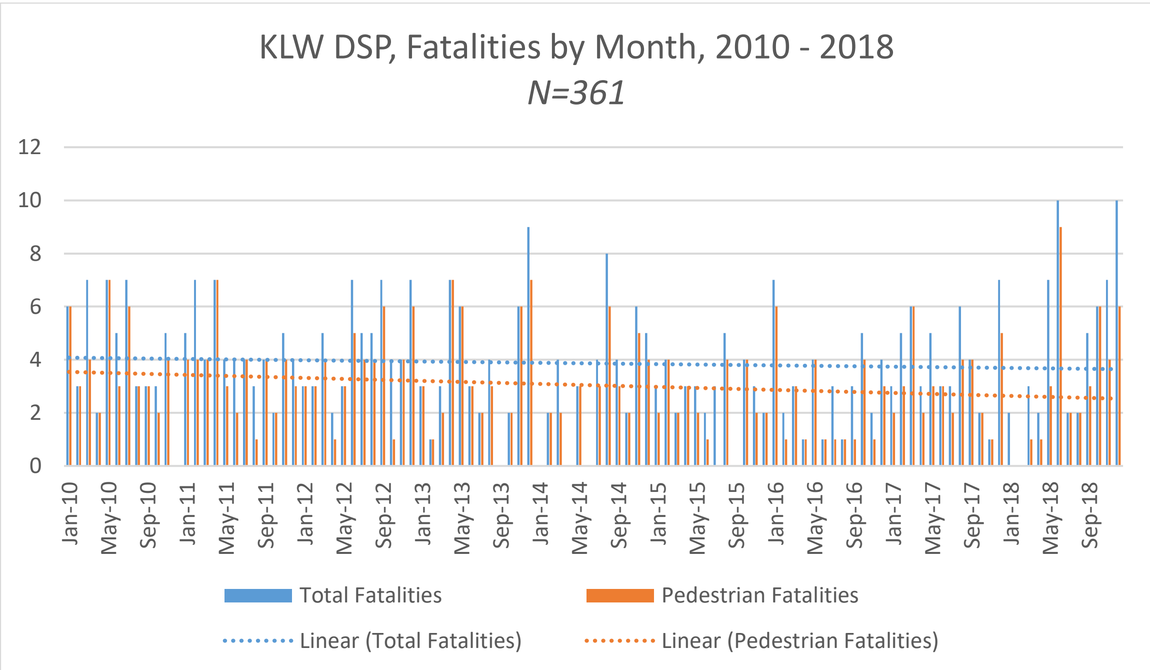



*Figure 4.25 KLW DSP, Fatalities by Month, 2010 to 2018*

The inclusion of 2018 data into the 2010-2017 profile showed that while the trend indicative of a decline in pedestrian deaths remained in place, fatalities as a whole were declining more slowly. This upswing in non-pedestrian fatalities relative to overall fatalities was observed consistently.

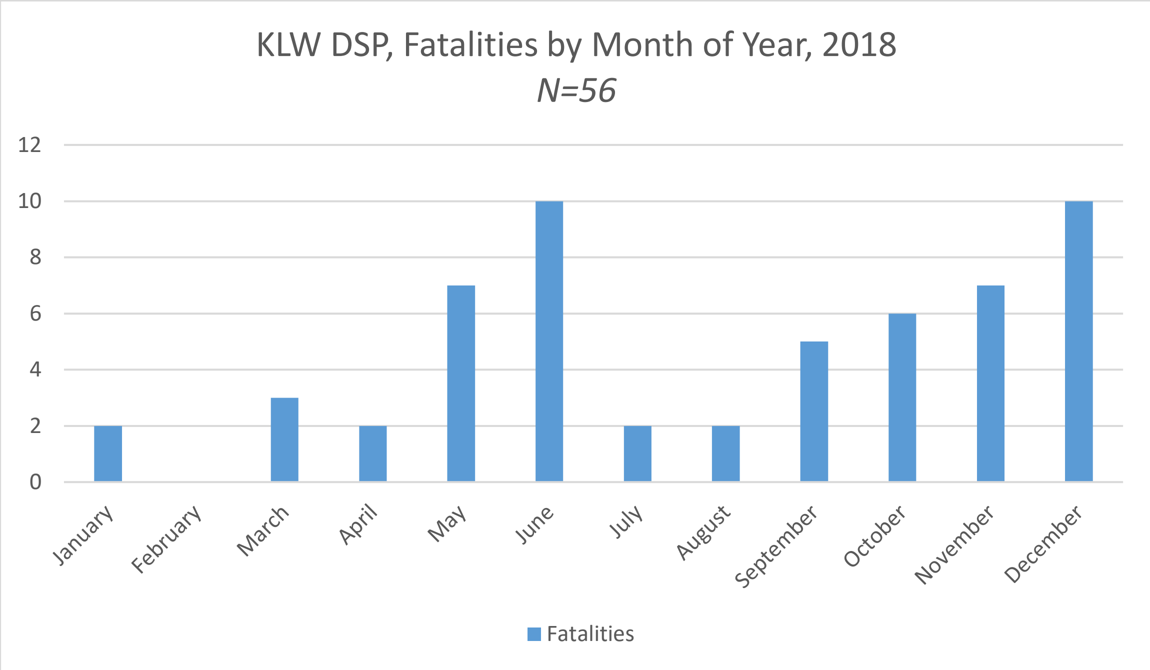



*Figure 4.26 KLW DSP, Fatalities by Month of Year, 2018*

Although record monthly peaks for both June and December were observed in 2018, KLW resisted identification of an in-year fatalities cycle, with a record low for fatalities set in February. At five fatalities, the first three months, also the most effective months, of the KLW DSP, had fewer fatalities had any other three-month period through 2018 although this must clearly be considered in the light of the wide variations in monthly fatalities observed in the area.

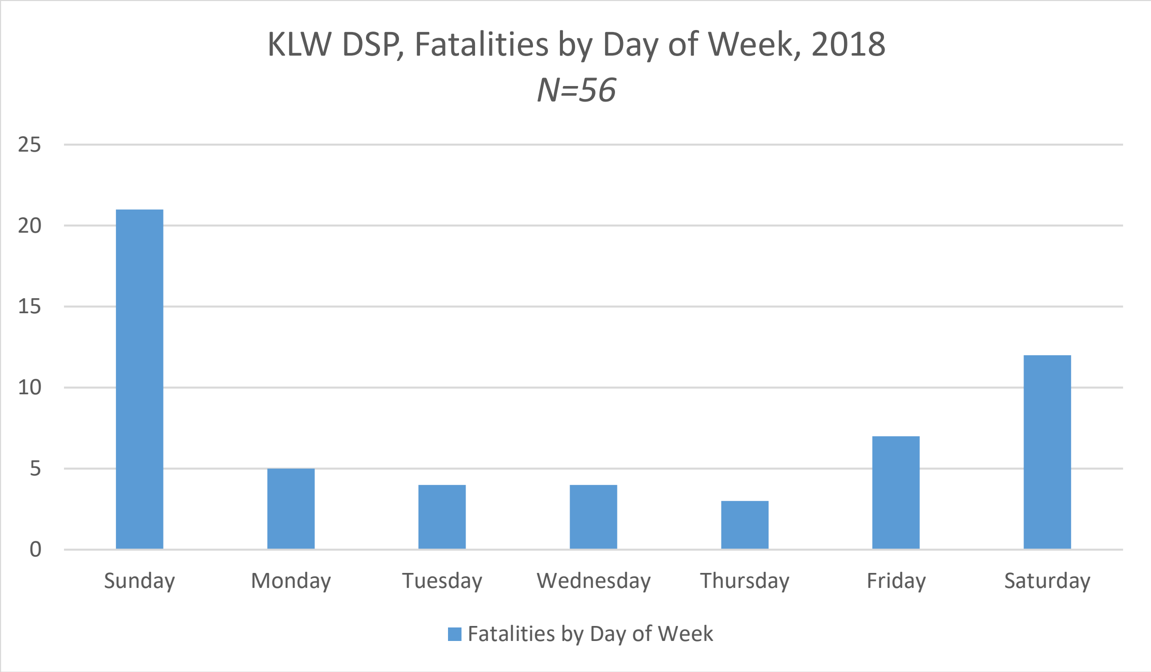



*Figure 4.27 KLW DSP, Fatalities by Day of Week, 2018*

Sunday fatalities far outstripped any other day of the week in 2018, showing a strongly different trend to the profile developed from 2010 to 2017. While DSP operations tended to take place on Saturday, inviting a link, the decline in these operations rapidly after three months post-implementation, suggests the origin of the change lies elsewhere.

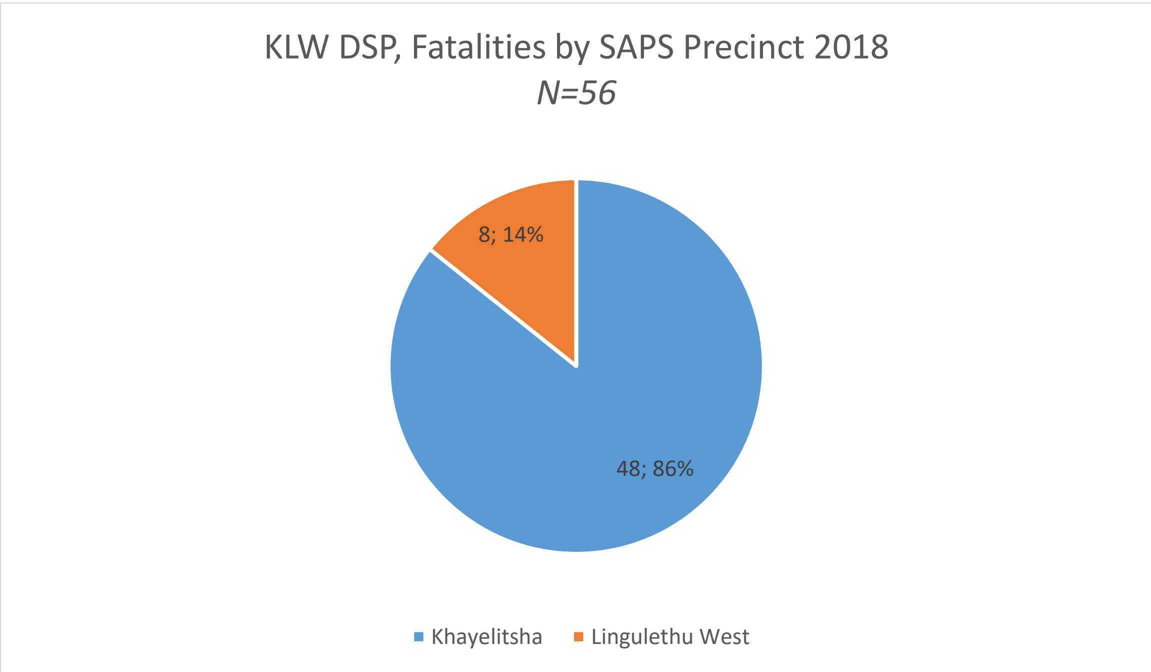



*Figure 4.28 KLW DSP, Fatalities by SAPS Precinct, 2018*

The preponderance of fatal injuries occurring within the Khayelitsha precinct increased. This may have a link to the increased proportion of non-pedestrian fatalities in 2018, as shown in Census data represented in the Evaluation, Khayelitsha includes several wards notably more affluent than its neighbour to the west.

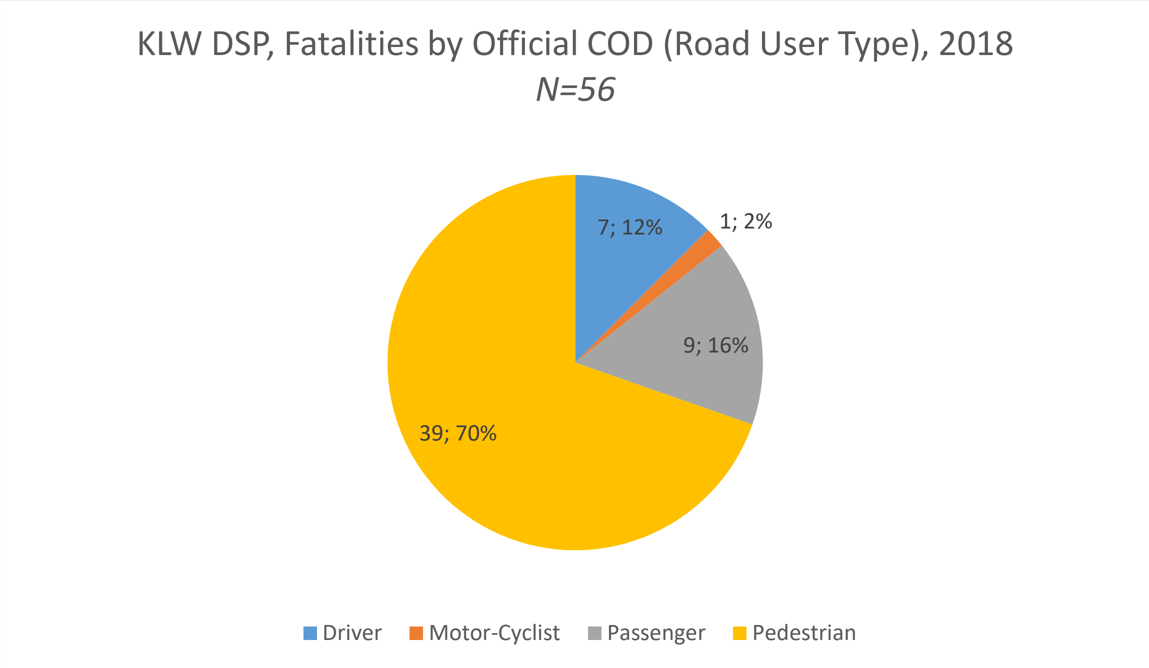



*Figure 4.29 KLW DSP, Fatalities by Road User Type, 2018*

The dominance of pedestrians as the largest road user group killed on KLW roads declined 12,5% from 80% to 70%. This is indicative of a potentially significant change in the traffic fatality profile of the area.

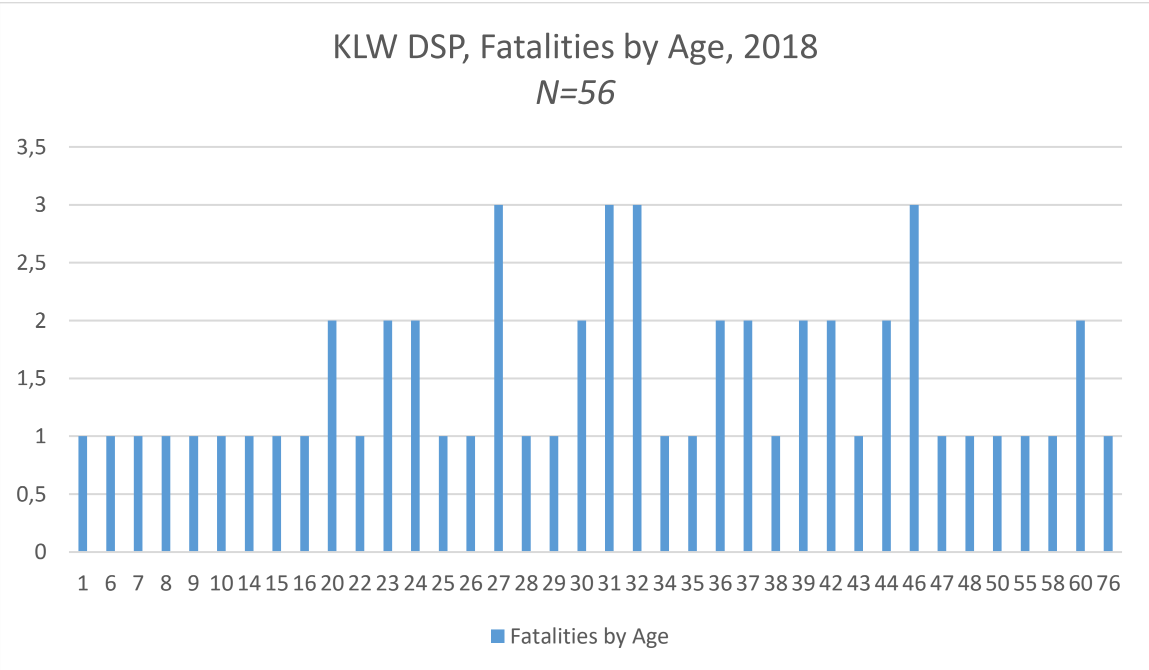



*Figure 4.30 KLW DSP, Fatalities by Age, 2018*

Fatalities distribution by age showed little significant change, with a small increase to 12,5% (from 11,63%) in the number of child fatalities (ages 0 – 14).

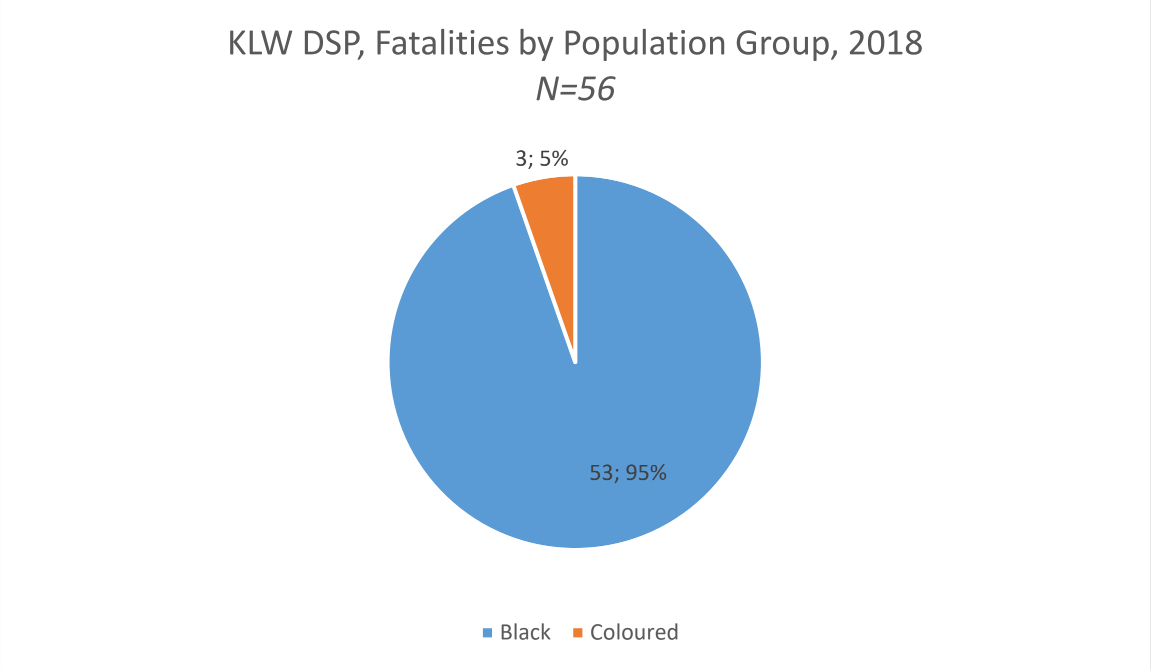



*Figure 4.31 KLW DSP, Fatalities by Population Group, 2018*

Black Africans remained the largest population group for traffic injury mortality.

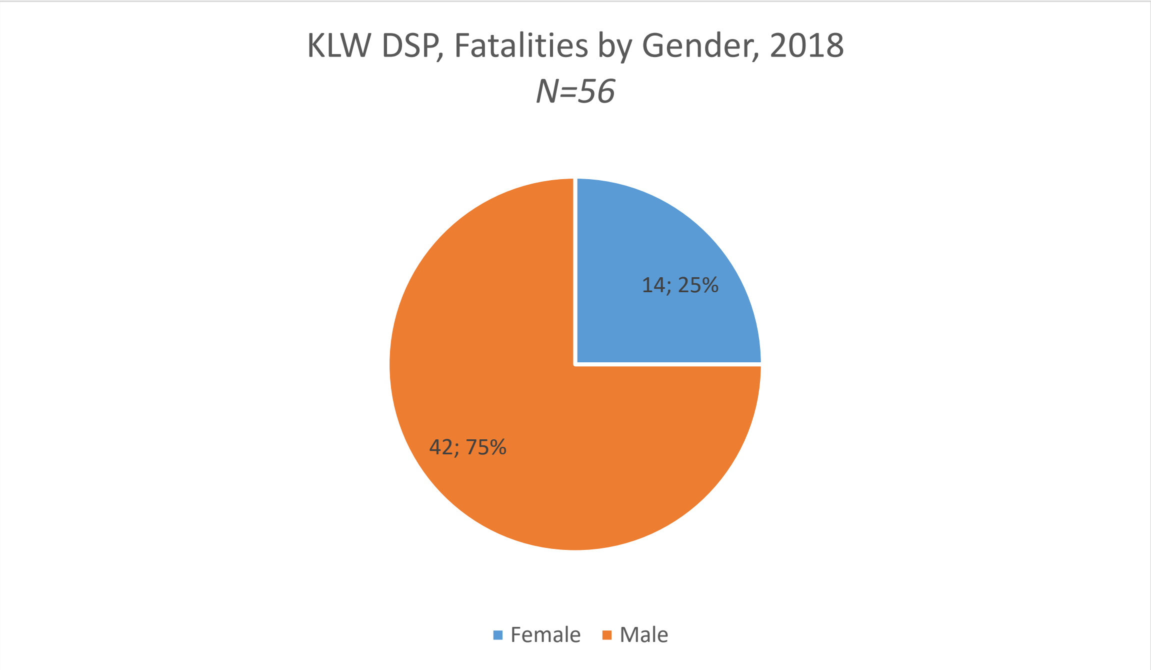



*Figure 4.32 KLW DSP, Fatalities by Gender, 2018*

Males continued to dominate traffic fatalities, although a higher proportion of female fatalities were observed (25% versus 19% in the 2010 – 2017 profile). This is indicative of a change in the profile of fatal traffic injuries in KLW. At 30%, substantially more female pedestrians were killed in 2018 than in 2010-2017 (24,13%). In the absence of other data, it can be postulated that this change may represent a positive improvement in female mobility, possibly due to increased participation in the economy or localized improvements in community safety.

#### 4.4.3 Pre- and Post-implementation Profiles Comparison Summary

Comparison between fatality profiles from 2010 to 2017 and 2018 suggest that some changes in the road safety environment occurred. Most significantly, lower proportions of pedestrian deaths and increased proportions of female fatalities were noted, accompanied by a major shift to fatalities peaking on Sundays to a far higher degree than previously observed. The changes in the fatalities profiles observed are not strongly linked to the objectives of the KLW DSP, although the DSP did place most of its emphasis on addressing pedestrian fatalities.

### 4.5 Operational and Media Data

Operational and media data was collected and used to query the extent to which the DSPs had in fact been implemented as devised, and to attempt to develop the foundation of a model for predicting the outcomes of DSP-type programs. Data were collected from the original DSPs, a wide range of operational reports and media schedules. Operational reports varied widely in consistency and format and did not follow the format developed for the DSP, with Provincial Traffic Services developing two different reporting formats. Media schedules were professionally produced and highly consistent, and backed with proof-of-flighting information, such as images of billboards, a function of their commercial origin.

Included in the data were certain FPS numbers for cross-reference, including overall fatalities, pedestrian fatalities and child fatalities, expressed for each period (ie monthly), the previous five periods, and as an average for the previous five periods.

The data collected were tabulated monthly. Where no evidence within the operational reports was found that confirmed that an operation took place, it was considered to have not taken place. While potentially useful data were captured from time to time within the operational reporting, such as DUI screenings, only those fields which had consistent information across the period under review, and across the two DSP areas, were ultimately used.

These data are discussed in Chapter 8: Predictive Modelling Using DSP Planning and Outcomes Data.

A table of fields with sources and use is provided below as Table 4.2.

| Field | Sample Value (KLW Jan 2018 used) | Name | Use by Author | Notes |
|---|---|---|---|---|
| Year | 2018 | Year | Yes | Year in which the activity occurred. |
| Financial Year | 2017/18 | Financial Year | No | Financial year in which the activity occurred. April to March for provincial authorities, July to June for municipal authorities. |
| Month | January | Month | Yes | Month in which the activity occurred. |
| Quarter | 17/18 Q4 | Quarter | Yes | Quarter in which the activity occurred, noting that quarter numbers do not align across provincial and municipal authorities, ie provincial Q1 is municipal Q4. |
| Roadworthy Screenings | 565 | Roadworthy Screenings | No | Numbers of screenings of vehicles for roadworthiness captured monthly from traffic authority reports. Captured inconsistently. |
| Number URW | 20 | Number of Unroadworthy Vehicles | No | Numbers of unroadworthy vehicles captured monthly from traffic authority reports. Captured inconsistently. |
| %URW | 3,54% | Percentage of Vehicles Found to Be Unroadworthy | No | Percentage of unroadworthy vehicles of those screened, captured monthly from traffic authority reports. Captured inconsistently. |
| Alcohol Screenings | 120 | Number of Drivers Screened | No | Number of drivers tested with a roadside breath alcohol screener (non-evidentiary). Captured inconsistently. |
| Number DUI | 26 | Number of Screened Drivers Arrested | No | Number of screened drivers observed to be over the legal limit for breath alcohol concentration (BrAC) and thus arrested for blood alcohol or |

| | | | | |
|---|---|---|---|---|
| | | | | evidentiary breath alcohol testing. Captured inconsistently. |
| %DUI | 21,67% | Percentage of Screened Drivers Arrested for DUI | No | Percentage of screened drivers arrested for DUI. |
| Joint Ops Planned | 6 | Numbers of Joint Operations Planned | No | Inconsistently applied to operation types and found to be inclusive of other operations types and thus redundant when enumerating numbers of operations. |
| Joint Ops Held | 1 | Numbers of Joint Operations Held | No | See above. |
| Speed Ops Planned | 0 | Numbers of Speed Operations Planned | Yes | Speed operations were conducted using laser speed measurement devices. No speed operations were conducted in KLW, while these were common in Caledon, a reflection of the higher operating speeds prevalent in the rural area. |
| Speed Ops Held | 0 | Numbers of Speed Operations Held | Yes | See above. |
| DUI Ops Planned | 2 | Number of DUI Operations Planned | Yes | DUI operations formed a significant part of both DSPs. In Caledon, Random Breath Testing (RBT) was launched in July 2017, and RBT was also introduced in KLW as part of the DSP launch. |
| DUI Ops Held | 1 | Number of DUI Operations Held | Yes | See above. |
| Ped Ops Planned | 5 | Number of Pedestrian | Yes | Pedestrian operations were core to both the Caledon and KLW DSPs. |

| | | | | |
|---|---|---|---|---|
| | | Operations Planned | | These consisted of both educational and enforcement elements in both areas. |
| Ped Ops Held | 5 | Number of Pedestrian Operations Held | Yes | See above. |
| Safely Home Ops | 1 | Number of Operations Aligning to the Safely Home Calendar | No | Inconsistently applied to operation types and found to be inclusive of other operations types and thus redundant when enumerating numbers of operations. |
| Total Operations | 7 | Number of Operations Held | Yes | The sum of discrete operations confirmed as having been conducted. |
| Fatalities | 2 | Fatalities | Yes | FPS fatalities for that period. |
| Fatalities Previous Period | 3 | Fatalities Previous Period | Yes | FPS fatalities for that period. |
| Fatalities Previous Five Periods | 16 | Fatalities Previous Five Periods | Yes | FPS fatalities for that period. |
| Average Fatalities Prev 5 Periods | 3,2 | Average Fatalities Previous Five Periods | Yes | Average of FPS fatalities for that period. |
| Pedestrian Fatalities | 0 | Pedestrian Fatalities | Yes | FPS fatalities for that period. |
| Ped Fatals Previous Period | 2 | Pedestrian Fatalities Previous Period | Yes | FPS fatalities for that period. |
| Child Fatalities 0 – 14 | 0 | Child Fatalities Aged 0 – 14 years | Yes | FPS fatalities for that period. |
| Child Fatals Prev Period | 1 | Child Fatalities Aged 0 – 14 years Previous Period | Yes | FPS fatalities for that period. |

| | | | | |
|---|---|---|---|---|
| National TV | 0 | | | Number of 45 to 90 second TV ads broadcast on national TV, including SABC 1, SABC 2 and ETV. Some DSTV channels. |
| National Radio | 0 | | | Number of 30 to 60 second radio spots on national stations, such as RSG. |
| Regional Radio | 81 | | | Number of 30 to 60 second radio spots on province-wide stations, such as Good Hope and KFM. |
| Community Radio Spots | 58 | | | Number of 30 to 60 second radio spots on stations within the target area, such as Valley FM and Overberg FM (in Caledon). |
| Community Radio Interviews | 0 | | | Number of 5 minute promotional interviews with local law enforcement and road safety officials on community radio at prime listening times. |
| Community Activations | | | | Direct engagements with communities in high risk areas by road safety officials, including staged activations. |
| Community Buses | 0 | | | Out of home adverts on public transport interchanges or buses operating on routes within the target community |
| Tavern Screens | 28 | | | Digital screens inside and outside taverns and bars in the target area. |
| Forecourt Screens | 0 | | | Digital screens at petrol station forecourts. |

*Table 4.2 Operational and Media Data*

# Chapter 5: Findings and Analysis of the Caledon District Safety Plan (DSP)

Covers the implementation process, challenges and impact over first six months operations. Compares Caledon to the control area of the West Coast (South) district in context of existing fatality trends.

## 5.1 Introduction: Origin of the Caledon DSP

In September 2015, the Transport Management branch of the DTPW adopted a 'Vision Zero'-type vision for the future of road safety in the Western Cape, expressed as "No-one should be killed or injured on our roads". This vision was accompanied by the identification of five strategic pillars on which to build a safe road network, to be captured in a 'Safety Implementation Plan'. One of these pillars was localised road safety plans, located around Traffic Law Enforcement's traffic centres, which are evidence-based, interdisciplinary (using the Four E's) and integrated across the three spheres of government; these became the District Safety Plans (DSPs).

In January 2016, the process of developing a DSP planning framework and implementing a pilot project began. A project plan was developed using Mission Analysis as a basis, then widely consulted within the DTPW, before being introduced in a series of meetings with personnel from Enforcement, Education and Engineering throughout the Caledon district. A series of workshops were then conducted, during which time a detailed Evaluation presentation was compiled and used as the basis for breakaway into Enforcement, Engineering and Education teams to develop responses. These responses were captured into planning tables, or grids, then synthesised and integrated into a single plan. A logical framework for monitoring and evaluation was developed and integrated into the plan. A quarterly planning and monitoring and evaluation cycle was developed for ongoing management of the DSP. The DSP was then considered and approved by the leadership of the implementing departments and municipalities, with formal implementation beginning on 1st October 2016.

Initiation of the pilot saw joint operations conducted by Traffic Law Enforcement and the three municipal services supported by Road Safety Management and Land Transport Safety, based around the Hermanus 'Whalefest'. The process of planning and implementation of the Caledon DSP was subsequently captured into the DSP Implementation Framework. Promising results in terms of fatality reductions were observed after six months, leading to a decision by Transport Management to further roll out DSPs.

*Figure 5.1 Handover of equipment to municipal traffic law enforcement, Caledon DSP, January 2017*

### 5.2 Implementation of the Caledon DSP

The Caledon traffic centre was chosen as the location for the DSP pilot due to its high road traffic injury burden, strategic position within the vital N2 corridor, relative stability and capacity of management, and proximity to Cape Town and ease of access for key officials. Due to the project being the first of its kind to be conducted within the Western Cape, a large degree of flexibility went into its planning, and certain meetings and workshops were arranged as the need arose, within the overall structure developed at the initiation of the project. It was also decided to move the venues of the workshops regularly, in order to ensure substantial work was done in each of the municipal areas within the DSP, as well as the Provincial Traffic Services' central facility in Brackenfell, the Gene Louw Traffic College. This led to wide variability in type of facility used, which included historical town halls and an agricultural co-op. This impacted the quality of presentation facilities to some extent.

#### 5.2.1 Key Findings of the Caledon DSP Evaluation

The Evaluation conducted for the Caledon DSP was the first of its kind, and was conducted over a period of two weeks by the author. In addition to the various datasets and statistics that the Evaluation covers, the Evaluation drew on an 'Environmental Appreciation' presentation compiled by the Caledon Traffic Centre in 2015, as well as local knowledge gathered via the workshops.

The Evaluation suggested the following (Western Cape Department of Transport & Public Works, 2017):

1. Fatalities showed a stronger link between day of week and time of day than time of year or traffic volumes. The traffic spikes experienced in the Easter and

December holiday periods were not matched by fatalities spikes, whereas significant spikes in fatalities occurred on weekends, especially at night.

2. While overall fatalities in the district were declining, pedestrian fatalities were rising, and pedestrian fatalities were strongly associated with weekends, especially night time.
3. Several high-risk road sections were identified, particularly around Grabouw and Caledon, with the highest risk area being the N2 directly adjacent the township and informal areas of Grabouw. Alcohol was identified as a significant element within the N2 hotspot outside of Grabouw, with 70% of fatalities being BAC positive.

### 5.2.2 Response to the Evaluation

#### 5.2.2.1 Enforcement

The central law enforcement response to the Evaluation was the adoption in practice of conducting a minimum of four joint pedestrian safety operations per month. These operations were largely focused on the Grabouw hotspot and were to be conducted as far as possible on Saturday afternoons, pre-empting the largest fatality spike detected in the Evaluation. The operations involved a combination of hard and soft approaches, whereby officers would first attempt to convince pedestrians (especially hitch-hikers) to move to safer locations, which the vast majority would do. Individuals who failed to comply, and who continued to pose a safety risk were occasionally arrested in order to move them to safety. Anecdotal officer reports suggest that, in line with the post mortem BAC results captured in the Evaluation, these individuals were invariably intoxicated. Twenty-four pedestrian operations were planned and conducted over the first two quarters of operations, many of them joint operations involving multiple law enforcement agencies, including municipal traffic and the SAPS.

#### 5.2.2.2 Education

Road Safety Management initiated a series of pedestrian education activities for both adults and children in the district. This was supported by the Safely Home Calendar on social media and through the rollout of the Ubuthakathi pedestrian alcohol campaign, which ran on TV and cinema throughout the province. Ubuthakathi also involved the deployment of a mobile billboard to the Caledon district. A radio campaign targeting driving and walking under the influence of alcohol was developed specifically for the Overberg region, in support of the Caledon DSP, and ran over the December and January period.

#### 5.2.2.3 Engineering

The key challenge identified was the N2 from Grabouw to Caledon, and a process to convince the road authority, Sanral, to initiate a road safety assessment was captured in the plan. This assessment was not to be completed until late 2017. The report and recommendations produced by this process are under review by Sanral as of the time of writing. Speed limit investigations were conducted by Transport Infrastructure on key provincial routes, which did not lead to reductions. Child pedestrian safety signage was erected by the Theewaterskloof municipality.

## 5.3 Challenges

Little active participation by decision-making traffic engineers from any of the three spheres of government took place in the implementation process. Sanral route managers attended workshops on behalf of the agency, but these individuals were consulting engineers from the firms contracted to manage individual route sections, rather than Sanral engineers or project managers who could make decisions or provide definitive inputs on behalf of the organisation. Participation by provincial Transport Infrastructure was very limited. No municipal engineers took part in the planning process. The result was the Engineering plan had to be developed largely by the other stakeholders, with the interventions captured into formal submissions to be sent to the relevant road authorities. These submissions requested professional traffic engineering assessments of identified issues (see 5.2.2.3 above) in order to develop specific action plans for intervention. This meant that Engineering interventions have thus far played little part in the Caledon DSP, notably in the first six months of operations, the period under review.

While municipalities were identified as critically important partners within the DSP, making up 60% of the available traffic officers in the district, the municipal traffic services had numerous equipment deficiencies, notably the absence of breath alcohol screeners. This was largely ameliorated by the procurement of screeners as well as equipment such as reflective jackets, gloves and traffic cones, which were distributed to the municipalities in December 2016. Other deficiencies, such as firearms and bulletproof vests were not addressed within the scope of the DSP.

## 5.4 Impact, including comparison with control area (West Coast (South))

### 5.4.1 Fatality trends in the Caledon DSP area, and the West Coast (South) at the time of implementation

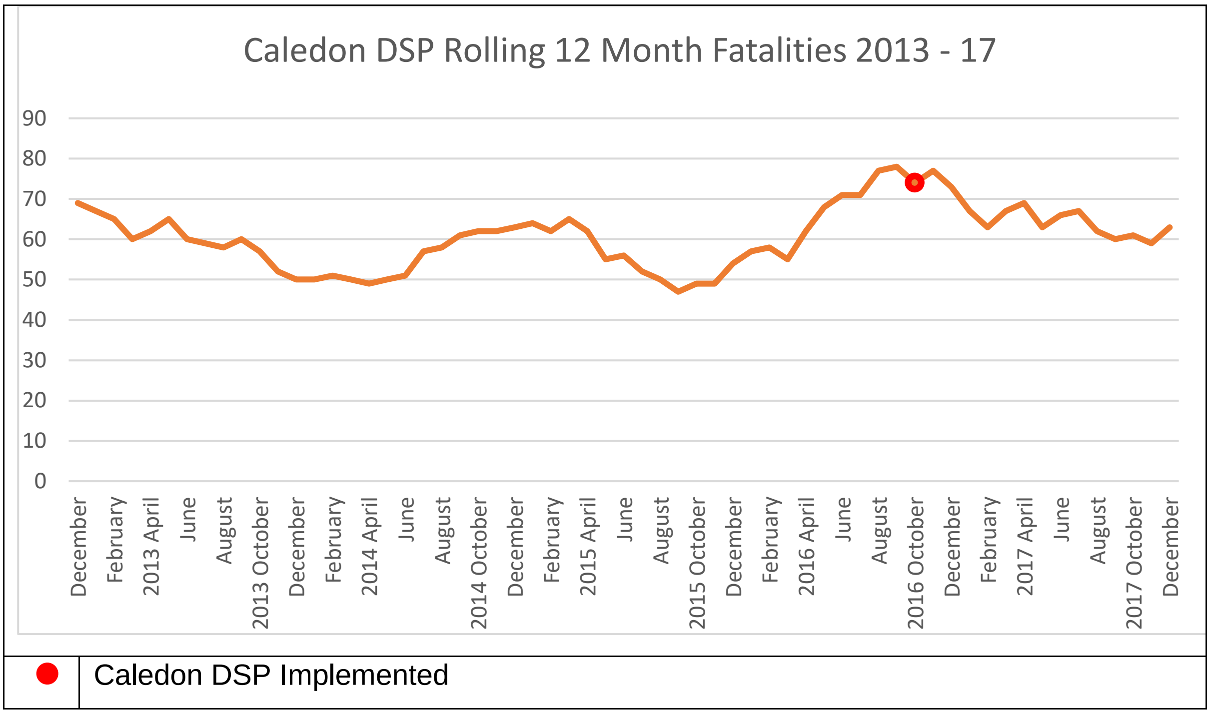



*Figure 5.2 Caledon DSP Rolling 12 Month Fatalities, 2013 to 2017*

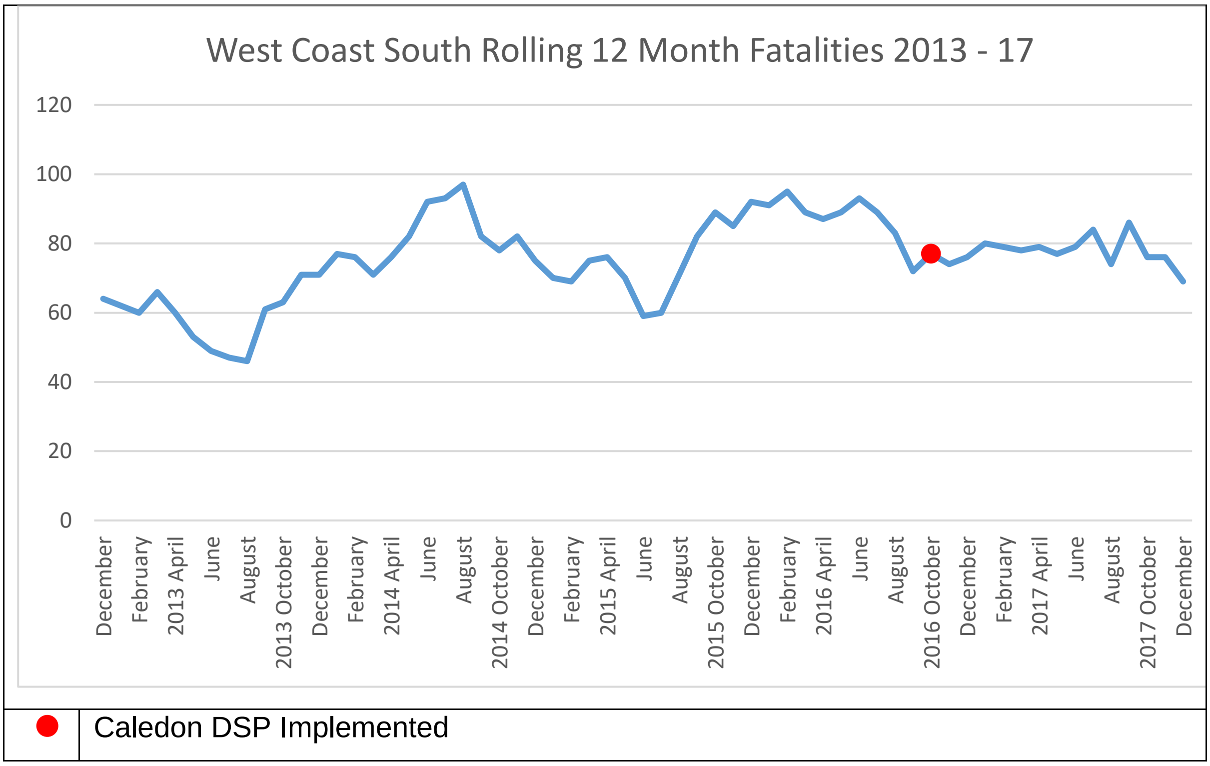



*Figure 5.3 West Coast South Rolling 12 Month Fatalities, 2013 to 2017*

Fatality trends, shown here by rolling twelve-month totals, in the two districts show fairly wide fluctuations over time.

In the year preceding the implementation of the Caledon DSP, fatalities in the Caledon district had risen from a twelve-month rolling total of 49 in October 2015 to a total of 78 in September 2016, an increase of over 59%. This suggests that the district was experiencing an upswing in road traffic fatalities. Six months post implementation, this total had declined by 14% to 67. This suggests that the upswing experienced in the year prior to the launch of the Caledon DSP had peaked and to some extent reversed.

In the year preceding the implementation of the Caledon DSP, rolling twelve-month fatalities totals in the West Coast (South) district had ranged from 89 in October 2015 to 95 in February 2016 and then subsided to 72 in September 2016. This suggests that the district was experiencing a slight downswing in road traffic fatalities. Six months post implementation, this total stood 8.3% higher at 78. This suggests that fatality numbers had to some extent stabilised during this period following the downswing between May and September 2016.

**5.4.2 Fatalities in the six months post implementation**

Fatalities in the first six months of operation of the Caledon DSP are shown below (ie October 2016 to March 2017), compared with five-year averages for the same period, and with the same preceding period (ie October 2015 to March 2016). Fatality figures are also shown for the West Coast (South) for the same periods. Pedestrian fatalities are singled out here, due to the heavy emphasis on pedestrian safety in the Caledon DSP (see 5.2.2.1 and 5.2.2.2 above).

| | Caledon DSP | | | West Coast (South) | | |
|---|---|---|---|---|---|---|
| | 5 Year Average Oct - Mar | Oct 2015 – Mar 2016 | Oct 2016 – Mar 2017<br>% diff 5y ave<br>%diff yoy | 5 Year Average Oct - Mar | Oct 2015 – Mar 2016 | Oct 2016 – Mar 2017<br>% diff 5y ave<br>%diff yoy |
| Total Fatalities | 31.6 | 36 | 26<br>-17.7%<br>-27.7% | 30.6 | 37 | 43<br>+40.5%<br>+16.2% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Pedestrian Fatalities | 10.8 | 11 | 4<br>-63%<br>-63.6% | 9.6 | 16 | 9<br>-6%<br>-43.7% |

*Table 5.1 Fatalities in Caledon DSP area compared with West Coast (South), Oct 2015 – Mar 2016*

Fatalities data for the periods under review are suggestive of a significant improvement in road safety outcomes in the Caledon district following the implementation of the DSP. This is particularly indicated by the number of pedestrian fatalities in the period, which was found to be 63% lower than the average number of pedestrian fatalities in the corresponding period in the preceding five years. In the West Coast (South), fatality numbers appeared to increase, especially as fatalities in the period were found to be 40.5% higher than the average number of fatalities in the corresponding period over the preceding five years. Pedestrian fatalities were found to be substantially lower than the preceding period (down by 43.7%). However, when compared to the five-year average, this total was found to be only 6% lower.

### 5.5 Sub Conclusion

Overall, the figures are suggestive that a positive impact on road traffic fatalities was experienced in the Caledon district subsequent to the implementation of the Caledon DSP, and that no such positive developments were simultaneously occurring in the control area of the West Coast (South). This is borne out both by the general fatalities trends occurring in these districts, and by the absolute numbers of fatalities experienced in the two districts in the six months after implementation of the Caledon DSP. The substantial decrease in pedestrian fatalities experienced in the Caledon district showed particular promise as a possible indicator of positive change in the district.

## Chapter 6: Findings and Analysis of the Khayelitsha – Lingelethu West District Safety Plan (KLW DSP)

Covers the implementation process, challenges and impact over first six months of operations. Compares KLW to the control area of Gunya in context of existing fatality trends.

### 6.1 Introduction: Origin of the KLW DSP

In May 2017, the DSP concept, and the fatalities figures after six months of operations in the Caledon district, were presented to the Metro District Road Traffic Management Coordinating Committee (Metro DRTMCC). The DRTMCC proposed a motion that a similar pilot project be initiated in the metro as soon as possible. After a series of discussions between City Traffic Services, the City's Transport and Urban Development Authority, DTPW and the SAPS, the SAPS precincts of Khayelitsha and Lingelethu West were identified for a Metro District Safety Plan (initially called a Metro Area-based Safety Plan). This area became known as KLW. KLW was selected for the following key reasons:

1. FPS data from 2010 – 2015 indicated that Khayelitsha had the highest number of fatalities of any SAPS precinct in the Western Cape.
2. FPS data indicated that Khayelitsha had an extraordinary concentration of pedestrian fatalities. Pedestrian injury had by this time been recognised as the leading road safety challenge facing the City of Cape Town. City authorities took the view that a success in Khayelitsha would be a strong indicator of the possibility of success of similar plans more broadly in the City.
3. The area, with Lingelethu West added, was clearly bounded by major routes, and included the N2 highway on its northern edge.

The planning process was initiated in August 2016, in parallel with the development of a District Safety Plan in the West Coast (South) district, the district used as a control study for the Caledon DSP. See Chapter 4, above. The KLW DSP was completed and approved in December 2016, and was initiated at the start of January 2017.

### 6.2 Implementation of the KLW DSP

The DSP Implementation Framework had by the time of project initiation been largely developed, based on the experience of the Caledon DSP. See Chapter 5 above. This Framework laid out the process for developing and implementing a DSP, and is summarised in Section 3.6 above. The guidelines within the Framework were followed closely in the development of the KLW DSP, and the process was completed within six months, substantially quicker than had been the case in the Caledon DSP. Further modifications were made to the Framework based on the experience of the development of a DSP in the metropolitan environment, and these were reflected in the document.

### 6.2.1 Key Findings of the KLW DSP Evaluation

The Evaluation conducted for the KLW DSP followed the pattern set by that of the Caledon DSP Evaluation. Due to the nature of the KLW area, and its scope, some differences existed between the data available for analysis in KLW when compared to Caledon. For example, population data, especially Census 2011 data, had to be aggregated from Ward level, which meant aligning wards to the SAPS precincts boundaries. This was not always possible to do precisely, in both KLW and in the control area of Gunya. Other datasets not available outside of the City were also utilized, including the records of the Cape Town Freeway Management System; these records included video footage of certain incidents which had been identified during the Evaluation, which added an additional dimension to the analysis. In addition, Blood Alcohol Concentration (BAC) was available for the fatality records analysed during the Evaluation.

The Evaluation suggested the following (Western Cape Department of Transport & Public Works, 2017):

1. Fatalities in KLW were approximately 80% pedestrians, 80% male and clustered on weekends, especially Saturday night into the early hours of Sunday morning.
2. Alcohol played a significant role in KLW traffic fatalities. Of the 75% of records of individuals aged 15 and over where post mortem Blood Alcohol Concentration (BAC) was known, 71% of males tested positive. Fully 43% of male traffic fatalities tested over 0.2 grams of alcohol per 100ml of blood (the legal limit for driving in South Africa is 0.05 g/100ml, or 0.02 g/100ml for professional drivers).
3. Arrests for Driving Under the Influence (DUI) had increased substantially over the financial years 2008/9 to 2014/15, and had been accompanied by a strong decline in fatalities, including pedestrian fatalities. DUI arrests had decreased significantly in 2015/16 and 2016/17, accompanied by a flattening in the decline in fatalities.
4. Fatalities were declining in KLW, with consistent decline from a high of 59 in 2009 to a low of 38 in 2016. This was being driven by a decline in pedestrian fatality numbers.
5. Hotspots were identified, including the N2 on the boundary of KLW, but also within the area, especially the transport interchange around Nolungile Railway Station.

### 6.2.2 Response to the Evaluation

#### 6.2.2.1 Enforcement

The central law enforcement response to the Evaluation was a significant drive towards conducting pedestrian safety operations, carried out in conjunction with Road Safety Education. Fourteen pedestrian safety operations were carried out in the first quarter of operations, although this reduced very considerably in the second quarter of operations. Significant numbers of DUI operations were undertaken, including five in the first quarter of operations. Random Breath Testing (RBT) had by this stage been introduced into the City of Cape Town, and four breath alcohol screeners were provided to City Traffic Services in Khayelitsha to initiate an RBT unit in the area, which did not materialise.

#### 6.2.2.2 Education

Road Safety Education initiated a series of 17 pedestrian education interventions in KLW in the first quarter of operations, although the number of interventions decreased dramatically in the second quarter. This was supported by the Safely Home Calendar on social media and through the relaunch of the Ubuthakathi pedestrian alcohol campaign, which ran on TV and cinema throughout the province until March 2018. Ubuthakathi was extensively promoted through Out of Home (OOH) advertising in Khayelitsha and Lingelethu West, including billboards and posters at transport interchanges, especially Nolungile Railway Station, and digital screens in taverns. A radio campaign promoting awareness of the deployment of RBT units in the City was launched and ran over the December and January period, including a version in isiXhosa targeted specifically at the broader Khayelitsha through broadcast on Radio Zibonele, and thus overlapped with the initial implementation.

#### 6.2.2.3 Engineering

Unlike the challenges experienced in Caledon (see 4.3 above), the KLW DSP planning and implementation process was characterised by a high involvement by traffic engineers, particularly the City of Cape Town’s Transport and Urban Development Authority. Strong support was received from Sanral, especially through the Freeway Management System. This meant that the engineering response was far more significant, especially with regards to pedestrians, and included 26 traffic calming interventions, four hazardous location investigations and two speed limit reviews to be carried out over the following twelve months. It should be noted however, that no interventions were completed sufficiently early within the first six months of operations to have had an effect on fatality numbers.

### 6.3 Challenges

The planning process for the KLW DSP was far smoother than that of the Caledon DSP, notably with regard to the extensive and close involvement of engineering resources.

Exceptionally good results were posted in the first quarter of operations. However, the planning process for the second quarter was marked by a significant drop in commitment levels, citing lack of resources. The second quarter itself was also marked by an increase in the numbers of violent protest actions in the vicinity of KLW. This led to the cancellation of numerous operations, and to traffic officers being drawn away from road safety activities during the quarter.

## 6.4 Impact, including comparison with control area (Gunya).

### 6.4.1 Fatality trends in the KLW DSP area, and Gunya, at the time of implementation

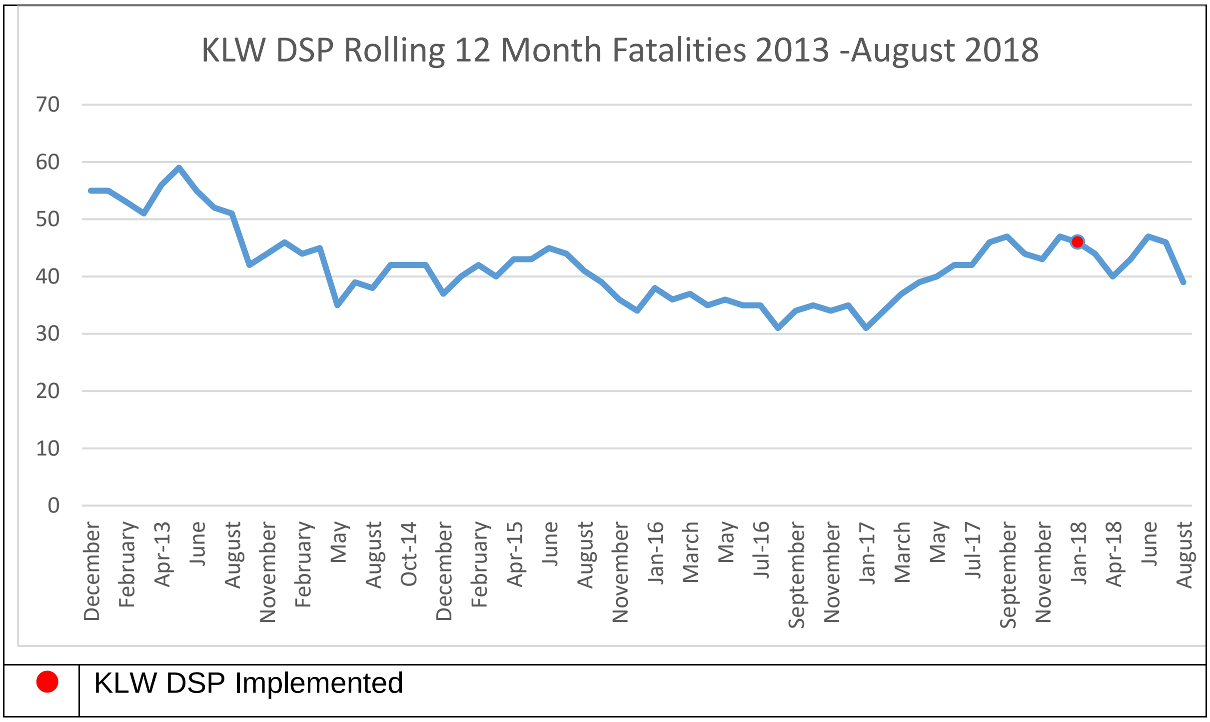



*Figure 6.1 KLW DSP Rolling 12 Month Fatalities, Jan 2013 – Aug 2018*

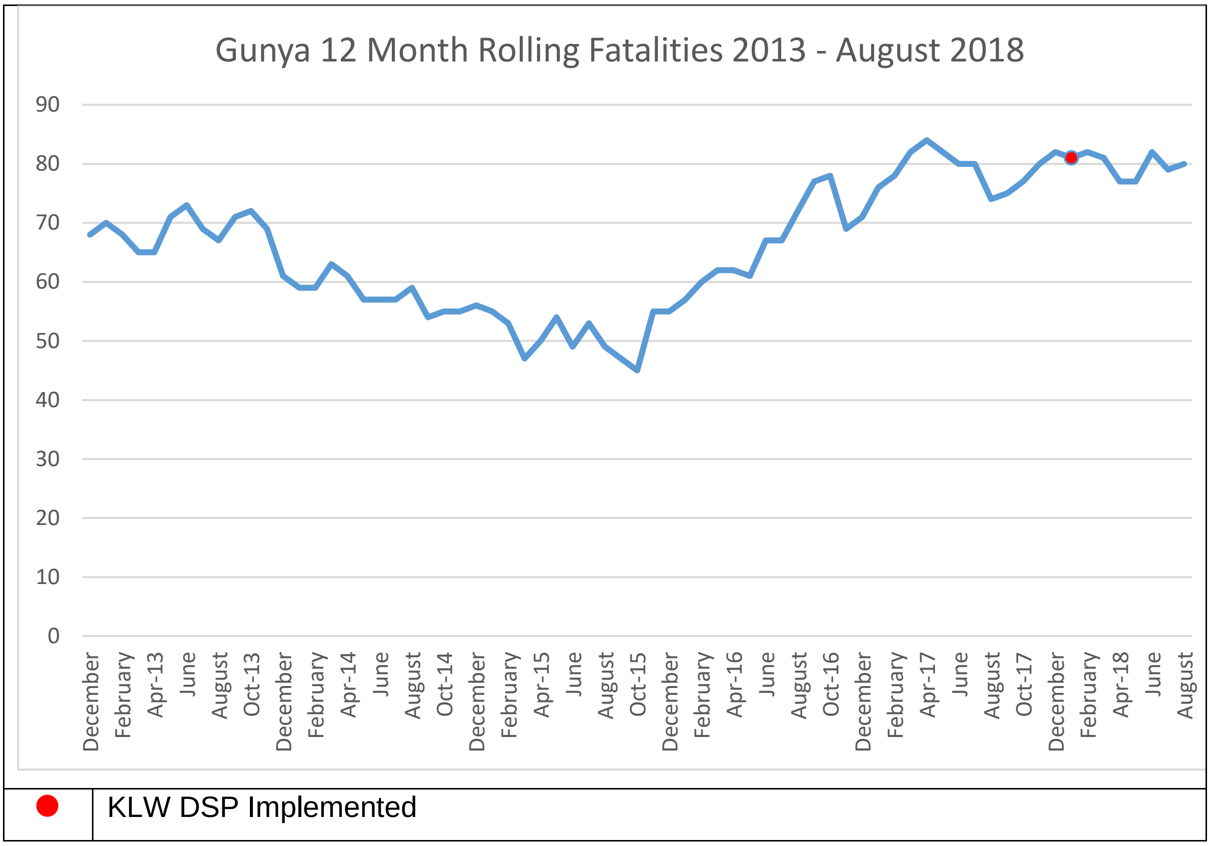



*Figure 6.2 Gunya Control Area Rolling 12 Month Fatalities, Jan 2013 – Aug 2018*

Fatality trends, shown here by rolling twelve-month totals, in the two areas show fairly wide fluctuations over time.

In the five years preceding the implementation of the KLW DSP, fatalities in the area appeared to be experiencing an upswing after a period of significant decline. Twelve month rolling fatality totals showed a high in May 2013 of 59 declining steadily to a low of 31 in January 2017. At the end of December of 2017, just prior to the launch of the KLW DSP, this number had climbed to 47, although data suggests the upswing had stabilized by this time. Post launch, fatalities totals declined slightly during the first quarter of operations, reaching a low of 40 in April 2018, before climbing again in the second, again reaching 47 in June 2018. In the five years preceding the implementation of the KLW DSP, rolling twelve-month fatalities totals in the Gunya area also displayed a period of decline, followed by an upswing in the years immediately preceding implementation. Fatalities totals had declined from a high of 73 in June 2013 to a low of 45 in October 2015. Fatalities totals showed consistent increases over the following two years and had reached 82 by the end of December 2017, peaking at 84 in April 2017. As was the case in KLW, the upswing appears to have stabilized by the time of implementation.

### 6.4.2 Fatalities in the six months post implementation

Fatalities in the first six months of operation of the KLW DSP are shown below (ie January 2018 to June 2018), compared with five year averages for the same period, and with the same preceding period (ie January 2017 to June 2017). Fatality figures are also shown for Gunya for the same periods. Pedestrian fatalities are also singled out here, due to the heavy emphasis on pedestrian safety in the KLW DSP (see 6.2.2.1 and 6.2.2.2 above).

| | KLW DSP | | | Gunya | | |
|---|---|---|---|---|---|---|
| | 5 Year Average Jan - Jun | Jan 2017 – Jun 2017 | Jan 2018 – Jun 2018<br>% diff 5y ave<br>%diff yoy | 5 Year Average Jan - Jun | Jan 2017 – Jun 2017 | Jan 2018 – Jun 2018<br>% diff 5y ave<br>%diff yoy |
| Total Fatalities | 18.4 | 25 | 24<br>+30.4%<br>-4% | 30.2 | 41 | 41<br>+35.7%<br>0% |
| Pedestrian Fatalities | 15 | 19 | 16<br>+6.6%<br>-15.7% | 27 | 37 | 31<br>+14.8%<br>-13.5% |

*Table 6.2 Fatalities Comparison, KLW DSP and Gunya Control Area*

Fatalities data for the periods under review suggest that some limited improvement in road safety outcomes in KLW district followed the implementation of the DSP when compared to the previous period, notably that pedestrian fatalities were 15.7% lower. This is potentially significant when considering the heavy emphasis on pedestrian safety in the KLW DSP. Overall fatalities were just 4% lower than the previous period. Comparison with five-year averages was less positive, with fatalities being 30.4% higher in January to June 2018, while pedestrian fatalities were almost the same as the five year average. In the control area Gunya, fatality numbers remained static compared to the previous period, although a 13.5% decrease in pedestrian fatalities was noted. Overall, fatalities appeared to be on the increase, especially as fatalities in the period were found to be 35.7% higher than the average number of fatalities in the corresponding period over the preceding five years. This increase was less pronounced for pedestrian fatalities, which were found to be higher than the preceding period by 14.8%, when compared to five-year averages.

## 6.5 Sub Conclusion

Overall, the figures are inconclusive in determining if a positive impact on road traffic fatalities was experienced in KLW subsequent to the implementation of the KLW DSP. The upswing in fatalities experienced in the years prior to implementation appears to have stabilized by the time of implementation. While some decreases were noted in comparison to the previous period, there was little positive difference compared to five-year averages. Where KLW fatality figures fared quite well was in comparison with Gunya. Gunya experienced fatalities 35.7% higher than the average for the preceding five years, with overall numbers static compared to the previous period; KLW experienced a smaller increase against five-year averages of 30.4%, while figures were slightly lower against the previous period (4%; 24 fatalities in 2018 vs 25 in 2017). An increase in pedestrian fatalities of 14.8% was noted in Gunya when compared to the previous period. That two adjacent areas of the City of Cape Town experienced such widely differing outcomes for pedestrian fatalities in the first half of 2018 is potentially suggestive of some improvement being experienced in KLW.

# Chapter 7: Comparing and contrasting Caledon and KLW

Considers factors which may have independently influenced success or failure which are unrelated to the DSP model. Examines the commonalities in terms of implementation and outcomes, and queries whether or not they can be linked and ascribed to the model.

## 7.1 Factors which may have independently influenced success or failure in Caledon and KLW

### 7.1.1 Caledon

Fatalities data for the area from 2008 to 2015, as presented in the Evaluation (Western Cape Department of Transport & Public Works, 2017), suggest spikes in pedestrian fatalities occurred in March and October during this period. There are potential links between pedestrian fatalities in the district to labour intensive harvesting which occurs at intervals, including October and March. Fruit picking (stone fruit, pome fruit and grapes) utilizes short term migrant labour. From 2014 until the present winter rainfall season (2018) the Western Cape experienced a significant drought, exacerbated by a strong El Niño effect and record high temperatures (Western Cape Department of Agriculture, 2017: 6-7). While areas in the northern and eastern districts have been more severely affected, the Caledon district, specifically the Theewaterskloof area has seen some impact. For example, the Western Cape pome fruit harvest, which includes apples and pears, is estimated to be between 9 – 20% lower than pre-drought levels. The lower harvests were discussed by the author with the Elgin Grabouw Villiersdorp en Vyeboom Agriculture Association (EGVV). The members suggested that the drought and diminished harvest has had an impact on reduced migrant labour figures. This may in turn impact pedestrian fatalities positively in that fewer migrant labourers were present during months previously identified as high risk. There is insufficient data to confirm or eliminate this possibility. Significant differences in year-on-year fatality results (see 5.4.2 above), in two years both occurring within the drought cycle, suggests this factor is unlikely to have had a significant influence. The control district, West Coast (South) was affected more severely by the drought, but did not experience a corresponding reduction in pedestrian or other fatalities, although it is noted that this region is not as dependant on migrant labour, due to the preponderance of grains over fruits in areas like Swartland.

No other external factors were identified as having potentially influenced road safety outcomes to a significant degree in the Caledon district, to the exclusion of other areas.

### 7.1.2 Khayelitsha – Lingelethu West

Fatality figures varied considerably in KLW between the two quarters of operations covered by the six months of fatalities data considered in this research. See Table 7.1 below.

| | KLW Quarter 1 | | | KLW Quarter 2 | | |
|---|---|---|---|---|---|---|
| | 5 Year Average Jan - Mar | Jan 2017 – Mar 2017 | Jan 2018 – Mar 2018 % diff 5y ave %diff yoy | 5 Year Average Apr - Jun | Apr 2017 – Jun 2017 | Apr 2018 – Jun 2018 % diff 5y ave %diff yoy |
| Total Fatalities | 9.6 | 14 | 5 -48% -64.3% | 8.8 | 11 | 19 +115% +72% |
| Pedestrian Fatalities | 7.8 | 11 | 3 -61.5% -72.7% | 7.2 | 8 | 13 +80.5% +37.5% |

*Table 7.1 KLW Fatalities, Quarter 1 and Quarter 2 of DSP implementation*

In the initial planning phase, known as the Design Phase within the DSP Implementation Framework, large numbers of traffic law enforcement operations and education operations by traffic services were planned. For example a grand total of 50 operations were planned for the first quarter, including 21 pedestrian operations (inclusive of law enforcement action and traffic services education activities). Of these, 27 were verified by Land Transport Safety monitoring and evaluation as having taken place. In the second quarter, however, only 3 of the total of 38 planned operations could be independently verified as having taken place. A table of planned vs executed operations in the KLW DSP is below.

| KLW Quarter 1 | | | | KLW Quarter 2 | | | |
|---|---|---|---|---|---|---|---|
| Ped Ops Planned | Ped Ops Executed | Total Ops Planned | Total Ops Executed | Ped Ops Planned | Ped Ops Executed | Total Ops Planned | Total Ops Executed |
| 21 | 21 | 50 | 27 | 16 | 0 | 38 | 3 |

*Table 7.2 KLW Operations Planned and Executed, Quarter 1 and Quarter 2*

The Law Enforcement team ascribed this to an inability to commit staff due to a surge in protest action in the south-east of the Metro. This surge of protest action drew traffic services staff in the KLW region increasingly into traffic management duties, and potentially severely undermined the impact of the KLW DSP.

Figures released by the SAPS at the end of May 2018 indicate that protest action in the City of Cape Town for the year to date had increased by 73% compared to the corresponding period in 2017 (Breakfast, 2018). According to Alderman JP Smith, Mayoral Committee member for Safety and Security in the City of Cape Town, much of this protest action was reported as occurring in the south-east of the Metro, the epicentre of which being Khayelitsha and surrounds (ibid). The City's road safety education staff are drawn from the Traffic Services (unlike in the province, where Road Safety Management is a separate, completely civilian directorate), and would thus also have been affected by any redirection of law enforcement resources.

Comparison of outcomes, especially pedestrian fatality figures, suggests that there was a significant environmental change between the two quarters. In the first quarter, pedestrian fatalities were at a record low, while in the second quarter they climbed to 52% above the five-year average. This difference could be ascribed to the reallocation of resources reported by the City of Cape Town. The difference may also have been exacerbated by the end of the Ubuthakathi pedestrian alcohol education campaign in April 2018.

## 7.2 Commonalities and differences in planning, implementation and outcomes between Caledon and KLW

The KLW DSP was implemented according to the DSP Implementation Framework developed out of the experience of implementing the Caledon DSP. The process followed was thus largely identical.

The KLW DSP was implemented with relative ease by comparison to the Caledon DSP. Contributing factors were:

1. The pre-existence of the DSP Implementation Framework.
2. The presence of only one municipality, in the form of the City of Cape Town, in the planning process. This made coordination much easier, and excluded disagreement over matters such as overall objectives and allocation of resources.
3. The City also co-led the process of developing the DSP, with formal project leadership shared between Traffic Services and TDA under the guidance of the author.

The shorter timeline achieved with the development of the KLW DSP may however have had the inadvertent effect of limiting the amount of awareness of the DSP process among operational staff, especially traffic officers. This in turn may have had impact on entropy levels within the DSP.

Engineering participation in the KLW DSP was far more robust than in the Caledon DSP. Sanral was well-represented in the planning process, and included a variety of significant projects within the plan. TDA co-led the planning process, and also made a very large contribution in terms of projects, including new projects as well as expanding a number of existing projects and capturing them within the plan. In Caledon, engineering participation was minimal, and engineering interventions were developed largely by the other stakeholders and transmitted to the relevant roads authorities in the shape of formal requests for road safety assessments, speed limit reviews and similar.

No significant differences in the initial implementation of the two DSPs was recorded. However, the Western Cape Government's direct role in the KLW DSP was limited to the planning process and the first quarter of operations. Subsequently, participation took place only indirectly, with the exception of Land Transport Safety, which continued to perform the Monitoring and Evaluation function until the end of the second quarter of operations.
In both cases, while various engineering elements were incorporated into the DSPs, especially in KLW, no significant engineering interventions had been completed at the time of writing. Impact of the engineering element of the plans, and thus indeed of the overall effect of an integrated model for road safety planning, has therefore yet to be fully tested. Only minor engineering projects, such as child pedestrian road safety signage erected in Grabouw and Stanford, were completed.

Outcomes of the DSPs varied significantly between Caledon and KLW. In Caledon, there were clear indications of an improvement in road safety outcomes in the first six months of operations. This was particularly noticeable with regard to pedestrian fatalities, which were seen to reduce by 63% compared to the previous period, and by 63.6% compared to the five-year average. This difference appears more significant due to the major emphasis placed on pedestrian road safety within the DSP. Outcomes in KLW showed less positive improvements. On the same indicator, pedestrian fatalities, KLW showed a 15.6% reduction compared to the same period the previous year, although this reduction brought the figure in line with the five-year average. KLW also showed significant variance between the two quarters falling within the six-month period under review, with the primary driver of this variance apparently being the inability of law enforcement to conduct more than a handful of road safety operations during the second quarter. The data suggests that the implementation of the DSP in Caledon had somewhat more success than in KLW if the full six-month period is examined for both areas, whereas the level of success in both areas is relatively high when only the first three months periods of operations are considered.

### 7.4 Sub conclusion

Caledon and KLW DSPs were similar in planning and execution, with some advantage exhibited in the KLW process. The DSP Implementation Framework was applied in both Caledon and KLW. The advantage seen the in the planning phase in KLW did not manifest in superior results for KLW as opposed to Caledon. The Caledon DSP showed more positive and consistent results in the two quarters under review. Results in KLW may have been impacted by a significant external factor in the form of a major reported increase in protest action, in areas adjacent to and including the area of operations, escalating throughout the second quarter of operations, and preventing significant numbers of law enforcement operations. No significant engineering elements of both DSPs were completed at the time of writing, and thus this important aspect of both DSPs did not play a significant role in the outcomes assessed in this research.

## Chapter 8: Predictive Modelling Using DSP Planning and Outcomes Data

Considers a theoretical base for data modelling, using DSP planning and outcomes data, with potential utility in predicting outcomes for DSP-type road safety interventions based on planning inputs, including traffic law enforcement operations and road safety education and marketing activities.

### 8.1 Introduction

Alongside analysis of the results of a model for road safety planning which is consistently applied in highly variable settings, it is useful to consider how the data made available in such a process can itself be modelled to help planners in predicting outcomes for such interventions based on the planning inputs applied. This can assist in identifying resourcing levels necessary to achieve targets (eg reductions in fatalities) or in setting realistic, attainable targets when utilizing the available resources.

### 8.2 DSP Input Data

The available input data was collected from a combination of the DSP documents themselves, completed monitoring and evaluation reports, and various other reports. In addition, media schedules developed by Safely Home, and the schedules of other road safety entities operating in the DSP areas were also examined. These data were captured into a single database by the author.

### 8.2.2 Data Captured

The mutually comparable operations data captured included:

1. Joint Operations
2. Speed Operations
3. DUI Operations
4. Pedestrian Operations

The mutually comparable education and marketing data captured included:

1. National TV Spots
2. National Radio Spots
3. Regional Radio Spots
4. Community Radio Spots
5. Community Radio Interviews
6. Community Activations
7. Community Buses

8. Tavern Screens
9. Forecourt Screens

### 8.3 Method of Analysis

A theoretical model for developing a "road safety outcomes score" for a given period was developed by multiplying the number of traffic law enforcement operations by a weighted number of "advertising units". No road safety engineering interventions were considered, due to the longer timeframes involved.

The resulting score can be compared to fatality outcomes in order to determine if a predictive relationship exists, which can then be used to devised either resource requirements to achieve targets, or targets based on available resources.

The base theoretical model is expressed as:

$$N_o \times N_a = R$$

Where

*o* = sum of traffic law enforcement operations. Minimum value = 1.

*a* = sum of advertising units. Minimum value = 1.

*R* = Road Safety Outcomes Score (RSOS)

In order to populate *o*, numbers of planned traffic law enforcement operations actually carried out in a given period were summed.

In order to populate *a*, weightings were applied to different advertising and education activities[10]. This was done by positing community radio spots as a base value for comparison with other media, then weighting other media based on generic qualities of that media or intervention type:

1. Reach, ie potential coverage within the target area.
2. Frequency, ie potential of the message being repeatedly heard or viewed.
3. Impact value, ie combination of visual, audio and text impacts, and location and timing of encountering the message.
4. Ability to customize or target the message to the relevant DSP area.

A table of weighting values and descriptions is provided below.

| **Advertising Weighting Table** | | NB: Minimum total set to 1 for modelling purposes |
|---|---|---|
| | | |

[10] Due to the nature of the DSPs, ie conducted within highly localized contexts, no existing media weighting tables were found to be usable, as advertisers do not restrict their campaigns in this manner. The weighting system for the DSPs was thus developed as a consultation between the author (who has ten years marketing experience and owns an advertising agency) and Rowena Fester, Head of Marketing at Bearfish Strategic Services and Teresa Van Den Bergh, Media Strategist at The Media Shop, Cape Town.

| Unit | Weight | Description |
|---|---|---|
| National TV Spots | 2 | 45 to 90 second TV ads broadcast on national TV, including SABC 1, SABC 2 and ETV. Some DSTV channels. Provides exceptional reach and impact value, and can be targeted at particular demographics. However, cannot be targeted at particular areas, and cannot be localized in any way. |
| National Radio Spots | 0,25 | 30 to 60 second radio spots on national stations, such as RSG. Can provide good reach but not targetable, and not possible to effectively localize content. |
| Regional Radio Spots | 0,5 | 30 to 60 second radio spots on province-wide stations, such as Good Hope and KFM. Can provide good reach but not targetable. |
| Community Radio Spots | 1 | 30 to 60 second radio spots on stations within the target area, such as Valley FM and Overberg FM (in Caledon). Usually done using a local official's voice. Provides good targeting with relatively wide reach relative to size of community. |
| Community Radio Interviews | 5 | 5 minute promotional interviews with local law enforcement and road safety officials on community radio at prime listening times. Enables dialogue with local official and deeper engagement on the subject with a person who is directly involved. |
| Community Activations | 10 | Direct engagements with communities in high risk areas by road safety officials, including staged activations. Once-off high impact events, with low but highly targeted reach. |
| Community Buses | 10 | Out of home adverts on buses operating on routes within the target community. Highly visible and are seen repeatedly by target audiences. Pedestrians very important target. |
| Tavern Screens | 10 | Digital screens within taverns where advertising can be displayed. Ads run continuously and are viewed by patrons throughout opening times, providing good situational positioning, especially for alcohol related ads. Good attention paid during slower / earlier times of day. |
| Forecourt Screens | 5 | Digital screens at petrol stations, highly visible and in a relevant location but often ignored as drivers engaged with other tasks while at petrol stations, especially cell phones and forecourt shops. |

*Table 8.1 Advertising Weighting Table*

### 8.4 Application to DSP Areas

When this model was applied to data from the first six months of operations of the Caledon DSP, the following graph emerged:

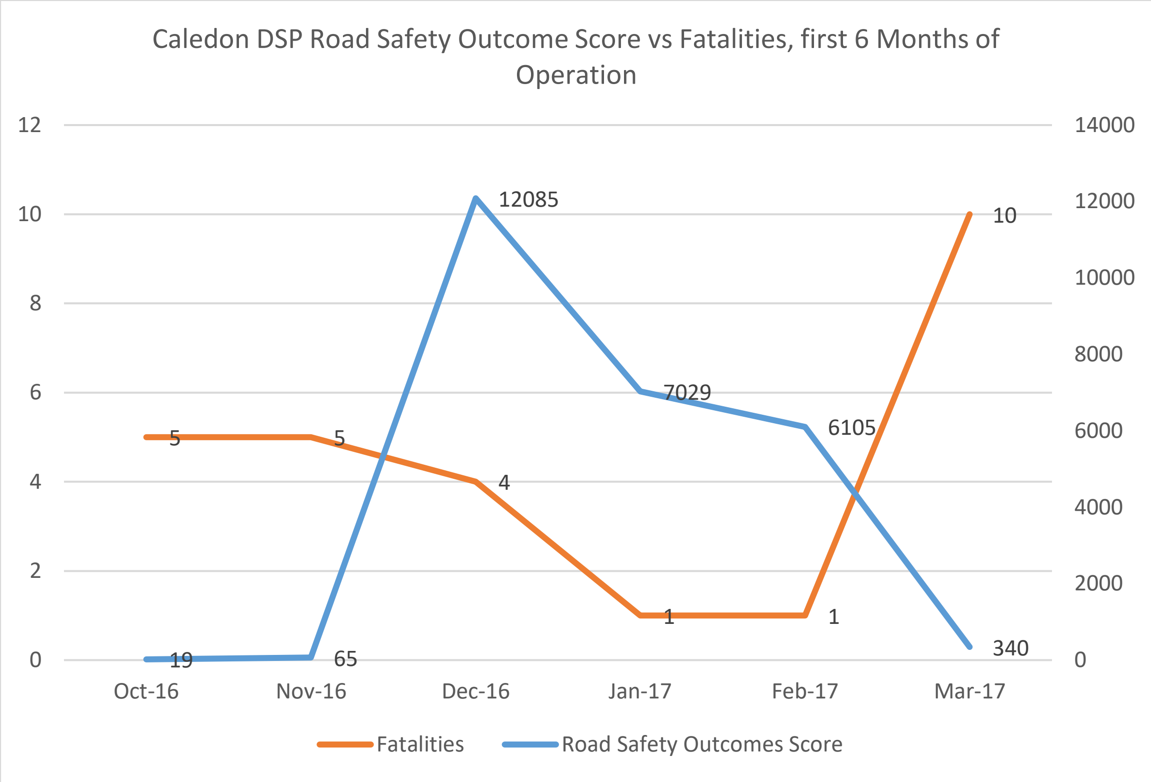



*Figure 8.1 Caledon DSP Road Safety Outcome Score vs Fatalities, first 6 Months of Operation*

When applied to the first six months of operations of the KLW DSP, the graph appeared as follows:

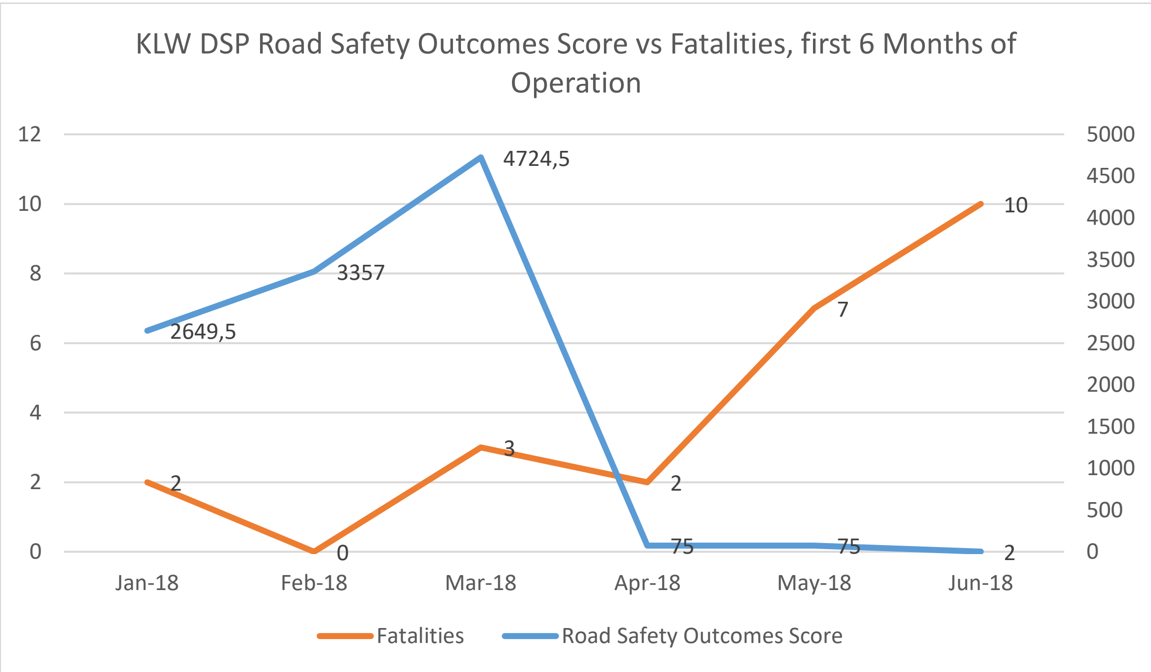



*Figure 8.2 KLW DSP Road Safety Outcomes Score vs Fatalities, first 6 Months of Operation*

The data suggest that greater road safety action inputs result in decreased in fatalities. This is clearest in the Caledon DSP, in which the Road Safety Outcomes Score was low at the outset of implementation. Road safety actions were already high at the point of implementation in KLW, largely due to the ongoing 'Ubuthakathi' pedestrian awareness media campaign which was already underway, and which ended in April 2018. The end of this campaign coincided with the precipitous increase in civil unrest in the area, as well as marked increases in fatality numbers.

If the successful DSP implementation periods (both Quarters 1 and 2 in Caledon, Quarter 1 in KLW), an average monthly Road Safety Outcomes Score (RSOS) of 4273,8 can be calculated for Caledon, while an average of 3577,0 can be calculated for KLW. The Caledon figure is 4056,3 if only the first quarter of implementation is included.

This suggests that a successful DSP implementation, or similar type of road safety planning intervention combining similar law enforcement operations with similar education and marketing interventions within an evidence-based planning framework, could derive planning targets by setting Road Safety Outcomes targets for each month or quarter of operations. In the case of Caledon and KLW, a nominal RSOS of 4300,0 per quarter would allow planners to determine numbers of operations and advertising requirements for that quarter, which should theoretically ensure that fatalities decrease during that period.

For example:

Traffic Law Enforcement operations available ($N_o$) = 2 per week = 24 per quarter

Advertising Units ($N_a$) necessary to achieve 4300 RSOS = 4300/$N_o$ = 179,16

A possible community radio-based media plan to achieve this could consist of:

1. 10 Community radio spots per week = 10 spots x 12 wks x 1 (weighting)= 120 Advertising Units
2. 1 Community radio interview per week = 1 x 12 x 5 = 60 Advertising Units
3. Total Advertising Units ($N_a$) = 180

The resulting equation is thus:

$$N_o \times N_a = R$$

or

$$24 \times 180 = 4320$$

### 8.4.1 Limitations

The model developed is a simple mathematical model based on limited data from only two areas where DSP interventions were implemented. The model as developed may predict positive outcomes where certain input levels are achieved but does not predict the scale of positive outcomes, that is, it does not tell planners how many lives will be saved or what percentage reduction could be achieved. It merely points towards threshold levels of activity necessary to make meaningful impact on traffic deaths.

# Chapter 9: Conclusion

## 9.1 Summary of Findings

The DSP Implementation Framework developed during and after the process of implementing a pilot District Safety Plan in the Caledon district constitutes a potentially useful planning model for developing and implementing evidence-based, integrated road safety plans that can collectively contribute to a safer road traffic system, in line with the successful sustainable safety systems now existing in Higher Income Countries. The successful development and practical application of such a model has high potential value for road safety and thus socio-economic outcomes in a Lower to Middle Income Country like South Africa. The model was successfully implemented in both the Caledon Traffic Centre district and the KLW area in a comparable manner.

Road safety outcomes, measured in terms of fatalities over the first six months of implementation, varied somewhat between the two areas, with those in Caledon being more positive and conclusive than those in KLW. In both DSP areas the primary focus was pedestrian road safety, and in both areas, fatality figures in this category showed improvements. KLW showed marked differences in activities and outcomes between the first quarter of operations and the second, largely because of protest action which caused resources to be drawn away from implementation of the plan, and the dissolution of planned activities, especially law enforcement operations.

A model for helping planners determine minimum law enforcement and education and marketing activity levels to achieve significant reductions in fatalities was also developed. The model indicates that planners could establish targets for interventions at certain level with reasonable expectation of positive outcomes The model proved limited in enabling the establishment of concrete targets, especially given the variability of outcomes observed within both positive and negative phases of road safety activities.

## 9.2 Conclusions

The DSP Implementation Framework as implemented can improve road safety outcomes. The model also shows promise for application in different environments, although the integration of engineering into the DSPs remained untested, as no major engineering interventions from within the plans had been implemented at the time of writing. It is thus possible that the positive results achieved are linked more directly to the introduction of an evidence-based planning framework by enforcement and education resources, rather than a true combination of evidence-based planning *and* integrated planning across all disciplines and stakeholders. It is thus unclear at this stage if this element of the overall aim of the model has been achieved. There is also considerable risk to the success of the model from external shocks, which may contribute to internal entropy, as may have been experienced in the KLW DSP due to increases in protest action in the area.

## 9.3 Future Research

Future research on the DSPs and related efforts to develop safer system planning tools or mechanisms, and models for predicting their outcomes, could focus on:

1. The impact of engineering plans on the overall outcomes achieved, especially where engineers have led or have been deeply involved in the planning process, compared to areas where engineers' participation has been limited. This needs to be done once major projects have been completed (eg Mew Way sidewalks project in KLW, or the N2 safety assessment recommendations implementation in Caledon).
2. The impact of external shocks, such as drought or protest action, on road safety, could provide a useful avenue of study to assist in developing resilience within the model.
3. The impact of internal entropy on the success of road safety models, especially as regards ongoing participations by stakeholders, especially entities such as the SAPS and municipal law enforcement, as well as engineering. Fatality numbers from Caledon, especially those after one year of operations, are suggestive of increasing entropy. Quarterly plans emerging from the district have tended to regress towards the kind of plans developed prior to implementation and appear to have drifted significantly from the evidence base.
4. The role that community organizations and mobilization can play in affecting road safety outcomes could be addressed in future applications of the model and studies of its results.
5. Social media can play a significant role in educating the public and shaping perceptions, with behaviour changes at population level, both positive and negative having been triggered in a wide range of contexts in recent years. Widespread use of sophisticated social media strategies by the Russian government was found, for example, to have influenced the outcome of the 2016 United States presidential election (US Department of Justice, 2019), illustrating the power of the medium to influence global events at the very highest levels. While more prosaically Safely Home conducted social media campaigning throughout the periods under review in this paper, the complexities, variabilities and vagaries of the medium placed its inclusion in the analysis outside the scope of this paper. A separate analysis of social media activity and its impact within discrete areas of the traffic system, and the traffic

system more broadly could be a useful adjunct to the study of the efficacy of planning models such as District Safety Plans. Its inclusion in the predictive modelling framework could also provide more refined and definitive results.

## Appendices

A. Terms of Fatalities Data Sharing Agreement

B. Caledon DSP, including Evaluation

C. KLW DSP Evaluation

D. KLW DSP

E. Caledon and KLW Operational and Media Data

## Bibliography

Bhalla, K. 2019. Building Road Safety Institutions in Low- and Middle-Income Countries: The Case of Argentina, *Health Systems and Reform*. 5:2:121-133 [Electronic]. Available: https://www.tandfonline.com/doi/full/10.1080/23288604.2019.1565061 [2021, November 6]

Breakfast, S. 2018. Cape Town protests: City records 73% increase in protests in 2018. *The South African* [Electronic], 7 November. Available: https://www.thesouthafrican.com/cape-town-protests-increase-in-2018/ [2021, November 6]

Elvik, R & Yaa, T. 2004. *The Handbook of Road Safety Measures*, *1st edition*. New York: Elsevier.

Federal Highway Administration. 2007. *Motor Vehicle Traffic Fatalities, 1900 – 2007.* [Washington]: Available: https://www.fhwa.dot.gov/policyinformation/statistics/2007/pdf/fi200.pdf [2021, November 6]

Forbes, TW. 1922. Age performance relationships among accident-repeater automobile drivers. *Journal of Consulting Psychology*, 2:143-148

Glanville, WH. 1955. Road safety and traffic research in Great Britain. *Journal of the Operations Research Society of America*, 3:283-299

Haddon, W. 1972. A logical framework for categorizing highway safety phenomena and activity.
*Journal of Trauma.* 12:193-207

Hagenzieker et al. 2014. *The history of road safety research: A quantitative approach*. SWOV Institute for Road Safety Research. The Hague:The Netherlands

Kyu, D. Bringing Back the 'Jay Driver'. 2016. *The Philadelphia Citizen* [Electronic]. 23rd September:1. Available: https://thephiladelphiacitizen.org/philly-free-streets-day/ [2021, November 6]

Matzopolous, R et al 2015. *The Injury Mortality Survey: A national study of injury mortality levels and causes in South Africa in 2009*. Pretoria: Medical Research Council.

Mohlala, S. 2017. *The Development of an Implementation and Management Plan for Traffic Management*, S Mohlala, 36th Southern African Transport Conference (SATC 2017).

Nation roused against motor killings. Secretary Hoover's conference. 1924. *The New York Times* [Electronic], 23rd November:1. Available: https://www.nytimes.com/1924/11/23/archives/nation-roused-against-motor-killings-secretary-hoovers-conference.html [2021, November 6]

Pretorius, H.B. 1998. *On Managing the Traffic Safety System: A Multidisciplinary Approach*. M.Sc. (Eng.) (Civil) Dissertation. Johannesburg: University of the Witwatersrand

Provincial Treasury, Western Cape Government. 2015. *Municipal Economic Review and Outlook 2015*. Cape Town: Provincial Treasury.

Road Traffic Management Corporation. 2010. *Annual Report 2009/10*. Pretoria: Road Traffic Management Corporation.

Road Traffic Management Corporation. 2018. *State of Road Safety Report 1 January – 31 December 2017*. Pretoria: Road Traffic Management Corporation.

Road Traffic Management Corporation. 2016. *Cost of Crashes in South Africa, Research and Development Report*. Pretoria: Roux & Labuschagne.

Road Traffic Management Corporation. 2010. *South African National Road Safety Strategy, 2011-2020* [Online]. Available: https://www.arrivealive.co.za/documents/Road%20Safety%20Strategy%20for%20South%20Africa%202011.pdf [2021 November 7th]

Statistics South Africa. 2012. *National Census 2011.* Pretoria: Statistics South Africa.

The Organization for Economic Co-operation and Development. 1997. *Road transport research: Outlook 2000*. Paris: France.

Tingvall, C., & Haworth, N. 1999. Vision zero; An ethical approach to safety and mobility, in *Proceedings of the 6th ITE international conference road safety and traffic enforcement*; Beyond 2000: Melbourne.

Wegman, F. 2017. The future of road safety: A worldwide perspective. *International Association of Traffic and Safety Sciences.* 40:66-71 [Electronic]. Available: https://www.sciencedirect.com/science/article/pii/S0386111216300103#s0010 [2021, November 6]

Wegman et al. 2008. Advancing sustainable safety. National road safety outlook for the Netherlands for 2005–2020. *Safety Science.* 46:323-343

Western Cape Department of Agriculture. 2017. *Informing the Western Cape Agricultural Sector on the Impact of Drought*. Cape Town: Department of Agriculture.

Western Cape Department of Transport & Public Works. 2017. *West Coast (South) DSP Evaluation*. Cape Town: Eliott.

Western Cape Department of Transport & Public Works. 2017. *Caledon District Safety Plan 2017/18*. Cape Town: Eliott

Western Cape Department of Transport & Public Works. 2017. *Caledon Traffic Centre District Safety Plan Annexure 1 – Appendix E: Evaluation*. Cape Town: Eliott.

Western Cape Department of Transport & Public Works. 2017. *KLW DSP Annexure 1 – Evaluation*. Cape Town: Eliott.

Western Cape Department of Transport & Public Works. 2016. *Seatbelt Survey Results Wave 3.* Cape Town: Department of Transport & Public Works.

World's First Fatal Car Accident. 2013. August 30. *The British Newspaper Archive* [Web log post]. Available: https://blog.britishnewspaperarchive.co.uk/2013/08/30/worlds-first-fatal-car-accident/ [2021 November 7th]

World Health Organization. 2004. *World Report on Road Traffic Injury Prevention*. Geneva: World Health Organization.