

THE COST OF CRASHES IN SOUTH AFRICA 2016

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ABSTRACT

The 'total cost of road traffic crashes' metric is an important road safety indicator that serves as the departure point for understanding the extent and magnitude of the road safety problem in a country and the stifling impact it has on efforts to eradicate poverty and grow the economy. The previous Road Traffic Crashes (RTCs) cost estimation was published in 2004 by the Department of Transport (DoT). Though it was useful for benefit/cost evaluation of road safety programmes and projects targeting specific types of RTCs and victim groups (the main purpose of the methodology used), the general view was that the methodology was cumbersome to apply and that the social costs elements of RTCs needed to be accounted more comprehensively. In September 2015 the Road Traffic Management Corporation commissioned the evaluation and review of the methodology of the 2004 DoT report (CoC 2004) with the overall aim to adopt a more user-friendly methodology to account appropriately for the local realities of the social and indirect cost of RTCs in the South African context. This paper provides an overview of the "Cost of Crashes 2016" project and of cost estimation outcomes of the various elements that make up the total cost of RTCs in South Africa. The total cost of RTC was estimated to amount to R 142.9 billion based on the available 2015 fatal RTC data, which represents about 3.4 per cent of the Gross National Product (GDP). The paper concludes with examples of applications of the CoC 2016 RTC costing in support of implementing the 'Safe System' approach.

1 INTRODUCTION

The 'total cost of road traffic crashes' metric is an important road safety indicator that serves as the departure point for understanding the extent and magnitude of the road safety problem in a country. Knowing and understanding this cost is essential for developing countries, such as South Africa, where the cost of Road Traffic Crashes (RTCs) to the economy presents a significant challenge in efforts to eradicate poverty. The previous RTC cost estimation exercise was conducted in 2003 and the report, "The estimation of unit costs of road traffic accidents in South Africa", was published by the Department of Transport (DoT) in 2004 (CoC 2004). Though CoC 2004 was useful for

benefit/cost evaluation of road safety programmes and projects targeting specific types of RTCs and victim groups, the general view was that the methodology was cumbersome to apply and that the social costs elements of RTCs needed to be accounted for more comprehensively.

In September 2015, the Road Traffic Management Corporation (RTMC) commissioned the evaluation and review of CoC 2004, with the overall aim to develop a more user-friendly methodology that would more appropriately account for the local realities of the social and indirect cost of RTCs in the South African context. This paper provides an overview of the “Cost of Crashes 2016” (CoC 2016) project and of cost estimation outcomes of the various elements that make up the total cost of RTCs in South Africa. The paper concludes with examples of possible applications of the CoC 2016 in support of implementing the ‘Safe System’ approach.

2 OVERVIEW OF THE COST OF CRASHES 2016 PROJECT

2.1 Research approach and objectives

The first phase of the project updated the RTC unit cost tables of CoC 2004 using the RTMC’s 2015 validated fatal RTC dataset and other relevant data for the three cost categories, namely human casualty-, vehicle repair- and incident-related costs. Where no new or updateable data were available, historical data were updated using consumer price indices. A benchmarking exercise of the CoC 2004 methodology against international practices assisted with determining relevance and inclusiveness as well as identifying potential additional variables for determining the cost of RTCs more comprehensively. Using the outcomes of the first phase, the focus of the second phase was the development of a 2016 methodology for estimating RTC costs for South Africa, or CoC 2016. CoC 2016 applied mainly the Human Capital (HC) approach but the methodology was expanded in order to more comprehensively address the social and environmental costs deficiencies of earlier RTC costing exercises, thus making it essentially a HC ‘hybrid’ method.

Objectives of CoC 2016 include the simplification of the methodology and improved user-friendliness in application. It also needed to be supportive of processes of implementing SANS 39001 and the Safe System approach in its progressive development trajectory (Figure 1). The ‘Safe System’ concept is essentially the basis for the five pillars of the United Nations Decade of Action for Road Safety 2011-2020 (DoA) and of the 2016 National Road Safety Strategy (NRSS).

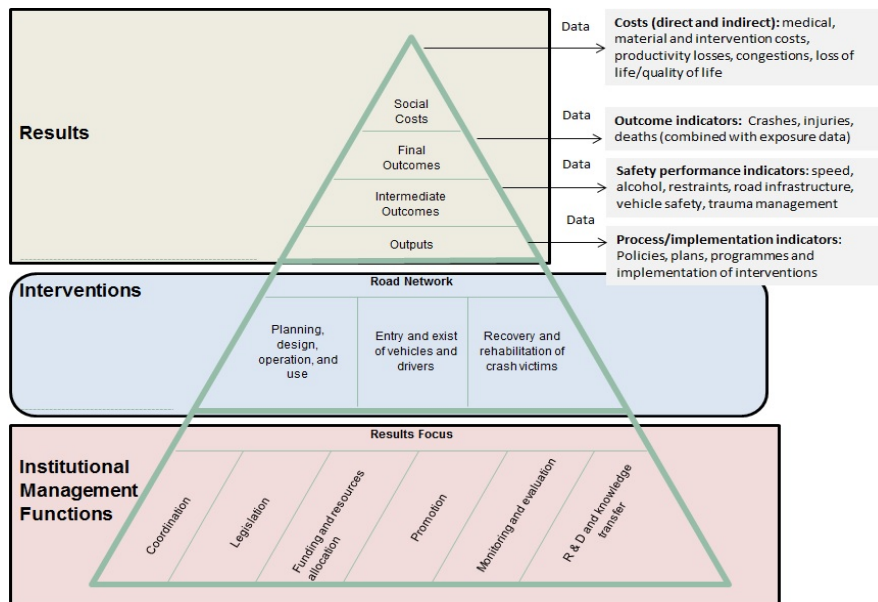


Figure 1: Towards a Safe System: Cost of RTCs in the Road Traffic Safety Management System (adapted from Bliss and Breen, 2009).

2.2 Cost categories and elements

The categories and elements included in CoC 2016 are show in Table 1.

Table 1: Cost categories and elements of CoC 2016

Cost category	Cost element
Human casualty costs	Present and future lost productivity Pain, suffering and lost quality of life Medical and rehabilitation treatment Funeral Work place re-occupation
Vehicle repair costs	Vehicle damage Towing Assessor
Incident costs	Emergency response Legal RTC management (crash scene attendance, crash investigation and reconstruction, data management, etc.) Infrastructure damage Delay, congestion and emissions

2.3 Methodology followed to produce CoC 2016

The methodology followed included a review of local and international literature; stakeholder interactions; data collection and processing; and the calculation of unit and total crash costs for use in applications. The outputs from these actions include the Crash Cost Data Source Traceability Matrix (CCDSTM), a Data Dictionary, and User Requirement Specifications (URS).

2.3.1 Literature review

The literature review highlighted a number of methods to estimate RTC costs, but there seems to be little consensus regarding the 'best' method. Most methodologies are data-dependent and rely heavily on available and useable data (Wijnen, 2013). RTC cost estimation is an inexact science that depends on the particular approach used, the number of RTC cost components estimated, quality and quantity of available data and the value of key parameters, such as the discount rate used (Commonwealth of Australia, 2000). The difficulty in putting monetary values on death, 'pain, grief and suffering' is well documented (Mohan, 2002). Putting a monetary value on a life is a sensitive aspect in many cultures and religions around the world, but the allocation of scarce resources to save lives needs to take precedence over the ethical concerns (Sund, 2010).

Although the Willingness-to-Pay (WTP) approach has become generally accepted as the more appropriate method (from a theoretical point of view) for estimating crash costs, data collection is costly (Jacobs et al., 1995; Mohan, 2002; Donário et al., 2012) and it assesses the cost only for the particular year in which the surveys are conducted (Donário et al., 2012). The HC method allows for the calculation of cost trends over a number of years based on historic data. Indications are also that the HC method provides more trustworthy estimates of the social cost of RTCs than the WTP method (Donário et al., 2012).

2.3.2 Stakeholder interactions and data collection

Interactions with various stakeholders, identified as typical sources of RTC costing-relevant data, took place with the assistance of the RTMC. The sourcing of data from conventional RTC costing-relevant sources is a worldwide problem. This is no different in South Africa and the Phase 1 report highlights the numerous challenges associated with RTC cost data. Thus, where local data was not available, use was made of surrogate input values from appropriate and credible international studies.

2.3.3 Crash Cost Data Source Traceability Matrix

The Crash Cost Data Source Traceability Matrix (CCDSTM) is a conceptual framework that takes cognisance of traditional and new data sources. It defines and describes each cost category, cost element and cost data item; and identifies other potential sources of RTC cost relevant data or surrogates used as alternative inputs to the costing items or categories, as well as the prospective stakeholders and sources. The CCDSTM remains a working document to inform and facilitate the continuous input as data becomes available during future annual updates.

2.3.4 Data dictionary

International best practices and the development of the CCDSTM guided the compilation of the crash cost dictionary. The RTC cost data dictionary currently contains descriptions of data elements some of which are not yet collected in South Africa. However, there is a need for a concerted and coordinated effort to collect these data elements for future use. Figure 2 below depicts a high level view of the typical RTC cost data elements.

There is also a need for a standardised approach to collect high quality data, based on

standardised guidelines and minimum requirements for data elements. This includes the collection of data on not only fatal RTCs but serious RTCs as well. Similar to the CCDSTM, the RTC cost data dictionary remains a working document, updated continuously as relevant data for the population of the CoC 2016 methodology becomes available.

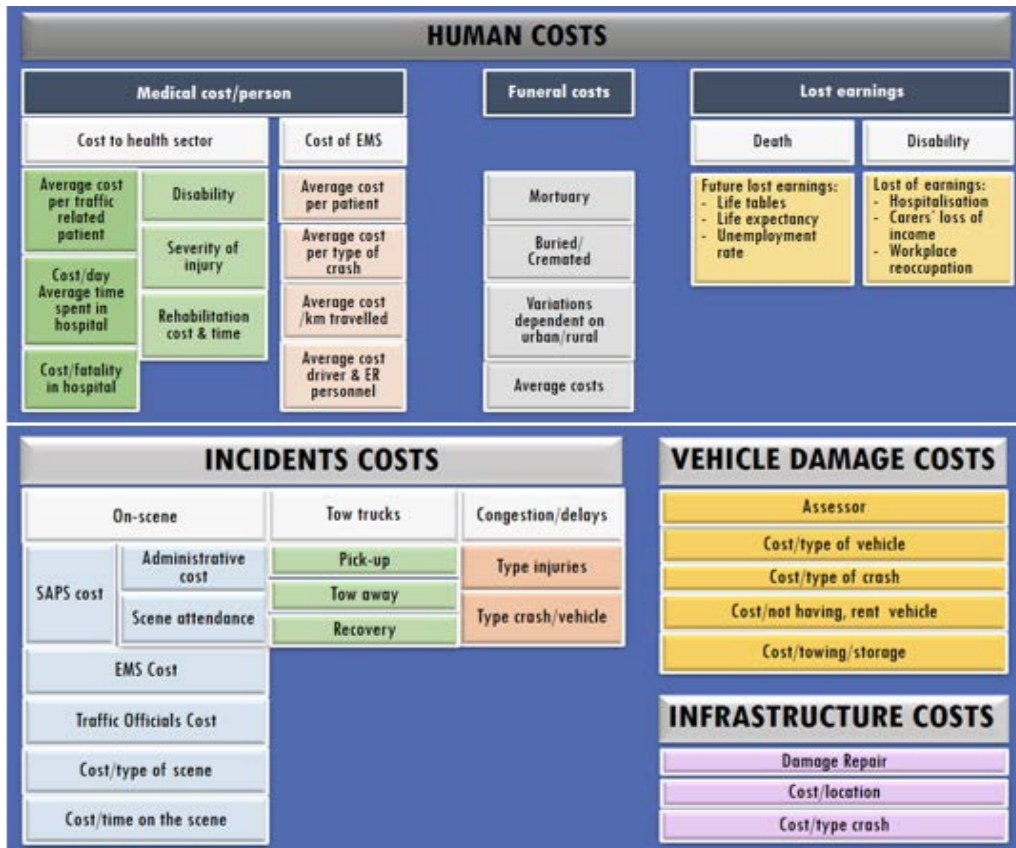


Figure 2: High level view of RTC costs data elements

2.3.5 User requirement specifications

Road safety is a shared responsibility. The RTSMS (see Figure 1) provides the framework for achieving high-level coordination of road safety stakeholders. Different stakeholders have different needs and stakeholders fall within two classifications namely primary and secondary users. Primary users include all stakeholders responsible for processing the data, analysing the data as well as ethically disseminating and reporting on the data. In South Africa, these entities include the DoT and RTMC; law enforcement agencies (SAPS and traffic) and the Road Accident Fund (RAF). Secondary users include other agencies involved in RTC records assessment and use including other departments and agencies such as the South African National Roads Agency Limited (SANRAL), Department of Health (DoH), Department of Justice (DoJ), Department of Home Affairs (DoHA) and private sector entities (Miller, 1995). These stakeholders represent the diversity of RTC data users and providers, the need for access to crash data, existing documentation of database capabilities, coordination among agencies, sources of duplication of effort, the methods used to collect data, and linkage opportunities. The development of a user requirement specification (URS) entailed an assessment of these users and their requirements.

To add impetus to road safety decision-making at the levels of the three elements of the RTSMS (i.e. institutional management functions, interventions and results), the URS was conceptualised to add value through informing and guiding the use of the results of the cost of RTCs estimations by a variety of users. The CoC 2016 methodology is organised for initial preparedness to support the 'Safe System' rollout and the achievement of road safety 'results focus' as the overarching road safety institutional management function. The URS imparts the need for RTC costing in CoC 2016 at three inter-related levels:

- To inform national resource planning to ensure that road safety is ranked equitably in terms of investment in its improvement.
- To internalise the impact of road system failure by an expression of tangibility, achieved through appropriate monetisation of all elements of the societal burden of RTIs and RTC damages. Internalisation must be aimed at all public and private sectors and communities as well as individuals.
- To ensure that the best use is made of any investment and to ensure the introduction of the most appropriate road safety improvements in terms of the benefits that they will generate in relation to the cost of their implementation.

3 COST ESTIMATION OUTCOMES

3.1 Crash statistics

The cost analyses calculations made use of the validated RTMC's 2015 fatal RTC dataset. According to the RTMC, 12,944 people died in 10,613 fatal RTCs in 2015. An increase of five percent was added to these figures, to account for under-reporting. Based on historical data, estimations are that the ratio of serious injuries to fatalities was 4.6:1 and the ratio for slight injuries to fatalities at 14.9:1. Based on these ratios and the under-reporting adjustment, it was estimated that 13,591 persons died, 62,520 persons were seriously injured and 202,509 were slightly injured in South Africa in 2015. A further 1,429,794 persons were involved in RTCs without sustaining any injuries. Estimations are that 71.2 per cent of road users injured in RTCs are male and 28.8 per cent female.

3.2 Total crash cost for 2015

The total cost of RTCs on South Africa's road network for 2015 amount to approximately R142.95 billion - equating 3.4 per cent of Gross Domestic Product (GDP). Human casualty costs accounted for 69.3 per cent of the total crash cost in 2015; vehicle repair for 14.9 and incident costs for 15.8 per cent (Figure 3).

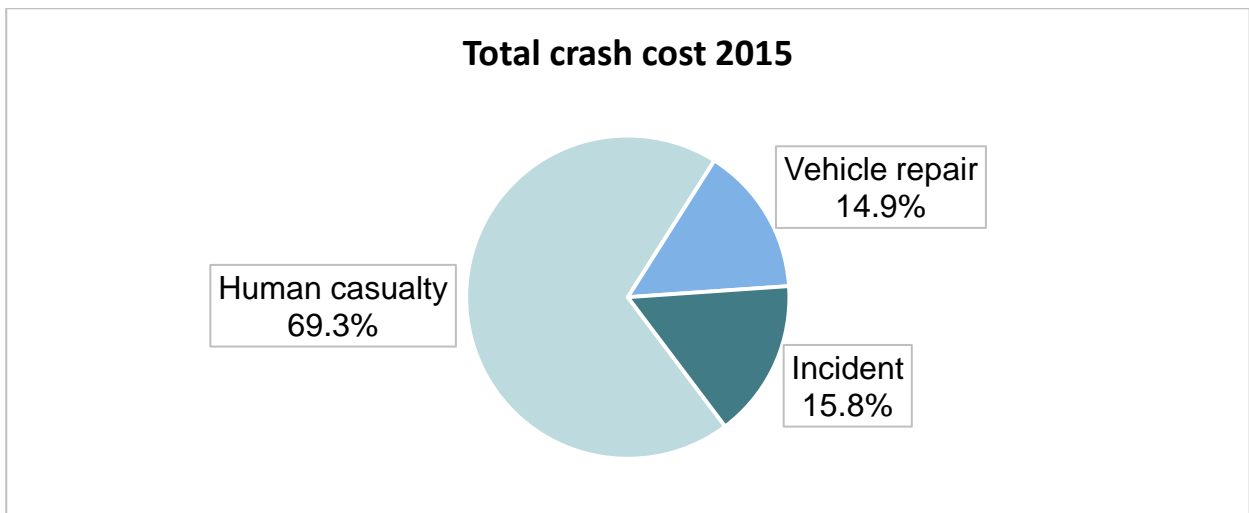


Figure 3: Proportion of total crash cost according to cost category, 2015

3.3 Unit cost figures

Table 2 shows the average costs per crash by crash severity. Economic evaluations of road safety interventions make use of these unit costs.

Table 2: Unit crash costs per RTC and RTI, by severity

Unit Cost per RTC (Rand)				
Fatal	Major	Minor	Damage only	Any severity
5 435 261	765 664	152 244	48 533	171 727
Unit Cost per RTI (Rand)				
Death	Serious	Slight	No injury	Any severity
3 916 187	423 858	71 352	1 085	56 032

For the purpose of more localized economic evaluations, additional unit cost tables were prepared; these include cost per vehicle type involved and costs for urban and rural areas.

4 APPLICATION OF THE COC 2016

A variety of stakeholders can use the results of the RTC cost analysis in different ways:

- to understand the impact of RTCs on the economy and society of South Africa as a whole, and on individuals, business and the government as separate entities;
- to benchmark South Africa's road traffic safety performance internationally;
- to serve as input into policy and strategy development in order to improve coordination and allocation of funds and other resources aimed at curbing the road traffic safety problem;

- to monitor and evaluate the cost-effectiveness of road traffic safety interventions at all levels; and
- to assist the road safety fraternity to achieve 'results focus' through effective implementation of the 'Safe System'.

4.1 Socio-economic impact of RTCs

By monetising the socio-economic burden of road safety failures, the impact thereof can be better understood and managed. It is evident that RTCs have a huge economic and societal impact in South Africa. For many, being a victim of a RTC means becoming disabled, losing income or losing a job, or difficulty in finding employment. For others losing a breadwinner means living in poverty, losing a parent or losing a home. For some losing a child, spouse or other loved one could mean psychological trauma and disruption of a stable family life. Putting a monetary value on these tangible and intangible losses makes the need for urgent and far-reaching interventions that are much more indisputable to policy and decision makers.

4.2 International benchmarking

It is difficult to benchmark South Africa's road traffic safety performance against those of other countries as the method of calculating RTC costs differs from country to country. Some countries adjust RTC figures for underreporting and some do not. The figure of 3.4 per cent for South Africa, however, does not compare favourably with countries using similar methodologies. According to the Institute for Road Safety Research in the Netherlands, SWOV (Wijnen, 2013) the cost of RTCs in low- and middle-income countries that correct for underreporting and use the HC method is 2.2 per cent of their GDPs. The average for high-income countries varies between 1.0 and 4.6 per cent of their GDPs. If only those high-income countries that use WTP methods (which result in higher estimates) are considered, the average is 3.7 per cent of GDP.

4.3 Policy and strategy development

The results of the RTC costing analysis should aid in making the economic and societal burden of RTCs tangible and relatable to policy and strategy formulation. It provides a clearer picture of the extent of investment needs and where priorities should be placed. As an example, in 2015 the cost of medical treatment due to RTIs was estimated at R 10.4 billion and the cost of pain, grief and suffering at R 42.5 billion. This places a substantial burden on the health and welfare system of South Africa.

Road safety investment should not only be the responsibility of the government and individual road users, but that of the road safety fraternity as a whole. All relevant stakeholders, including public and private sector employers, should take ownership and be held accountable to invest in road safety improvement. Investment should not only take the form of financial expenditure, but all stakeholders can achieve substantial cost savings

by being focused on achieving road safety results and by planning and executing activities in line with the 'Safe System' approach.

4.4 Economic evaluation of transport projects

Real road safety improvement can only come from implementing measures proven to be successful, i.e. evidence-based countermeasures. Implementing these measures comes at a cost and where there is competition for resources such as funding, it is of utmost importance to conduct an economic analysis before implementing any measures. An economic analysis would typically consist of cost and benefit metrics. A cost metric is a calculation of the investment costs of the project while a benefit metric is an estimate of the cost savings resulting from the same project over a number of years. Results from the CoC 2016 study can assist in calculating the value of cost savings that could potentially be achieved in programs and projects aimed at preventing RTCs and RTIs.

4.4.1 Infrastructure improvement projects

When evaluating measures to improve road safety, RTC prediction models are used to estimate the number of RTCs and RTIs that may potentially occur in the future, both before and after the implementation of the particular measure. The estimate is expressed as a RTC or RTI rate in relation to traffic volume, length of road, population, etc. RTC rates, such as the number of fatalities or RTCs per kilometre driven, are useful to determine which projects, sites or routes should receive priority attention. To calculate kilometres driven for a site or section of road, traffic counts and the length of the section are required – the number of kilometres driven on that section in a year can then be determined. The RTC rate per kilometre driven is calculated by dividing the number of RTCs occurring on the particular section of road per year into the number of kilometres driven.

To assist in determining what RTC or RTI rates could typically be achieved after implementing a road safety improvement measure, a lot of work is being done internationally in developing Crash Modification Factors (CMFs) for various measures. These CMFs indicate the “measure of the estimated effectiveness of a safety countermeasure” (American Association of State Highway and Transportation Officials, 2012) The Highway Safety Manual (AASHTO, 2016) describes a CMF as “a factor estimating the potential changes in RTC frequency or RTC severity due to installing a particular treatment”. As an example, a CMF of 0.7 means a 30 per cent reduction in RTCs and a CMF of 1.2 means a 20 per cent increase in RTCs. CMFs can be found at the CMF Clearing House (Federal Highway Administration, 2016). New Zealand (NZ) has also developed CMFs, shown in their Crash Estimation Compendium (NZ Transport Agency, 2016).

The difference between the RTC or RTI rate before and after implementation of a measure is the saving that can be achieved. Results of the CoC 2016 study can determine the RTC cost savings to be achieved by implementing specific countermeasures. RTC costs per kilometre driven can be used to compare different road sections or road types for prioritisation purposes. Kilometres driven by particular modes of transport, for example

buses or minibus taxis, and the costs associated with RTCs involving these modes, are useful to drive public transport policy decisions. These types of 'before and after' 'benefit cost' analyses are regularly done by road and traffic engineers before implementing infrastructure improvement programs at site and route level.

4.4.2 Road user behaviour interventions

In addition to the above-mentioned CMFs, which largely relate to road safety engineering measures, the Rosebud Thematic Network (European Commission, 2006) provided examples of assessed road safety measures involving human behaviour interventions. For example, drinking and driving campaigns in Germany, Sweden and Norway resulted in benefit cost ratios (B/C-ratio) ranging from 4.7 to 20 (a B/C ratio of greater than 3 is considered excellent). Compulsory first aid education in schools showed a B/C ratio of 90; randomly scheduled law enforcement a ratio of 55; random breath testing 36 to 55; reflective devices for pedestrians 5 to 7 and seatbelt reminder in cars 11. Speed enforcement is less effective: B/C ratio of 2.9 to 3.6. As a practical example, should an amount of R 1.0 million be invested in effective speed enforcement, an improvement in road safety (measured in terms of crash cost savings) of between R 2.9 and R 3.6 million could be expected. Investing that same million rand in an effective drinking and driving campaign could result in a cost (and life) saving of between R 4.7 and R 20 million. More research is required to determine the proportion of South Africa's human casualty cost that can be attributed to any of these activities but the quoted B/C ratios indicate that RTC costs can be saved through implementing effective evidence-based road safety education, campaign and law enforcement interventions.

5 RECOMMENDATIONS

The cumbersome process of obtaining useable South African based RTC cost data and related research for purposes of compiling the CoC 2016 is to a large extent indicative of the significant fragmentation that exists among the road traffic safety management fraternity and the wide array of role players. This relates to the lack of clear leadership and the associated road safety governance failure. Following are two main recommendations; the first to propagate improved governance in that consistent efforts are required to capture RTC- and RTC cost relevant data and to improve access to such data, the second to emphasise the importance of implementing evidence-base actions and measures as being essential for an effective Safe System rollout.

5.1 Periodic updating of the model

The CoC 2016 calculations model contains metrics that need to be updated on a recurring annual basis to improve the availability and accessibility of RTC and concomitant RTC cost data that are reflective of the South African context. There must be a continuous quest to improve the availability and accessibility of RTC costing-relevant data. Relevant (local not excluding other international) research on the RTC cost parameters and results from local micro-costing studies can then also be considered. Much of this will not necessarily realise through top down demands on stakeholders for data, but through

transformations to a road safety ‘results focus’ paradigm with self-manifest shared responsibility across sectors and is likely solely dependent on credible road safety governance and convincing leadership.

Further development of a RTC costing methodology would ideally be based on consistent and reliable RTC data on a national level. Good RTC recording systems and databases typically contain a plethora of data elements, but at the core severity of RTC and injuries sustained; road user type, gender and age; RTC date and time; RTC type; location and road condition per RTC; type of vehicle(s) involved and factors contributing to each RTC are the bare essentials. The reliability of the RTC costing system is dependent on a consistent, credible, comprehensive, and timely RTC database. This requires recording of RTC data to be conducted with diligence - ensuring a high standard and high integrity of the RTC database. In the absence of this, strategies will have to be developed to simulate RTC statistics as part of a go forward strategy as was the case with CoC 2016. The reporting and recording of RTCs need to be pursued with austerity as under-reporting is a problematic element of RTC costing. Currently, it is uncertain what the level of under-reporting of RTCs is in South Africa.

5.2 Implementation of the Safe System

The CoC 2016 methodology is organised for initial preparedness to support Safe System rollout and achievement if road safety “results focus” is the overarching road safety institutional management function. At country level, monetising the socio-economic burden of traffic system failures in a form expressed as a percentage of GDP may have the result of being an “invisible” quantum. The reason is mainly that it is not possible, from such a large lump sum number, to differentiate responsibilities and accountabilities for road safety actions to be taken. It has the effect of the road safety epidemic being the metaphorical “elephant in the living room”.

RTC costing methods should aid in making the societal burden of RTCs tangible and relatable to policy formation and investment needs as well as to measuring effective, accountable spending on interventions that effectively reduce RTCs and injuries. It should facilitate cost-benefit analyses at various levels for selection and prioritisation of remedial- and countermeasures and the monitoring and evaluation of their implementation. With the ultimate RTC costing URS, the aim is to assist in informing the value that a RTC costing methodology could add to decision-making and provide a clearer picture of the financial burden placed on the various sectors affected by RTCs – thus making the costs of crashes to society visible.

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