Contract Report CR-2004/6

March 2004

National Department of Transport

The estimation of unit costs of road traffic accidents in South Africa

DOCUMENT RETRIEVAL PAGE			Report No: CR-2004/6
Title: The estimation of unit costs of road traffic accidents in South Africa			
Author: EJH de Beer, EC van Niekerk			
Client: National Department of Transport	**Client Reference No**:	**Date**: March 2004	**Distribution:** Restricted
Project No: 9456/TML01	OE2: 9456: **Traffic Engineering and Safety**		**ISBN:**

Abstract:

In 2002, the National Department of Transport in South Africa identified the need to broaden the current methodology to include unit costs for accident victims according to age groups and severity of casualties, and unit costs for the number of vehicles involved according to vehicle type and type of accident, with a possible further breakdown in terms of urban and rural areas. The tender for the undertaking of a project on the cost of road traffic accidents was awarded to CSIR Transportek, which conducted the study during 2003.

This document deals with the study undertaken to develop a new methodology that provides comprehensive accident unit cost figures. Chapter 1 gives a background to the study. Chapter 2 discusses the main issues pertaining to accident costing and gives an overview of the methodology used in the current study. Chapter 3 gives the unit cost tables to be used for the calculation of accident costs at a national or local level. Examples are given to assist with calculations. Chapter 4 gives recommendations, including a method for annual adjustment of the unit cost figures.

Details of the study are contained in Annexures A to F. Annexure A gives an overview of international practices to calculate human casualty costs and a review of the previous methods used in South Africa is given in Annexure B. Annexure C gives details of the methodology followed during the current study. Annexures D and E describe the results of the current study that produced the human casualty unit cost and vehicle damage cost tables supplied in Chapter 3. Annexure F compares the human casualty unit cost discussed in Annexure D with similar costs obtained from the Road Accident Fund.

Keywords: Accident costs, human casualty costs, vehicle damage costs

Proposals for implementation: It is proposed that the accident unit cost figures developed during this study be used to calculate total traffic accident costs at a national, provincial and local level to quantify the extent of the problem, but also at accident location level for cost-benefit purposes.

Related documents: None

Signatures:				
C Mac Carron	**FJJ Labuschagne**	**PR Venter**	**S Roets**	**P Hendricks**
Language Editor	Technical Reviewer	Programme Manager	Info Centre	Division Director

DISTRIBUTION LIST

No of Copies	Recipient	Date dispatched

ACKNOWLEDGEMENTS AND DISCLAIMER

This investigation was undertaken by the Division of Roads and Transport Technology of the CSIR, on behalf of the National Department of Transport.

The work was undertaken by:

Ms EJH de Beer
Ms EC van Niekerk

in collaboration with:

Mr G Botha (NDOT).

The following organisations provided data and their contributions are gratefully acknowledged:

The Road Accident Fund
Statistics South Africa
The South African Insurance Association (SAIA)
Short-term insurance companies that insisted on remaining anonymous
The Southern African Bus Operators Association (SABOA)
Botlhaba Tswana Transport
Elwierda Lux
The Afrox Group
Unitrans Services (Pty) Ltd
Tanker Services
CSIR fleet management
Ledwaba Funeral Parlour
Mamelodi Burial Services
Church Street Funerals
Avbob
Rentmeester Grobbelaars Funeral Services (Pty) Ltd
Prestige Burial Services
SAFFAS
Falcon Funeral Homes
Eden District Municipality
Fire Services Boland District Municipality
Fire Services Tshwane
Eastern Cape Emergency Medical and Rescue Service (Queenstown Metro)
Emergency Medical Services Potchefstroom
Emergency Service Kemptonpark
Emergency Service Groblersdal
Emergency Services Kungwini Local Municipality
ER24 Witbank
KwaZulu-Natal Emergency Rescue Services
Nelson Mandela Metro
Mangaung Local Authority
The South African Police Services

The valuable input of those who commented on the content of the report is also acknowledged.

The findings of this report are those of the authors and do not necessarily reflect the views of the National Department of Transport.

REPORT PREPARED BY:

CSIR Transportek
PO Box 395
PRETORIA
0001
Tel: +27 12 841 3906
Fax+27 12 841 4200

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Background

Road traffic accidents have an enormous impact on South African society in terms of human loss, pain and suffering, and cost to the economy and the individual. CSIR Transportek developed the procedure used to estimate the cost of traffic accidents in South Africa in 1991. The same procedure was used to estimate the cost of accidents again in 1998. However, the CSIR has been estimating the unit cost of accidents periodically since 1962 and the methodology has improved throughout this period, taking into account both local and international research.

Accident unit cost figures used up to now are based on the "Human Capital" approach or the "Gross Output" method, which take into account the following cost aspects:

- Direct costs
    - Hospital, medical and funeral costs
    - Vehicle damage costs
    - Damage to goods carried
    - Damage to fixed property
    - Legal Costs
    - Insurance administrative costs
    - Towing costs
    - Policing and promotion costs
- Loss of output
- Qualitative costs
    - Pain, suffering, and loss of amenities of life

In 1999, the United Kingdom Department for International Development (DFID) commissioned a joint Ross Silcock/ Transport Research Laboratory team to investigate the potential for an improved methodology for road accident costing in developing countries, in line with the DFID focus on sustainable livelihoods The Scoping Study (Silcock et al, 2000) concluded that the "Human Capital" approach, which includes direct costs, loss of output and cost of pain, grief and suffering, is appropriate for use in developing countries. However, the study identified a number of areas for investigation as part of a second phase of actual case studies to be completed in a selected number of developing countries. Research into the vehicle damage cost component entailed additional surveys. The loss of output component was to be broadened to include the financial impacts of road crashes on the family unit by conducting household surveys.

One of the case studies was conducted in South Africa, and the joint Ross Silcock/ Transport Research Laboratory team appointed CSIR Transportek as the local consultant to conduct the surveys and analysis for the areas of potential improvement to the previous costing methodology. The study was conducted in 2001.

In 2002, the National Department of Transport in South Africa identified the need to broaden the current methodology to include unit costs for accident victims according to age groups and severity of casualties, and unit costs for the number of vehicles involved according to vehicle type and type of accident, with a possible further breakdown in terms of urban and rural areas. The tender for the undertaking of a project on the cost of road traffic accidents was awarded to CSIR Transportek, which conducted the study during 2003.

1.2 Objectives of the study

The main objective of the study was to develop a methodology for the estimation of unit accident costs that would facilitate the evaluation of the impact of road safety interventions, for example by calculating the cost-benefit ratio of remedial measures. A further objective was to determine the accident unit cost figures for 2002.

1.3 Content of the report

Chapter 2 discusses the main issues pertaining to accident costing and gives an overview of the methodology used in the current study. Chapter 3 gives the unit cost tables to be used for the calculation of accident costs at a national or local level. Examples are given to assist with calculations. Chapter 4 gives recommendations, including a method for annual adjustment of the unit cost figures.

Details of the study are contained in Annexures A to F. Annexure A gives an overview of international practices to calculate human casualty costs and a review of the previous methods used in South Africa is given in Annexure B. Annexure C gives details of the methodology followed during the current study. Annexures D and E describe the results of the current study that produced the human casualty unit cost and vehicle damage cost tables supplied in Chapter 3. Annexure F compares the human casualty unit cost discussed in Annexure D with similar costs obtained from the Road Accident Fund.

2 METHODOLOGY TO DETERMINE ACCIDENT UNIT COSTS

The calculation of traffic accident costs tends to be a complex and controversial subject. Road safety practitioners need to put a value to this socio-economic burden to demonstrate the impact on society at large in order to encourage more investment into traffic accident and injury prevention. Cost benefit analyses are often done to weigh the cost of the intervention against the cost of the benefits in terms of a saving in accidents or injuries expected to be achieved through this intervention. In these efforts the ethical principles in valuing a human life or the loss of quality of life through injury, tend to become somewhat blurred.

Although note was taken of the sensitivity around reducing pain and suffering to numbers, the purpose of this study was to estimate the total cost of traffic accidents and injuries to the South African society as a whole, within the constraints of the availability of applicable data. Costs to society as a whole meant costs to the individual and its family, the community, government departments, the private sector, and the economy through loss of potential production.

The method used to estimate the human casualty unit cost during this study, was largely based on the value of lost output or productivity, by making use of the average life expectancy, employment rate and income of the population, similar to the previous method used in South Africa. However, the previous method only provided standardised unit costs by severity of the accident, regardless of the number of injuries sustained per accident, whereas the new method calculates standardised unit costs per human casualty. Human casualty costs are also provided for specific age groups.

Whereas the previous method provided vehicle damage costs in terms of severity of the accident, this study provided vehicle damage costs and incident costs according to type of vehicle and type of accident. Person costs per type of accident were also calculated, which enabled the determination of accident costs to a much greater level of detail than before. Costs are also given in terms of urban and rural areas. Urban areas are defined as all built-up city, town and village areas and rural areas as all areas outside of built-up areas.

Efforts were made to calculate unit human casualty costs using data on payments made by the Road Accident Fund (RAF) but these were found to overestimate the costs of fatal and serious injuries and underestimate the costs of slight injuries. The results of these calculations are shown in Annexure F.

There are various reasons why the values of the human casualty cost components derived from RAF payments may not be representative of the “real” costs of traffic casualties. These include:

- Relatively few payments were made during 2002;
- Some claims were several years old and payments were not updated for inflation;
- The victims that claim from the RAF are not representative of the road user population;
- Individual circumstances of the victims were taken into account;
- Actual claims were not paid but payments were based on a fault-based system where “guilty” parties received less compensation, and so on.

Two sets of unit cost tables were prepared, one reflecting the human casualty costs and the other vehicle damage and incident costs. These tables are to be used when calculating accident costs for the various types of accident, various types of vehicle involved, age group of the victims and urban or rural area. Chapter 3 shows the tables as well as examples on how to use their content in calculating accident costs.

3 RESULTS - UNIT COST TABLES TO CALCULATE ACCIDENT COSTS

3.1 Unit cost tables

Table 1 and Table 2 show the unit Human Casualty Costs according to age group and extent of casualty for urban and rural areas respectively.

Table 1: Unit Human Casualty Cost according to age group and severity of injury – Urban Table

Age group	Fatal (killed)	Serious Injury	Slight Injury
0-1	R 479 927	R 214 399	R 112 995
1-4	R 506 457	R 217 689	R 112 995
5-9	R 553 648	R 223 540	R 112 995
10-14	R 590 536	R 228 114	R 112 995
15-19	R 627 581	R 232 708	R 112 995
20-24	R 663 318	R 240 946	R 113 859
25-29	R 686 248	R 243 789	R 113 859
30-34	R 685 154	R 243 653	R 113 859
35-39	R 667 400	R 241 452	R 113 859
40-44	R 633 881	R 237 296	R 113 859
45-49	R 588 077	R 231 616	R 113 859
50-54	R 539 920	R 225 644	R 113 859
55-59	R 480 748	R 218 307	R 113 859
60-64	R 427 700	R 207 923	R 112 995
65-69	R 385 299	R 202 665	R 112 995
70-74	R 353 554	R 198 729	R 112 995
75-79	R 321 039	R 194 697	R 112 995
80 and older	R 273 091	R 188 751	R 112 995
Unknown age	R 624 405	R 236 121	R 113 859

Table 2: Unit Human Casualty Cost according to age group and severity of injury – Rural Table			
Age group	Fatal (killed)	Serious Injury	Slight Injury
0-1	R 482 132	R 180 691	R 113 877
1-4	R 508 662	R 183 041	R 113 877
5-9	R 555 853	R 186 527	R 113 877
10-14	R 592 741	R 187 685	R 113 877
15-19	R 629 786	R 199 057	R 113 877
20-24	R 665 124	R 249 727	R 114 741
25-29	R 688 054	R 280 686	R 114 741
30-34	R 686 960	R 254 966	R 114 741
35-39	R 669 206	R 231 281	R 114 741
40-44	R 635 687	R 218 918	R 114 741
45-49	R 589 883	R 208 077	R 114 741
50-54	R 541 726	R 200 055	R 114 741
55-59	R 482 554	R 194 035	R 114 741
60-64	R 429 906	R 188 066	R 113 877
65-69	R 387 504	R 183 027	R 113 877
70-74	R 355 759	R 180 677	R 113 877
75-79	R 323 244	R 180 215	R 113 877
80 and older	R 275 296	R 180 083	R 113 877
Unknown age	R 629 777	R 239 296	R 114 741

Table 3 and Table 4 show the unit Vehicle Damage and Incident Costs according to accident type and vehicle type for urban and rural areas respectively.

Table 3: Unit Vehicle Damage and Incident Cost according to Accident Type and Vehicle Type – Urban Table (R)

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Average
Head-Rear end	18 601	19 646	23 349	55 433	19 077	19 831	72 634	11 330	15 190	22 669
Sideswipe same direction	17 917	19 586	24 676	36 346	18 809	20 959	38 322	11 330	15 498	22 397
Turn from wrong lane	30 026	21 750	43 420	180 910	33 058	31 577	86 462	11 330	24 223	38 041
Head-on	22 004	20 055	31 317	105 199	22 990	24 371	70 475	11 330	24 499	27 961
Sideswipe opposite direction	19 298	19 536	27 244	55 161	20 631	19 912	68 453	11 330	15 522	24 075
Turn in front of oncoming traffic	19 473	19 918	28 469	87 971	20 213	18 733	73 255	11 330	15 366	24 368
Approach at angle: Both straight	19 074	19 692	28 212	65 216	19 797	21 700	82 060	11 330	18 602	24 091
Approach at angle: Both turning	18 314	19 788	28 000	68 848	19 739	20 798	65 709	11 330	19 053	23 415
Reversing	19 379	20 719	26 736	69 099	21 300	21 188	20 430	11 330	15 625	24 174
Single vehicle: Overturned	32 723	25 825	56 402	190 830	38 932	46 115	246 946	16 730	30 631	44 505
Single vehicle: Fixed object	31 857	27 140	41 824	209 228	34 805	42 692	271 917	17 730	26 997	39 409
Pedestrian	17 279	19 909	17 627	30 195	17 237	19 136	35 023	16 730	21 091	20 017
Bicycle	18 373	24 231	19 801	40 231	18 850	19 253	47 112	17 730	17 763	21 157
Animal	30 334	25 753	33 564	83 775	34 050	36 415	29 430	16 730	16 730	36 966
Other and Unknown	23 877	24 915	34 588	32 603	22 732	36 053	20 430	11 330	12 390	22 912
Average	27 182	26 190	27 103	71 419	28 208	35 528	203 739	29 117	26 923	32 532

Table 4: Unit Vehicle Damage and Incident Cost according to Accident Type and Vehicle Type – Rural Table (R)

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Average
Head-Rear end	20 237	17 156	28 767	64 683	20 249	19 387	132 738	9 380	20 754	24 459
Sideswipe same direction	18 747	17 956	33 599	85 341	20 604	18 316	110 047	9 380	17 426	24 569
Turn from wrong lane	18 988	16 173	27 109	16 130	17 002	14 931	19 280	9 380	16 015	22 008
Head-on	23 843	16 360	38 282	300 599	24 432	21 032	208 377	9 380	26 630	30 748
Sideswipe opp direction	21 386	16 728	30 278	163 523	22 154	18 253	79 346	9 380	15 713	26 055
Turn in front of oncoming traffic	21 011	19 685	35 421	75 087	21 968	18 562	57 099	9 380	12 697	26 777
Approach at angle: Both straight	21 401	17 678	32 791	50 522	21 103	18 598	76 009	9 380	18 858	26 487
Approach at angle: Both turning	19 831	15 363	17 281	16 130	19 508	18 032	19 280	9 380	18 226	22 604
Reversing	18 093	8 880	25 669	30 869	19 341	16 316	57 099	9 380	16 015	22 575
Single vehicle: Overturned	28 750	22 283	55 188	340 689	34 295	43 237	269 455	12 530	25 799	41 454
Single vehicle: Fixed object	28 099	22 844	40 543	206 488	32 170	39 602	211 790	13 620	33 524	37 131
Pedestrian	13 352	15 487	13 578	26 409	13 258	14 644	40 512	12 530	12 530	16 238
Bicycle	14 427	20 529	17 647	25 685	14 454	15 659	27 420	13 620	29 101	17 816
Animal	26 344	18 513	34 268	22 630	26 348	39 617	26 330	12 530	12 530	33 939
Other and Unknown	20 756	15 363	21 421	16 130	17 372	18 424	132 738	9 380	18 226	22 708
Average	23 923	22 886	23 828	71 995	25 041	32 957	216 327	26 032	23 640	29 730

3.2 The use of accident cost estimates for evaluation purposes

Road traffic accident cost estimates can be used for different purposes and it is important that the various purposes be understood clearly before an attempt is made to calculate safety benefits.

It must be noted that the unit cost figures produced during this study should not be used in the calculation of the cost of any single accident. For example, to calculate the cost of one specific accident where a number of overseas visitors are killed as passengers in a luxury tour bus, using the method described in this report would probably underestimate the cost of the accident, as the specific circumstances of the victims would not be taken into account. The unit cost figures described in this report are based on average values and should be understood and used as such.

For the purposes of this study, the aim of traffic accident cost estimates is, firstly, to determine the total cost of road traffic accidents at a national or provincial level and comparing this figure with the budget spent on the improvement of road traffic safety (Section 3.2.1).

The second aim is to determine the total cost of road traffic accidents at a localized level and using this figure in a cost benefit analysis. This could be divided into two different uses. Firstly, to determine the benefits of programmes that aim to reduce the severity of injuries and not necessarily the frequency of accidents, such as programmes to increase seatbelt-wearing rates (Section 3.2.2), and secondly, to determine the benefits of road or intersection improvement projects that aim to reduce accident frequency of specific types of accidents, for example head-on accidents or head-rear end type accidents (Section 3.2.3).

3.2.1 Total accident costs at macro level

Calculating the total accident costs for a country is not as straight forward an exercise as one might imagine. Ozanne-Smith and Watson (Issues in cost of injury research – paper presented at a Conference on Measuring the severity and costs of accidental injuries organised by ECOSA) stated that costs associated with the incident itself, such as legal costs and property damage, should be excluded from the calculation of total costs of injuries, as seen from a public health perspective. In this case, the total costs of road traffic injuries in South Africa should be calculated by multiplying the number of victims of each severity by its associated standardized casualty cost figure as shown in Tables 1 and 2 of this document, and by adding these resultant values together.

Example

Table 5 gives an example of calculating the total traffic injury cost from a public health perspective. The data used in the example are the actual 1998 casualty figures. Columns (a), (b) and (c) of Table 5 represent the actual number of fatal, serious and slight injuries per age group – no injuries in the “0-1” and “unknown age” categories are given and therefore those rows are not used in the calculations. Columns (d), (e) and (f) represent the estimated unit cost figures per severity and age group category, as indicated in Tables 1 and 2 of this document. Columns (g), (h) and (i) are calculated by multiplying the number of injuries by its associated injury unit cost figure ((a) multiplied by (d), (b) multiplied by (e) and (c) multiplied by (f)). Column (j) is derived by adding Columns (g), (h) and (i) together.

The total cost of injuries (human casualty costs) in the example amounted to nearly R 23,8 billion (R 16,6 billion for urban injuries and R 7,2 billion for rural injuries).

However, from a transport safety perspective a more holistic approach could be followed where person costs, vehicle damage and incident costs such as legal and administration costs, are included in the calculation of the total costs of road traffic accidents and injuries in South Africa. In this case, vehicle damage and incident costs, as indicated in Table 3 and 4 of this document should by taken into consideration, in addition to the human casualty costs as shown in Table 5.

Table 6 and Table 7 show examples of calculated vehicle damage and incident costs per vehicle type and accident type. The total vehicle damage and incident costs for urban areas in the example shown in Table 6 amounted to nearly R 17,5 billion and the costs for rural areas amounted to nearly R 1,2 billion (Table 7), giving a total vehicle damage and incident costs of R 18,7 billion.

Adding the human casualty costs to the vehicle damage and incident costs calculated in the example, the total costs were estimated at R 42,5 billion. Eighty per cent of the costs represented accidents occurring in urban areas. Human casualty costs constituted 56 per cent of the total costs.

Table 5: Example of calculating injury costs from a public health perspective

Age group	Number of injuries (actual data)			Cost per injury (from Tables 1 and 2)			Injury costs			Total cost (j): (g) + (h) + (i)
	Fatal (a)	Serious (b)	Slight (c)	Fatal (d)	Serious (e)	Slight (f)	Fatal (g): (a) x (d)	Serious (h): (b) x (e)	Slight (i): (c) x (f)	
Urban areas										
0-4	116	418	763	R 506 457	R 217 689	R 112 995	R 58 749 030	R 90 993 876	R 86 215 195	R 235 958 101
5-9	198	858	1 743	R 553 648	R 223 540	R 112 995	R 109 622 268	R 191 797 614	R 196 950 307	R 498 370 189
10-14	123	714	1 671	R 590 536	R 228 114	R 112 995	R 72 635 892	R 162 873 711	R 188 814 666	R 424 324 269
15-19	181	1 035	3 420	R 627 581	R 232 708	R 112 995	R 113 592 133	R 240 852 819	R 386 442 943	R 740 887 896
20-24	654	3 647	9 431	R 663 318	R 240 946	R 113 859	R 433 809 736	R 878 728 849	R 1 073 806 373	R 2 386 344 958
25-29	1 013	5 275	12 133	R 686 248	R 243 789	R 113 859	R 695 168 827	R 1 285 986 888	R 1 381 454 005	R 3 362 609 720
30-34	667	3 418	8 804	R 685 154	R 243 653	R 113 859	R 456 997 854	R 832 807 326	R 1 002 416 637	R 2 292 221 817
35-39	472	2 471	6 477	R 667 400	R 241 452	R 113 859	R 315 012 803	R 596 627 598	R 737 466 215	R 1 649 106 616
40-44	371	2 157	5 297	R 633 881	R 237 296	R 113 859	R 235 169 932	R 511 846 504	R 603 112 327	R 1 350 128 763
45-49	352	1 813	4 410	R 588 077	R 231 616	R 113 859	R 207 003 166	R 419 919 536	R 502 119 192	R 1 129 041 894
50-54	300	1 525	3 709	R 539 920	R 225 644	R 113 859	R 161 975 889	R 344 107 579	R 422 303 874	R 928 387 342
55-59	304	1 412	3 061	R 480 748	R 218 307	R 113 859	R 146 147 348	R 308 249 504	R 348 523 095	R 802 919 946
60-64	176	866	2 009	R 427 700	R 207 923	R 112 995	R 75 275 283	R 180 061 207	R 227 006 980	R 482 343 471
65-69	77	371	859	R 385 299	R 202 665	R 112 995	R 29 668 051	R 75 188 765	R 97 062 716	R 201 919 532
70-74	22	85	300	R 353 554	R 198 729	R 112 995	R 7 778 197	R 16 891 945	R 33 898 504	R 58 568 646
75-79	11	64	178	R 321 039	R 194 697	R 112 995	R 3 531 428	R 12 460 598	R 20 113 112	R 36 105 138
80+	22	97	193	R 273 091	R 188 751	R 112 995	R 6 007 994	R 18 308 871	R 21 808 037	R 46 124 902
Total	5 059	26 226	64 458				**R 3 128 145 831**	**R 6 167 703 190**	**R 7 329 514 180**	**R 16 625 363 200**
Rural areas										
0-4	80	96	229	R 508 662	R 183 041	R 113 877	R 40 692 977	R 21 165 306	R 26 077 778	R 87 936 062
5-9	114	138	292	R 555 853	R 186 527	R 113 877	R 63 367 229	R 31 232 655	R 33 252 014	R 127 851 898

Table 5: Example of calculating injury costs from a public health perspective

Age group	Number of injuries (actual data)			Cost per injury (from Tables 1 and 2)			Injury costs			Total cost (j): (g) + (h) + (i)
	Fatal (a)	Serious (b)	Slight (c)	Fatal (d)	Serious (e)	Slight (f)	Fatal (g): (a) x (d)	Serious (h): (b) x (e)	Slight (i): (c) x (f)	
10-14	77	163	380	R 592 741	R 187 685	R 113 877	R 45 641 040	R 37 636 322	R 43 273 169	R 126 550 531
15-19	122	367	862	R 629 786	R 199 057	R 113 877	R 76 833 881	R 86 425 300	R 98 161 768	R 261 420 949
20-24	512	1 364	2 819	R 665 124	R 249 727	R 114 741	R 340 747 624	R 332 446 232	R 323 454 810	R 996 648 666
25-29	740	2 159	3 977	R 688 054	R 280 686	R 114 741	R 509 454 977	R 532 349 434	R 456 324 859	R 1 498 129 271
30-34	552	1 494	3 033	R 686 960	R 254 966	R 114 741	R 379 422 316	R 368 176 345	R 348 009 379	R 1 095 608 039
35-39	399	1 012	2 233	R 669 206	R 231 281	R 114 741	R 267 172 423	R 247 165 944	R 256 216 598	R 770 554 965
40-44	372	885	1 752	R 635 687	R 218 918	R 114 741	R 236 624 097	R 212 469 732	R 201 026 189	R 650 120 018
45-49	307	670	1 359	R 589 883	R 208 077	R 114 741	R 181 216 647	R 157 047 391	R 155 932 986	R 494 197 024
50-54	279	611	1 050	R 541 726	R 200 055	R 114 741	R 151 252 789	R 139 569 237	R 120 478 024	R 411 300 050
55-59	199	509	839	R 482 554	R 194 035	R 114 741	R 96 107 631	R 112 534 940	R 96 267 678	R 304 910 249
60-64	144	343	632	R 429 906	R 188 066	R 113 877	R 61 906 397	R 72 272 197	R 71 970 113	R 206 148 707
65-69	70	137	282	R 387 504	R 183 027	R 113 877	R 27 125 310	R 28 146 428	R 32 113 247	R 87 384 984
70-74	16	22	76	R 355 759	R 180 677	R 113 877	R 5 692 152	R 4 433 264	R 8 654 634	R 18 780 050
75-79	13	17	37	R 323 244	R 180 215	R 113 877	R 4 202 172	R 3 357 161	R 4 213 440	R 11 772 773
80+	13	33	48	R 275 296	R 180 083	R 113 877	R 3 578 844	R 6 320 638	R 5 466 085	R 15 365 567
Total	4 009	10 020	19 900				**R 2 491 038 506**	**R 2 392 748 526**	**R 2 280 892 771**	**R 7 164 679 803**
All areas together										
Total	9 068	36 246	84 358				**R 5 619 184 336**	**R 8 560 451 716**	**R 9 610 406 951**	**R 23 790 043 003**

Table 6: Example of calculating vehicle damage and incident costs – Urban areas

Number of vehicles involved in traffic accidents (actual data)

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total
Head-Rear end	191 846	2 073	21 079	2 461	44 344	10 192	520	194	9 254	281 963
Sideswipe same direction	80 560	1 761	13 795	2 618	21 358	8 982	580	172	5 586	135 412
Turn from wrong lane	13 078	300	2 385	293	3 561	1 351	90	31	557	21 646
Head-on	8 062	216	1 148	116	2 085	474	26	19	347	12 493
Sideswipe opposite direction	28 398	594	4 071	601	7 577	2 201	134	65	1 329	44 970
Turn in front of oncoming traffic	14 211	548	1 517	136	3 557	607	47	16	326	20 965
Approach at angle: Both straight	35 552	873	3 981	385	8 182	1 393	83	50	1 122	51 621
Approach at angle: Both turning	12 584	340	1 685	297	3 334	974	90	24	563	19 891
Reversing	45 475	245	4 512	492	13 932	3 669	155	86	1 808	70 374
Single vehicle: Overturned	6 745	586	1 117	68	2 916	739	67			12 238
Single vehicle: Fixed object	41 613	529	3 485	675	20 026	4 148	206		24	70 706
Pedestrian	21 204	376	5 222	450	7 214	856	46		10	35 378
Bicycle	4 889	76	558	66	1 115	228	17		107	7 056
Animal	4 939	123	428	28	1 489	176	11		5	7 199
Other	1 875	47	281	50	560	157	9	10	477	3 466
Total	511 031	8 687	65 264	8 736	141 250	36 147	2 081	667	21 515	795 378

Vehicle damage and incident unit costs per vehicle (from Table 3)

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	
Head-Rear end	R 18 601	R 19 646	R 23 349	R 55 433	R 19 077	R 19 831	R 72 634	R 11 330	R 15 190	
Sideswipe same direction	R 17 917	R 19 586	R 24 676	R 36 346	R 18 809	R 20 959	R 38 322	R 11 330	R 15 498	
Turn from wrong lane	R 30 026	R 21 750	R 43 420	R 180 910	R 33 058	R 31 577	R 86 462	R 11 330	R 24 223	

Table 6: Example of calculating vehicle damage and incident costs – Urban areas

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total
Head-on	R 22 004	R 20 055	R 31 317	R 105 199	R 22 990	R 24 371	R 70 475	R 11 330	R 24 499	
Sideswipe opposite direction	R 19 298	R 19 536	R 27 244	R 55 161	R 20 631	R 19 912	R 68 453	R 11 330	R 15 522	
Turn in front of oncoming traffic	R 19 473	R 19 918	R 28 469	R 87 971	R 20 213	R 18 733	R 73 255	R 11 330	R 15 366	
Approach at angle: Both straight	R 19 074	R 19 692	R 28 212	R 65 216	R 19 797	R 21 700	R 82 060	R 11 330	R 18 602	
Approach at angle: Both turning	R 18 314	R 19 788	R 28 000	R 68 848	R 19 739	R 20 798	R 65 709	R 11 330	R 19 053	
Reversing	R 19 379	R 20 719	R 26 736	R 69 099	R 21 300	R 21 188	R 20 430	R 11 330	R 15 625	
Single vehicle: Overturned	R 32 723	R 25 825	R 56 402	R 190 830	R 38 932	R 46 115	R 246 946	R 16 730	R 30 631	
Single vehicle: Fixed object	R 31 857	R 27 140	R 41 824	R 209 228	R 34 805	R 42 692	R 271 917	R 17 730	R 26 997	
Pedestrian	R 17 279	R 19 909	R 17 627	R 30 195	R 17 237	R 19 136	R 35 023	R 16 730	R 21 091	
Bicycle	R 18 373	R 24 231	R 19 801	R 40 231	R 18 850	R 19 253	R 47 112	R 17 730	R 17 763	
Animal	R 30 334	R 25 753	R 33 564	R 83 775	R 34 050	R 36 415	R 29 430	R 16 730	R 16 730	
Other	R 23 877	R 24 915	R 34 588	R 32 603	R 22 732	R 36 053	R 20 430	R 11 330	R 12 390	
Vehicle damage and incident costs (actual data x unit cost figures)										
Vehicles	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total costs
Head-Rear end	3 568 434 165	40 725 697	492 182 899	136 421 583	845 971 929	202 121 526	37 769 602	2 198 020	140 571 264	5 466 396 686
Sideswipe same direction	1 443 370 829	34 490 538	340 398 647	95 153 648	401 717 248	188 253 511	22 227 020	1 948 760	86 571 806	2 614 132 008
Turn from wrong lane	392 678 205	6 525 087	103 556 682	53 006 737	117 719 709	42 660 370	7 781 549	351 230	13 492 441	737 772 010
Head-on	177 397 523	4 331 869	35 952 100	12 203 138	47 933 817	11 551 625	1 832 351	215 270	8 501 186	299 918 879
Sideswipe opposite direction	548 026 513	11 604 343	110 912 170	33 151 905	156 323 416	43 825 920	9 172 705	736 450	20 629 107	934 382 530
Turn in front of oncoming traffic	276 732 876	10 914 971	43 188 158	11 964 016	71 897 681	11 371 229	3 443 000	181 280	5 009 215	434 702 426
Approach at angle: Both straight	678 113 349	17 190 932	112 311 693	25 107 981	161 979 755	30 227 421	6 810 942	566 500	20 871 914	1 053 180 488
Approach at angle: Both turning	230 467 800	6 727 999	47 179 192	20 447 780	65 810 357	20 257 507	5 913 796	271 920	10 726 623	407 802 975
Reversing	881 270 891	5 076 132	120 631 857	33 996 615	296 745 943	77 740 134	3 166 650	974 380	28 249 147	1 447 851 750
Single vehicle: Overturned	220 719 541	15 133 740	63 001 236	12 976 453	113 526 483	34 079 062	16 545 385	0	0	475 981 900
Single vehicle: Fixed object	1 325 682 834	14 356 953	145 755 316	141 228 968	696 999 623	177 085 683	56 014 943	0	647 931	2 557 772 251

Table 6: Example of calculating vehicle damage and incident costs – Urban areas										
	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total
Pedestrian	366 388 986	7 485 617	92 047 350	13 587 705	124 345 496	16 380 511	1 611 070	0	210 910	622 057 645
Bicycle	89 825 896	1 841 572	11 048 739	2 655 256	21 018 279	4 389 616	800 899	0	1 900 682	133 480 940
Animal	149 821 622	3 167 651	14 365 574	2 345 702	50 700 405	6 409 112	323 730	0	83 650	227 217 446
Other	44 768 576	1 171 024	9 719 351	1 630 137	12 729 757	5 660 301	183 870	113 300	5 910 068	81 886 384
Total cost: urban areas	**10 393 699 607**	**180 744 128**	**1 742 250 965**	**595 877 624**	**3 185 419 899**	**872 013 528**	**173 597 513**	**7 557 110**	**343 375 944**	**17 494 536 318**

Table 7: Example of calculating vehicle damage and incident costs – Rural areas										
	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total
Number of vehicles involved in traffic accidents (actual data)										
Head-Rear end	4 268	43	686	87	2 134	1 012	39	84	283	8 636
Sideswipe same direction	2 192	22	415	78	1 327	790	34	46	276	5 180
Turn from wrong lane	266	4	48	9	214	66	4	12	16	639
Head-on	778	10	136	21	487	186	6	9	39	1 672
Sideswipe opposite direction	1 524	18	219	53	829	518	32	20	155	3 368
Turn in front of oncoming traffic	343	6	55	5	177	61	3	14	13	677
Approach at angle: Both straight	519	8	79	11	303	107	4	14	53	1 098
Approach at angle: Both turning	274	1	42	7	145	64	1	5	14	553
Reversing	317	0	68	7	202	103	2	5	23	727
Single vehicle: Overturned	4 712	77	714	48	2 630	799	27		4	9 011
Single vehicle: Fixed object	3 602	20	268	46	1 464	378	19		3	5 800
Pedestrian	955	6	197	18	598	95	3			1 872
Bicycle	276	3	45	7	150	23	0	0	4	508
Animal	2 787	8	308	30	1 300	250	5		2	4 690
Other	91	1	20	3	44	21	1	2	30	213
Total	22 904	227	3 300	430	12 004	4 473	180	211	915	44 644

Table 7: Example of calculating vehicle damage and incident costs – Rural areas

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total
Vehicle damage and incident unit costs per vehicle (from Table 4)										
	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	
Head-Rear end	R 20 237	R 17 156	R 28 767	R 64 683	R 20 249	R 19 387	R 132 738	R 9 380	R 20 754	
Sideswipe same direction	R 18 747	R 17 956	R 33 599	R 85 341	R 20 604	R 18 316	R 110 047	R 9 380	R 17 426	
Turn from wrong lane	R 18 988	R 16 173	R 27 109	R 16 130	R 17 002	R 14 931	R 19 280	R 9 380	R 16 015	
Head-on	R 23 843	R 16 360	R 38 282	R 300 599	R 24 432	R 21 032	R 208 377	R 9 380	R 26 630	
Sideswipe opposite direction	R 21 386	R 16 728	R 30 278	R 163 523	R 22 154	R 18 253	R 79 346	R 9 380	R 15 713	
Turn in front of oncoming traffic	R 21 011	R 19 685	R 35 421	R 75 087	R 21 968	R 18 562	R 57 099	R 9 380	R 12 697	
Approach at angle: Both straight	R 21 401	R 17 678	R 32 791	R 50 522	R 21 103	R 18 598	R 76 009	R 9 380	R 18 858	
Approach at angle: Both turning	R 19 831	R 15 363	R 17 281	R 16 130	R 19 508	R 18 032	R 19 280	R 9 380	R 18 226	
Reversing	R 18 093	R 8 880	R 25 669	R 30 869	R 19 341	R 16 316	R 57 099	R 9 380	R 16 015	
Single vehicle: Overturned	R 28 750	R 22 283	R 55 188	R 340 689	R 34 295	R 43 237	R 269 455	R 12 530	R 25 799	
Single vehicle: Fixed object	R 28 099	R 22 844	R 40 543	R 206 488	R 32 170	R 39 602	R 211 790	R 13 620	R 33 524	
Pedestrian	R 13 352	R 15 487	R 13 578	R 26 409	R 13 258	R 14 644	R 40 512	R 12 530	R 12 530	
Bicycle	R 14 427	R 20 529	R 17 647	R 25 685	R 14 454	R 15 659	R 27 420	R 13 620	R 29 101	
Animal	R 26 344	R 18 513	R 34 268	R 22 630	R 26 348	R 39 617	R 26 330	R 12 530	R 12 530	
Other	R 20 756	R 15 363	R 21 421	R 16 130	R 17 372	R 18 424	R 132 738	R 9 380	R 18 226	
Vehicle damage and incident costs (actual data x unit cost figures)										
Vehicles	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total costs
Head-Rear end	86 371 540	737 700	19 734 493	5 627 427	43 210 611	19 619 356	5 176 800	787 920	5 873 302	187 139 148
Sideswipe same direction	41 093 178	395 028	13 943 728	6 656 578	27 341 141	14 469 308	3 741 590	431 480	4 809 659	112 881 689
Turn from wrong lane	5 050 703	64 692	1 301 241	145 170	3 638 437	985 419	77 120	112 560	256 235	11 631 577
Head-on	18 549 489	163 601	5 206 373	6 312 578	11 898 204	3 911 993	1 250 265	84 420	1 038 575	48 415 499

Table 7: Example of calculating vehicle damage and incident costs – Rural areas

	Motorcar	Motorcycle	Minibus	Bus	LDV bakkie	Truck	Articulated truck	Tractor	Other / Unknown	Total
Sideswipe opposite direction	32 591 788	301 095	6 630 870	8 666 732	18 366 029	9 455 028	2 539 080	187 600	2 435 529	81 173 751
Turn in front of oncoming traffic	7 206 882	118 107	1 948 138	375 436	3 888 391	1 132 258	171 298	131 320	165 065	15 136 896
Approach at angle: Both straight	11 107 137	141 424	2 590 520	555 739	6 394 096	1 989 970	304 037	131 320	999 479	24 213 722
Approach at angle: Both turning	5 433 784	15 363	725 820	112 910	2 828 588	1 154 016	19 280	46 900	255 167	10 591 828
Reversing	5 735 449	0	1 745 520	216 085	3 906 979	1 680 597	114 199	46 900	368 337	13 814 067
Single vehicle: Overturned	135 471 108	1 715 813	39 404 024	16 353 077	90 195 293	34 546 190	7 275 292	0	103 197	325 063 995
Single vehicle: Fixed object	101 212 341	456 882	10 865 603	9 498 431	47 096 595	14 969 646	4 024 010	0	100 572	188 224 078
Pedestrian	12 751 032	92 925	2 674 870	475 368	7 928 422	1 391 142	121 537	0	0	25 435 296
Bicycle	3 981 733	61 586	794 126	179 797	2 168 098	360 149	0	0	116 404	7 661 892
Animal	73 419 755	148 102	10 554 516	678 900	34 251 800	9 904 304	131 650	0	25 060	129 114 086
Other	1 888 785	15 363	428 419	48 390	764 383	386 908	132 738	18 760	546 787	4 230 533
Total cost: rural areas	**541 864 702**	**4 427 679**	**118 548 260**	**55 902 618**	**303 877 068**	**115 956 285**	**25 078 897**	**1 979 180**	**17 093 368**	**1 184 728 057**

3.2.2 Injury prevention and reduction

Some interventions and measures aimed at reducing the severity of injuries sustained by victims involved in road traffic accidents do not necessarily reduce the frequency of accidents. Examples are programmes to increase seatbelt wearing, pedestrian-friendly vehicle design, breakaway poles, the removal of roadside furniture, the provision of guardrails, the reduction of operating speed, etc. The benefit of these measures is measured in terms of the change in distribution of persons per casualty class or severity of injury. It must also be kept in mind that the type of accident might change after introduction of the measure, for example, removal of hazardous roadside items might change the accident type from colliding with a fixed object to type overturned.

To calculate the saving in injury costs at site level, the person costs given in Table 8 should be used. Because these interventions are aimed at reducing injuries, vehicle damage and incident costs are not taken into account.

Table 8: Person costs per accident (R)

Accident type	**Urban**	**Rural**	**Anywhere**
Single-Vehicle Accidents			
Overturned	250 094	232 747	261 454
Fixed object	157 718	170 167	160 423
Animal	131 227	142 762	145 279
Pedestrian	128 004	79 079	126 080
Bicycle	102 568	105 317	113 153
Multiple-Vehicle Accidents			
Head-Rear end	145 744	199 775	151 707
Sideswipe same direction	150 014	204 223	154 902
Sideswipe opposite direction	180 723	244 272	198 317
Head-on	328 981	339 839	397 319
Turn from wrong lane	155 542	193 198	154 443
Turn in front of oncoming traffic	181 205	260 712	185 807
Both straight	178 803	269 241	175 778
Both turning	151 572	215 982	153 062
Reversing	123 287	195 540	131 953
Accidents of any category			
Any type	174 070	211 349	184 348

To calculate the safety benefit of, for example, the installation of guardrails in order to reduce the severity of single-vehicle accidents where vehicles leave the road and overturn at a particular section of road in a rural area, read the person cost of such an accident (overturned in rural area) from Table 8: R 232 747. When a guardrail is installed, these accidents would become accidents involving fixed objects - read the person costs of an accident involving a fixed object in rural area from Table 8: R 170 167. The saving in person costs is R 232 747 – R 170 167 = R 62 580 per accident. If the accident severity per year at this site and the cost of installing the guardrail were known, a cost-benefit analysis could be done.

3.2.3 Accident frequency reduction

To determine the cost-benefit of a countermeasure that aims to reduce accident frequency at a site, along a route or over an area, the number of accidents by accident type should be determined before and after implementation of the countermeasure. For example, the installation of new traffic signals could impact on the frequency of accidents of a number of different types of accident, namely head-rear end, turn from wrong lane, turn in front of oncoming traffic, both straight, both turning and other accident types. The statistically significant changes within any of these accident types should be calculated and multiplied by the respective accident type cost as given in Table 3 or Table 4 of this document. To calculate the benefit-cost ratio, capital and operating costs, the evaluation period and the discount rate should be taken into account.

Countermeasures that could affect the frequency of specific types of accident, for example pedestrian accidents, are the provision of sidewalks, refuge islands and raised pedestrian crossings. However, it must be kept in mind that such measures could affect the frequency of other types of accident, either negatively or positively, and thus the change in frequency of all accident types should be calculated. The provision of a pedestrian crossing might affect pedestrian accidents positively but might have a negative impact on head-rear end accidents. The provision of traffic islands at intersections might decrease the number of pedestrian accidents but might also positively affect the number of vehicle accidents involving turning movements.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Comparison with previous studies

The approach used in this study to determine the costs of road traffic accidents differs from the previous approach used - during previous studies the main results produced unit costs of a fatal accident, a serious or major accident, a slight or minor accident and a non-injury or damage-only accident – those results did not reflect the severity levels of the various victims involved in a particular accident and would therefore underestimate the cost of traffic accidents. Further, the approach described in this document produced standardised unit costs of human casualties according to severity of injury and age group of the victims, which should be used to evaluate the impact of interventions aimed at reducing the severity of injuries.

Standardised unit costs of accidents according to type of accident and type of vehicle were also produced, which should be used to evaluate the impact of, for example, engineering projects aimed at reducing the accident frequency of a particular type of accident. These unit costs were calculated independently of accident severity for a number of reasons, such as:

- vehicle repair costs are not directly related to the severity of the accident – modern vehicle design could cause an accident with minor or no injuries to result in 100 per cent damage to, and thus full replacement of, the vehicle involved;
- accident reporting, recording and analysis, other administrations costs, towing costs, etc are independent of the severity of the accident.

4.2 Comparison of methods used in this study

The human casualty costs calculated using productivity values amounted to R 624 405 for a fatality, R 236 121 for a serious injury and R 113 859 for a slight injury in an urban area. The figures for rural areas differ slightly – R 629 777 for a fatality, R 239 296 for a serious injury and R 114 741 for a slight injury. The lost output component contributed to 70,9 per cent of the human casualty cost of a fatality, 9,4 per cent of a serious injury and 0,1 per cent of a slight injury.

The human casualty costs calculated using RAF payments for 2002 amounted to R 898 924 for a fatality, R 761 614 for a serious injury and R 82 306 for a slight injury. The lost output component contributed to 76 per cent of the human casualty cost of a fatality, 54 per cent of a serious injury and 3 per cent of a slight injury.

It is recommended that the method using RAF payment data only, not be used when calculating road accident costs, as this method is based on a small sample that is not representative of road accident victim population of South Africa. At the time of payment, some claims were several years old and especially payments of medical and hospital costs had not been updated for inflation; the victims that claim from the RAF were not necessarily representative of the road user population; actual claims were not paid but payments were based on a fault-based system where “guilty” parties received less compensation, and so on.

Further, it seems that the method using RAF payment data overestimates the human casualty costs for serious injuries, particularly the payments made for lost future earnings. Hospital and medical cost payments made during 2002 also differ considerably from the payments made by the Road Accident Fund in previous years.

Values for cost components such as pain and suffering, legal and administration costs could still be obtained from the Road Accident Fund but it is recommended that the value of lost productivity be calculated regularly by updating income and unemployment rates per age group. Life expectancy values may be updated from time to time from studies done by institutions such as the World Health Organisation.

It must be mentioned that note has been taken of the “friction cost method” that is being developed in an effort to better estimate the value of lost productivity. These new developments resulted from the criticism that the human capital approach overestimates the value of lost productivity in a society with high unemployment – permanent loss of productivity in the case of death or disability may result in a high costs to the individual but costs society very little as absences are covered relatively quickly by previously unemployed persons. Standardised unit costs of human casualties should be recalculated when the friction cost method has been fully developed and accepted.

Where vehicle repair costs are concerned it is recommended that South African Insurance Association and its member companies be made aware of the need to store the required data centrally in order to facilitate painless calculation of vehicle repair and other related costs. This could be done without compromising the need for confidentiality demanded by short-term insurance companies.

4.3 Annual adjustment of unit cost figures

It is recommended that the unit cost figures be adjusted for inflation on an annual basis by using the Consumer Price Index.

It is recommended that the data used for the calculation of the unit human casualty cost be updated every five years to accommodate changes in income levels, employment rates and life expectancy figures for the South African population. The “human capital approach” method used should be reviewed periodically to keep abreast of developments and to reflect new thinking in this area, e.g. as soon as the ‘friction cost” method becomes standard practice, this should become part of the methodology for estimating human casualty costs.

Further, it is recommended that all the data used for the calculation of unit vehicle damage and incident cost figures be update every five years to accommodate changes in vehicle prices and in vehicle repair, operational and administration costs.

ANNEXURE

A INTERNATIONAL PRACTICES USED IN CALCULATING HUMAN CASUALTY COSTS

One of the human components of accident cost is the loss of economic output of persons killed or injured in accidents. In a study by de Haan (1992), lost output represented a proportion of 23% of the cost of an accident. In a fatal accident, the loss of output represented 80 % of the cost. In a study in 1994 in the USA, loss of wages over remaining life and loss of productive household activity were 85% of total cost of a fatal accident (lost wages represented 70%). Lost wages were 28% of the average cost of an accident. In this same study, household productivity lost accounted for 8.2% of the cost of all crashes and 15.9% of the cost of fatal crashes.

Loss of future earnings or loss of output is thus a major component of especially fatal accidents and will have a major influence on the calculation of the cost of fatal injuries.

A1 Incidence and prevalence

Cost can be prevalence or incidence based. Prevalence-based costs measure all problem-related expenses during one year, regardless of when the problem occurred. These costs are often used to project health care spending. (Denmark conference)

Incidence based costs sum the lifetime costs that are expected to result from problems that arose during a single year. These costs measure the savings the prevention can yield.

Discounting: in incidence-based costing and cost-outcome analysis, future costs and benefits must be discounted to present value. The PCEHM (US Panel on Cost-Effectiveness in Health and Medicine) recommends that a 3% discount rate be used to accommodate cross-study comparisons. Governments often require analyses of proposed government investments at discount rates of 7% to 10% to offset optimistic impact estimates, lowering total expected benefits.

A2 Willingness-to-pay/contingent valuation

This approach entails the use of surveys to measure people's willingness to pay (WTP) or willingness to accept (WTA). WTP is the maximum amount of money an individual is prepared to give up to ensure that a proposed project is undertaken. WTA is the minimum amount of monetary compensation the individual needs in order voluntarily to accept that the proposed project is not undertaken. (Prague seminar).

The Value of a Statistical Life (VOSL) is defined as the marginal willingness to pay to avoid the risk of a fatal accident, averaged over a large number of people. The values based on willingness to pay are considerably higher than those based on gross or net earnings. (CR-99/009)

A3 Human-capital method or gross-output method

The human-capital method considers human life as an investment with potential future returns. When an investment is lost, a stream of potential returns is also lost. The individual is the focal point. All markets, including the labour market, are perfectly competitive if there is no employment. (Prague seminar).

Since this approach values life as the value of forgone production, a life is cut short when a person dies (or become disabled) before the age of normal retirement (often assumed to be 65 for men and 60 for women). One of the arguments against this method, is the fact that the real earnings may be more than the real cost to society, e.g. short absences from work may be covered by other workers or made up by the sick persons themselves. For longer absences, workers may be drawn from the pool of unemployed. Another criticism of the human-capital method, is that it takes the value of life on non-income producing people (children and the unemployed) as negligible or zero. Furthermore, groups of workers who receive "lower" wages or no wages (e.g. through unpaid housework) are considered worth "less" in money terms. (Ec Cost of Healthwww.nohsc.gov.au).

Koopmanschap and Van Ineveld argue that the loss will generally be confined to the period needed to adapt to the changed situation. Expected production losses due to illness may be much smaller than potential losses because process within the firm and on the labour market lead to replacement and, after a period of adaptation, reduce the production loss substantially. This method, called the frictional method for estimating indirect costs, reduces the potential production loss assumption used in the human capital approach to the time it takes a firm to adapt to the (productive) loss of a sick worker.

Discounting is usually used in the human-capital approach.

A report by the Bureau of Transport and Regional Economics (BTRE) summarises the different arguments in regard to the willingness-to-pay and human capital approaches. This is shown in Table A1.

Table A1: Advantages and disadvantages of the human-capital and willingness-to-pay approach

APPROACH	ADVANTAGES	DISADVANTAGES
Human Capital	Data more reliable and available	Values some lives higher than other due to labour market inequities, such as wage discrimination. Simplistically applied, the very young and old are undervalued
	Consistent and transparent results	Overestimates costs in an economy with less than full employment
	Simple to use	Does not reflect a key reason for investment in safety: aversion to death / injury rather than income protection
		Ignores the loss of 'joy of life', while values for pain, suffering and grief are often arbitrary
		Actuarial uncertainties regarding life expectancy and earnings
		Selection of appropriate discount rate is controversial
Willingness to Pay	Comprehensive	People have difficulty understanding and valuing small risks (generally less than 1 in 10000)
	Incorporates subjective welfare costs	Individual perceptions of risk may differ
	Reflects individual preferences	WTP does not necessarily imply ability to pay
		Differences exist between peoples expenditure patterns/ actions and their real preferences
		Aggregating the individual WTP may not produce the social WTP, as individuals may ignore external social costs
		Difficulty in applying the value of a statistical life rather than a particular life
		Methodological difficulties (e.g. inaccurate responses) and strategic behaviour in surveys
		Equity is not taken into account
		Discrepancy in results using WTP and WTA
		Values will change with income and variations in road safety

A4 Some problems in low income countries

Due to a scarcity of good rehabilitation care facilities and lack of aids for the disabled, road crash victims suffering permanent disability would suffer greater lack of access to employment opportunities in low income countries. Owing to lack of welfare functions provided by the state and health care facilities, families of injury victims have to spend more time looking after injury victims in low income countries. This causes greater time loss and implied economic loss. Data may not be available. The experience of poor communities in coping with medical catastrophes is different than that experienced by economically well-off communities. (Denmark Conference)

Mohan identified the following problems during the Conference:

- Inappropriate or absence of treatment leading to complications and longer treatment time
- Reallocation of labour of family members and reduced productivity of the whole family
- Permanent loss of job for the victim even if he/she survives
- Loss of land, personal savings, household goods
- Poor health and educational attainment of surviving members
- Dissolution or reconstitution of the household
- Since a large number of poor households depend on daily wages and temporary jobs, don't have health insurance, or the assistance of social welfare schemes, a serious injury can result in the permanent reduction of income.

A4.1 Disability Adjusted Life Years (DALYs) and Quality Adjusted Life Years (QALYs)

Calculation of DALYs allows the comparison of disability and death on a common scale. Although this does not translate directly into a cost, it allows nevertheless the comparison of one type of injury or illness, with another type of injury or illness, to illustrate the "burden of disease" of that particular injury. This measure quantifies the number of years lost due to disability and early mortality.

A QALY is a health outcome measure that assigns a value of 1 to a year of perfect health and 0 to a death. QALY loss is determined by the duration and severity of the health problem. To compute this, one estimates the fraction of perfect health lost during each year that a victim is recovering from a health problem or living with a residual disability, then sums these fractions. People killed lose a full QALY per life-year (adjusted for pre-existing conditions). Miller (in Injury Prevention and Control) suggests that QALY be monetised through the WTP approach.

A4.2 CPSC Injury Cost Model (USA) (internet)

The morbidity cost of injury is represented by the wages lost by people who either are unable to work at all because of injury and disability or cannot work at a level of full effectiveness; for persons too sick to perform their usual housekeeping services an imputed value of the services is included. Calculating the morbidity cost involves applying average earnings by age and gender to work-loss years for those currently employed, attaching money value to housekeeping services lost and applying labour force participation rates and earnings to persons who cannot be employed due to injury. In this model, morbidity due to injury is calculated as the number of days of restricted activity, times the average daily earnings (real or imputed) and adjusted to reflect the probability that the person will survive.

The cost of mortality is calculated in the same way, except for the values of days lost (which in the morbidity calculation is related to the real days lost and mortality to life days lost in the future). In the morbidity calculation, the lost life expectancy due to the injury is also taken into account.

The USA costing model makes use of a value to represent the rate of increase in labour productivity.

A4.3 NOHSC - Australia

In this method the total number of productive years of life lost (by age and gender), were multiplied by the appropriate average earnings, adjusted for unemployment rates. Life years lost up to age 65 for males and 60 for females have been used to estimate the cost of lost production. The life years lost were converted to a present value by weighting future life years using a discount figure of 5%. This discounting procedure is performed to account for society's 'time preference', that is people would rather benefit now than later and put off future costs rather than pay them now.

A4.4 Earnings

Miller: Work loss cost value productivity losses. This includes victim's loss of wages and the replacement cost of lost household work, as well as fringe benefits. This category also include victim work loss from death or disability (permanent and short term) and losses by family and friends who care for sick children, travel delay for uninjured travelers and employer productivity costs caused by temporary or permanent worker absence (e.g. the cost of hiring and training replacement workers)

Miller: Children under 15 will not lose work in the short term. When children are impaired sufficiently that they would have been able to work if they had been employed, someone else generally will lose work while serving as a care giver. It is reasonable to assume parental work loss equals the loss that normally occurs when an adult suffers a comparable injury. For other age groups the value of lost work depends on the work that someone of the victims age and gender normally would do and the amount they would earn.

A4.5 Data required

To enable different calculations, it is necessary to have the following data:

- Different labour force participation rates (employment, participation, economically active)
- Income of employed persons by age group and gender
- Income of informal sector by age group and gender
- Life expectancy per age group
- GDP per capita
- Days lost due to non-permanent disability
- The effect of partial disability on employment
- The severity of the injury
- The degree of disability
- The likelihood of a man / woman in a particular age group living to a certain age

A4.6 Assumptions

Use of the methodology requires a number of assumptions regarding economically active ages, economically active persons, the output of persons in the informal sector who are economically active but for whom no data are available, the output of persons providing unpaid services such as homemakers and voluntary workers, duration of productive time lost by persons who are injured or disabled and whether persons injured or killed in road accidents are representative of or differ from the population.

A4.7 Data available in South Africa

A4.7.1 Life expectancy

Between 1996 and 2001, South Africa had an average life expectancy of 57.1 years (Institute of Futures Research). In 2002, this decreased to 50.6 for males and 53.1 for females. Life Tables for the South African population (Male and Female) were obtained for 2000.

According to an Medical Research Council report[1], HIV/AIDS will cause the average life expectancy to fall drastically in the next decade, but increase again in later years. It is important that updated life tables be obtained to update future cost calculations.

For each age group, the following is calculated (based on gender):

- The average life expectancy for the age group
- The probability that a person from that age group will reach 60 (taken as retirement age)
- For persons under 30, the probability that a person from that age group will reach 30
- For persons older than 60, the probability of reaching 85

Table A2 shows calculations based on life tables prepared by the World Health Organisation.

Table A2: Calculations based on life tables for South Africa (2000) World Health Organisation

Age	Gender	Probability to die before 65	Probability to die before 60	Probability to die before 30	Probability to die before 85	Life expectancy
<1	Male	0.672570	0.611437	0.197315		50.08229
1 to 4		0.609550	0.585303	0.143328		54.41038
5 to 9		0.640278	0.573117	0.118154		56.38877
10 to 14		0.637462	0.569774	0.111250		56.75589
15 to 19		0.635274	0.567178	0.105886		57.01091
20 to 24		0.630053	0.560982	0.093088		57.54786
25 to 29		0.618247	0.546972	0.064145		58.60252
30 to 34		0.592081	0.515920			60.59726
35 to 39		0.545887	0.461102			63.5526
40 to 44		0.488711	0.393251			66.58094
45 to 49		0.422726	0.314946			69.43066
50 to 54		0.346180	0.224109			72.07343
55 to 59		0.259016	0.120671			74.41624
60 to 64		0.157331			0.883402	76.46320
65 to 69					0.861632	78.69679
70 to 74					0.824358	81.17429
75 to 79					0.749418	84.02195
80 to 84					0.570517	87.25035
85 to 89						90.90386
90 to 94						94.87304
95 to 99						99.18118
100+						101.66710
<1	Female	0.591907	0.546019	0.229568		52.57023
1 to 4		0.539980	0.521154	0.187371		56.41672
5 to 9		0.557299	0.507520	0.164232		58.40637
10 to 14		0.554259	0.504137	0.158492		58.74223
15 to 19		0.551937	0.501554	0.154108		58.97274
20 to 24		0.543133	0.491761	0.137489		59.74825

[1] The impact of HIV/AIDS on Adult Mortality in South Africa

Table A2: Calculations based on life tables for South Africa (2000) World Health Organisation						
Age	**Gender**	**Probability to die before 65**	**Probability to die before 60**	**Probability to die before 30**	**Probability to die before 85**	**Life expectancy**
25 to 29		0.518042	0.463848	0.090119		61.68411
30 to 34		0.470306	0.410745			64.87179
35 to 39		0.405284	0.338411			68.60007
40 to 44		0.342633	0.268715			71.66567
45 to 49		0.283184	0.202582			74.12236
50 to 54		0.228737	0.142013			75.99260
55 to 59		0.170126	0.076811			77.62591
60 to 64		0.101079			0.800610	79.13401
65 to 69					0.778189	80.77954
70 to 74					0.740090	82.71694
75 to 79					0.664209	85.11589
80 to 84					0.491789	87.99952
85 to 89						91.38595
90 to 94						95.16340
95 to 99						99.34808
100+						101.76100

A4.7.2 Injury severity and the degree of disability

Internationally, injuries are classified according to the Abbreviated Injury Scale (AIS) for personal injuries, e.g. Minor (AIS1); Moderate (AIS2); Serious (AIS3); Severe (AIS4); Critical (AIS5) and Fatal (AIS6).

Disability due to injury are divided into different levels by (Manual for cost calculation in safe community planning):

- Discomfort of less than a month duration
- Discomfort of less than a year duration
- Enduring injury (1 to 30% disability and need for outpatient care)
- Enduring injury (31 to 74% medical disability and permanent home care)
- Enduring injury (75 to 100% medical disability and permanent need for institutional care
- Death

Traditionally in traffic accidents, the police allocated severity codes are used (fatal, serious and slight). Police-allocated severity codes are generally available within the accident database. Severity is also linked to age and gender variables in the accident database. Information in regard to the degree of an injury not resulting in death, is not available from the accident data base, that is, the number of days lost due to the injury.

A4.7.3 Unemployment rates

Statistics South Africa uses different measures of unemployment. The official definition states as unemployed those who state they are unemployed in the four weeks prior to the survey and took specific steps to find employment. The expanded version of unemployment also includes 'discouraged job-seekers', those who have not taken active steps.

In most publications from Stats SA, unemployment rates are given by gender and population group rather than age group. The official national unemployment rate for 1999 was given as 23.3, while the unemployment rate based on the expanded definition was 36,2. The different unemployment rates are summarized in Table A3.

Table A3: Different measures of unemployment (from Stats SA: The South African Labour Market (2002)

Unemployment definition (2001 data)	Male	Female	All
Unemployment rates based on official definition (working age population)	26,1	33,4	29,5
Expanded definition	35,2	48,0	41,5
Labour force participation rate	63,1	49,8	56,1
Labour absorption rate	46,6	33,3	39,6

The official unemployment rates for age categories, are shown in Table A4. The official unemployment rate has increased since 1995.

Table A4: Official unemployment rate (expanded definition) by age and education (1999) (In Stats SA Labour 2002)

Age group	None	Less than Matric	Higher than Matric	TOTAL (1999)	VALUES FOR 1995	Labour activity rate 1999[2]	
						M	F
15 to 24	41,2	46,2	38,4	42,5	33,0	28	22
25 to 34	22,8	31,8	21,5	26,9	18,3	80	60
35 to 44	20,1	21,3	7,9	16,9	10,2		
45 to 54	12,0	14,3	3,8	11,2	7,5		
55 to 65	7,7	9,3	1,9	7,1	4,6	50	22

Table A5 shows the labour force participation rate by gender in 1999.

[2] These values were read from a graph, and should be seen as an estimate

Table A5: Labour force participation rate, 1999		
Age group	Male	Female
15-19	8	5
20-29	57	42
30-39	84	59
40-49	82	55
50-54	73	41
55-59	59	29
60-64	35	12

A secondary analysis of the World Values survey for South Africa (data 1995 to 1997) has been conducted to identify the labour absorption rate (proportion of the working-age population that is employed). Although the values may be outdated, the relative absorption by gender and age group might be used, based on newer absorption rate figures.

A4.7.4 Census 2001

Statistics South Africa provided spreadsheets containing age, gender, and income categories as well as employment numbers. The data were analysed and findings presented in Tables A6 to A8 and Figure A1.

Table A6: Labour absorption rate by age group (World Values survey 1996)

Age group	Gender				Total	
	Male		Female			
	N	Average	N	Average	N	Average
16 to 24	269	13.89%	287	13.34%	556	13.62%
25 to 29	181	50.49%	183	46.46%	364	48.59%
30 to 34	174	75.62%	224	52.54%	398	62.07%
35 to 39	181	70.78%	201	55.81%	382	62.75%
40 to 44	153	80.51%	146	53.76%	299	67.62%
45 to 49	119	76.56%	124	57.49%	243	66.45%
50 to 54	71	76.51%	81	44.74%	152	59.99%
55 to 64	178	42.02%	138	28.51%	316	35.80%
65 and older	125	6.82%	89	6.38%	214	6.64%
Average	**1451**	**50.64%**	**1473**	**40.18%**	**2924**	**45.35%**

Table A7: Employment ratios for males (2001 Census data)								
Age group	**Number in employment category**				**Proportion in employment category**			
	Not applicable	**Employed**	**Unemployed expanded def**	**Not economically active**	**Not applicable**	**Employed**	**Unemployed expanded def**	**Not economically active**
0 to 4	2 223 683	0	0	0	1.0000	0.0000	0.0000	0.0000
5 to 9	2 425 743	0	0	0	1.0000	0.0000	0.0000	0.0000
10 to 14	2 518 672	0	0	0	1.0000	0.0000	0.0000	0.0000
15 to 19	0	111 139	292 994	2 048 026	0.0000	0.0453	0.1195	0.8352
20 to 24	0	547 049	831 290	719 492	0.0000	0.2608	0.3963	0.3430
25 to 29	0	917 352	757 687	222 841	0.0000	0.4834	0.3992	0.1174
30 to 34	0	942 039	506 820	144 704	0.0000	0.5912	0.3180	0.0908
35 to 39	0	891 464	416 015	133 375	0.0000	0.6187	0.2887	0.0926
40 to 44	0	761 211	339 783	132 182	0.0000	0.6173	0.2755	0.1072
45 to 49	0	579 998	258 158	129 097	0.0000	0.5996	0.2669	0.1335
50 to 54	0	425 848	185 045	158 414	0.0000	0.5535	0.2405	0.2059
55 to 59	0	257 816	112 085	182 324	0.0000	0.4669	0.2030	0.3302
60 to 64	0	150 550	61 647	307 051	0.0000	0.2899	0.1187	0.5913
65 to 69	280 564	0	0	0	1.0000	0.0000	0.0000	0.0000
70 to 74	215 827	0	0	0	1.0000	0.0000	0.0000	0.0000
75 to 79	125 489	0	0	0	1.0000	0.0000	0.0000	0.0000
80 to 84	74 279	0	0	0	1.0000	0.0000	0.0000	0.0000
85 +	39 371	0	0	0	1.0000	0.0000	0.0000	0.0000
TOTAL	**7 903 628**	**5 584 466**	**3 761 524**	**4 177 506**	**0.3689**	**0.2606**	**0.1755**	**0.1950**

Table A8: Employment ratios for females (2001 Census data)								
Age group	**Number in employment categories**					**Proportion in employment categories**		
	Not applicable	**Employed**	**Unemployed expanded def**	**Not economically active exp def**	**Not applicable**	**Employed**	**Unemployed expanded def**	**Not economically active expanded def**
0 to 4	2 226 055	0	0	0	1.0000	0.0000	0.0000	0.0000
5 to 9	2 427 681	0	0	0	1.0000	0.0000	0.0000	0.0000
10 to 14	2 542 604	0	0	0	1.0000	0.0000	0.0000	0.0000
15 to 19	0	81 648	361 485	2 085 105	0.0000	0.0323	0.1430	0.8247
20 to 24	0	383 512	983 705	827 702	0.0000	0.1747	0.4482	0.3771
25 to 29	0	612 587	988 128	434 959	0.0000	0.3009	0.4854	0.2137
30 to 34	0	659 445	699 752	387 128	0.0000	0.3776	0.4007	0.2217
35 to 39	0	669 991	563 446	396 751	0.0000	0.4110	0.3456	0.2434
40 to 44	0	592 638	407 472	385 673	0.0000	0.4277	0.2940	0.2783
45 to 49	0	453 559	292 370	373 790	0.0000	0.4051	0.2611	0.3338
50 to 54	0	299 431	176 689	392 364	0.0000	0.3448	0.2034	0.4518
55 to 59	0	169 732	95 572	387 615	0.0000	0.2600	0.1464	0.5937
60 to 64	0	74 762	26 742	632 267	0.0000	0.1019	0.0364	0.8617
65 to 69	451 099	0	0	0	1.0000	0.0000	0.0000	0.0000
70 to 74	374 812	0	0	0	1.0000	0.0000	0.0000	0.0000
75 to 79	216 052	0	0	0	1.0000	0.0000	0.0000	0.0000
80 to 84	152 997	0	0	0	1.0000	0.0000	0.0000	0.0000
85 +	96 409	0	0	0	1.0000	0.0000	0.0000	0.0000
TOTAL	**8 487 709**	**3 997 305**	**4 595 361**	**6 303 354**	**0.3630**	**0.1709**	**0.1965**	**0.2696**

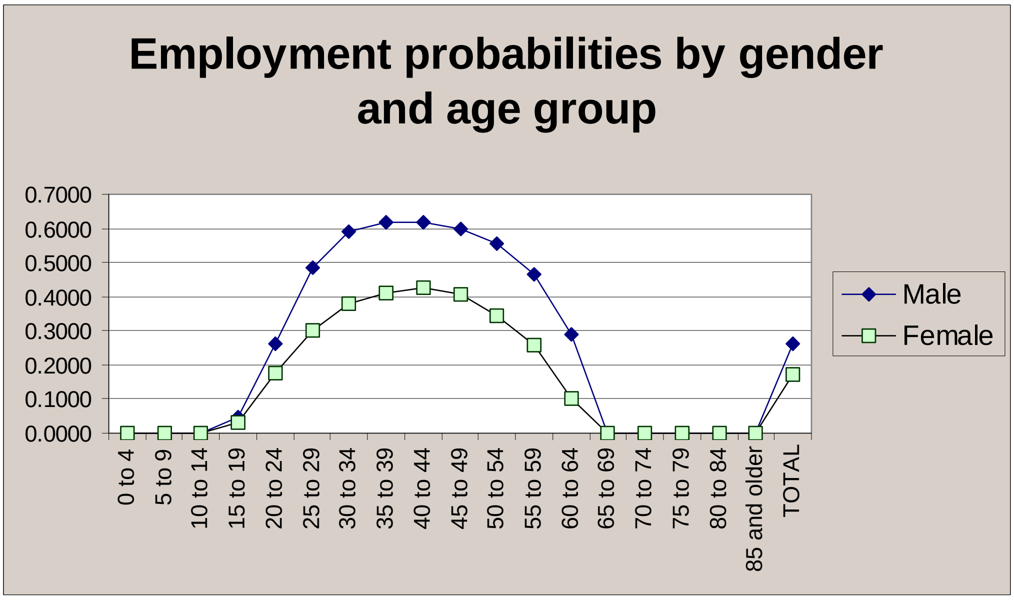

Figure A1: Employment probabilities in South Africa

A4.7.5 Selection of unemployment rates

The selection of the unemployment rates to use is a methodological, ethical and practical issue.

It is expected that a person who is now young (with a high probability of being unemployed) will have a higher probability to be employed later in life. It would thus not really be acceptable to use one unemployment probability for the calculation of lifetime loss, but will be acceptable to use for calculation of present loss.

The very young are not employed at all. Studies indicate that the time loss of children due to injury, might be translated into losses to adults due to the caring for children (present loss).

For the cost of productivity lost due to injury, the official unemployment definition (expanded) and the labour absorption rate (or the proportion not absorbed) will be used.

A4.7.6 Disability and unemployment

The official unemployment rate (1999) of people who were disabled were 21% for both women and men. 29% of disabled people who were working, worked part-time in 1999[3]. According to Stats SA (2002), there is a trend in the economy towards part-time work.

[3] Stats SA (Labour 2002) cautions against a small sample for this data

A4.7.7 Earnings

One of the key values in accident cost is the value of lost earnings. There are however, different sources of information pertaining to earnings. According to Stats SA[4], 9 113 847 people were employed (22% of the population). The distribution of monthly income is shown in Table A9.

Table A9: Monthly income of employed persons

Monthly income	Midpoint	N in bracket
None	0	103 354
1 to200	100.5	731 729
201 to 500	350.5	1 445 441
501 to 1 000	750.5	1 637 326
1 001 to 1 500	1 250.5	1 537 026
1 501 to 2 500	2 000.5	1 190 508
2 501 to 3 500	3 000.5	711 013
3 501 to 4 500	4 000.5	468 158
4 501 to 6 000	5 250.5	398 666
6 001 to 8 000	7 000.5	224 111
8 001 to 11 000	9 500.5	153 021
11 001 to 16 000	13 500.5	91 026
16 001 to 30 000	23 000.5	53 712
30 000 or more	40 000	21 221
Unspecified		347 533

A calculation of the above (excluding the unspecified category), shows that the average monthly income for South Africans was R 2 116, with an annual salary of R 25 392 (based on the 1996 census). According to the October 2000 household survey[5], the weighted average annual income per household was R 39 082.

According to the 2001 Census data, 14 214 164 people received income (32% of the population), with an average annual income of R 39 796 (males received on average R 49 179 and females R 29 683). These figures translated to an average annual income across the population of R 12 623 (R 16 922 for males and R 8 684 for females). Table A10 shows the income per age group and gender.

[4] South African Statistics 2002
[5] Income and expenditure of households 2000 South Africa, Stats SA, released November 2002

Table A10: Average income according to age group and gender (2001 Rands)				
Age group	Male		Female	
	Average of earners	Average of population	Average of earners	Average of population
0 to 4	20 979	1 716	20 349	1 673
5 to 9	36 564	1 462	37 358	1 494
10 to 14	65 177	1 361	68 518	1 352
15 to 19	28 914	1 911	30 347	1 692
20 to 24	26 372	7 635	26 195	5 639
25 to 29	36 107	18 348	33 138	11 356
30 to 34	49 792	31 128	38 836	16 670
35 to 39	56 392	37 184	38 207	17 904
40 to 44	64 541	43 080	38 643	19 032
45 to 49	67 440	45 214	35 859	17 717
50 to 54	70 672	46 726	35 573	16 949
55 to 59	68 561	44 719	30 876	14 719
60 to 64	48 318	33 704	15 541	12 274
65 to 69	32 685	27 550	13 082	11 294
70 to 74	28 217	25 235	12 575	11 133
75 to 79	28 014	25 368	13 993	12 420
80 to 84	24 528	22 125	12 370	11 104
85+	21 800	19 303	13 059	11 551
Average	49 179	16 922	29 683	8 684

A4.7.8 Labour 2002: The hourly wages by According to Stats SA figures

The hourly wages for 1999 were adjusted to 2002 figures. A December 2002 Stats SA survey shows the wages to be an average of R20.07. The average per age group values are then somewhat less than the 1999 values adjusted for 2002.

Figure A2 shows the annual earnings of the economically active age groups in South Africa.

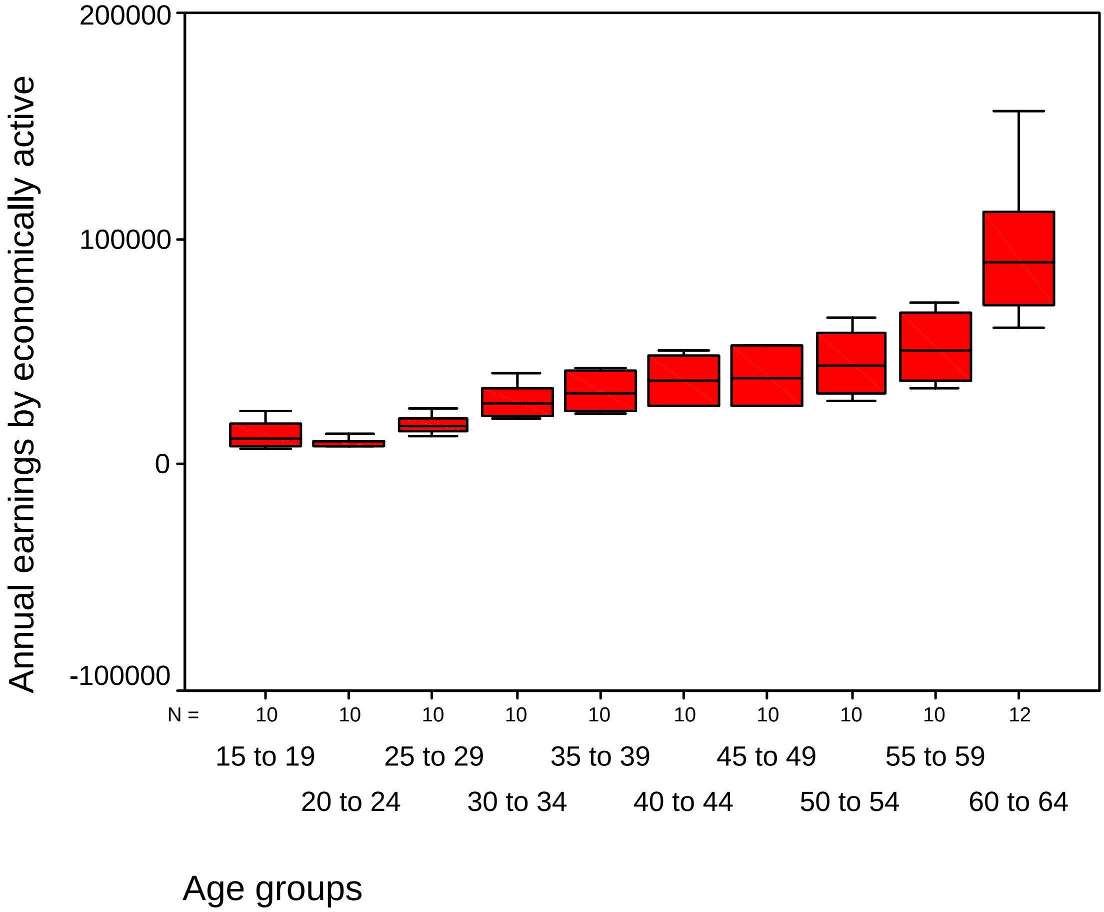

Figure A2: **Annual earnings of economically active age groups in South Africa**

ANNEXURE

B REVIEW OF PREVIOUS METHODS USED IN SOUTH AFRICA

B1 Human casualty cost

In the work completed by CSIR Transportek on the accident cost figures for 1998 (Schutte 2000), the component of lost output (that is the loss of economic output of persons killed or injured in accidents) is calculated using two methods, which are then compared. These are:

- based on GDP per capita, and
- based on likely future earnings where it is assumed that the production value of the life of a person is directly related to the age of the person.

The method based on GDP per capita required that the age profile of people involved in accidents was obtained and assumptions regarding the average length of working life were made using data on the average life expectancy and unemployment rates of the population. The future output was calculated to a present value using the then official discount rate of 8 percent per annum.

The method based on future earnings used a calculation where the average cost of a fatality is determined by weighing the present value of future output at different ages by the relative contribution of that age group to total fatalities. In comparison with the other method, the cost of a fatality was found to be higher and it was recommended that due to unspecified problems with input values that this method should not be used and that the lower estimate should be adopted. Schutte et al listed the data required for these calculations:

- Unemployment rates;
- Income of employed persons by age group;
- Income of informal sector by age group;
- Life expectancy per age group;
- GDP per capita, and
- Sick leave taken by persons injured

These data sets are readily accessible from Statistics South Africa (SSA). Much of the data used in the crash costing completed by Schutte is based on data compiled by SSA as part of the national population census completed in October 1996. The national census is also supplemented by the October Household Survey (OHS), which is completed annually by SSA depending upon availability of funds.

Although an allowance is added to the overall costs to represent the intangible elements of pain, grief and suffering and the loss of amenities of life, the methods only take into account the loss of output of the individual victims of road crashes. The wider secondary impacts upon other members of the family such as giving up work or education to look after the victim were not included in the costing.

B2 Vehicle damage cost

During the study conducted with TRL on an improved methodology for road crash costing in developing countries, a review of previous methods used in South Africa was done to identify shortcomings. The following sections of this document describe the results of this review.

The most recent attempt to assess the cost of vehicle damage resulting from road accidents in South Africa was completed by Schutte (2000) for 1998. The method adopted was based on the previous estimate completed by de Haan (1992) for 1991 accidents, which was in turn based on Morden (1989) for 1988 accidents.

It is necessary to describe the method adopted by Morden in 1989 and the refinement of this method by de Haan in 1992 in order to understand the most recent estimate by Schutte (2000).

B2.1 Method adopted by Morden for 1988

Morden uses data from a survey of seven short-term insurance companies and one insurance broker and reports that he had obtained a total of 1222 settled claim files. This data is summarised in Table B1, reproduced from Appendix 5 of Morden's report.

It should be noted that the values in Table B1 relate only to the insurance company payments and do not include the excess amount paid by the insured. The full value of vehicle damage is the payment by the insurance company *plus* the excess paid by the insured. However, Morden did not provide survey data for the 'full value', only the insurance company payouts. It should also be noted that Morden's table contained a total sample size of only 1,100 rather than the reported 1,222.

Table B1: Average Payments (Rand) (by type of vehicle and severity of the injury sustained) by short term insurance companies in respect of damage to vehicles as a result of traffic accidents (after Morden)					
		Damage only	Slight	Serious	Fatal
Car	Average value	2,787	6,127	5,277	8,865
	Sample size	760	61	20	10
LDV	Average value	2,538	6,746	4,673	
	Sample size	100	6	3	
Combi	Average value	4,834	9,398	9,086	22,748
	Sample size	31	6	11	2
Heavy Commercial Vehicle	Average value	13,860	7,393		24,547
	Sample size	33	3		3
Articulated	Average value	15,944	29,127		25,953
	Sample size	15	4		5
Bus	Average value	2,455	13,059		33,925
	Sample size	1	1		2
Tractor	Average value	2,346			
	Sample size	4			
Motorcycle	Average value	1,880	2,208	1,108	
	Sample size	9	5	2	
Other	Average value	2,146			
	Sample size	3			

Rather than apply the values in Table B1 (with the excess values added) to the total number of road crashes of each category, Morden made additional calculations because the data was based on insurance records, which were not representative of the value of all accidents in South Africa.

Morden gave two reasons why insurance records may not be representative of all accidents in South Africa:

1) Morden advised that 79 per cent of the 1988 road traffic accidents were damage only accidents, and that when the damage to the insured vehicle was less than the excess payable, then no claim was initiated. After discussions with representatives of the insurance industry, it was also thought that, at most, only 1/3 of all vehicles registered in South Africa were insured.

2) Morden also suggested that not all vehicles involved in an accident will incur the full damage as ascertained from the survey.

In order to estimate the damage suffered by all vehicles, whether insured or not, Morden made the arbitrary assumption that only 50 per cent of vehicles involved in traffic accidents suffer the full average damage cost. The remaining 50 per cent are assumed to suffer only half the average damage cost. The calculation is illustrated by the data within Table B2.

However, it is not clear how the average cost of full damage per vehicle type was calculated from the insurance records (column 2 in the table). This is because the insurance records in Table B1 included damage by severity of injury sustained, whereas column 2 within Table B2 provided only an average cost for full damage irrespective of the severity of the accident.

The final total within Table B2 provides a total cost of the damage to vehicles (R2,668,754,185). A subsequent stage in Morden's method is to calculate the average cost of damage to vehicles by the degree of the severity of the accident. The results of this calculation are shown within Table B3.

The number of vehicles involved in accidents by type of accident severity (column 2 of Table B3), was taken from published statistics. The cost per vehicle for slight, serious and fatal accidents (column 3 of Table B3) was calculated from the insurance company records. The total cost for slight, serious and fatal accidents (a, b and c in Table B3) were calculated by multiplying the number of vehicles for each severity, by the average cost for each type of severity. The total cost for damage only accidents (e) was calculated by subtracting the total cost for slight, serious and fatal accidents (a, b and c in Table B3) from the total overall cost (d), calculated previously. The cost per vehicle for damage only accidents (f) could then be calculated by dividing the total for damage only accidents by the number of vehicles (1,322,812,773 / 545,659 = 2,424).

Morden also provided an estimate of the cost of damage to goods in transit using insurance data. This amounted to a total of R79,862,400 which is equivalent to only about 3 per cent of the total amount for vehicle damage.

Table B2: Damage to vehicles by type of vehicle (assuming 50% suffer full damage, and 50% suffer half damage) (1988 Rand) (after Morden)			
50% of vehicles suffer full average damage:			
1) Type of vehicle	2) Average cost of full damage per vehicle (from insurance records)	3) Number of vehicles involved in accidents (x 50%) (from published statistics)	4) Total (2x 3)
Motor car	3,622	239,624	867,918,128
Light delivery vehicles	3,358	45,805	153,813,190
Combis	8,541	23,876	203,924,916
Heavy Commercial Vehicles	18,492	19,875	367,528,500
Articulated	24,176	1,014	24,514,464
Buses	21,116	6,889	145,468,124
Motor cycles	2,112	7,573	15,994,176
Subtotal A		344,656	1,779,161,498
50% of vehicles suffer half average damage:			
1) Type of vehicle	2) Average cost of half full damage per vehicle	3) Number of vehicles involved in accidents (x 50%)	4) Total (2x 3)
Motor car	1,811	239,624	433,959,064
Light delivery vehicles	1,679	45,805	76,906,595
Combis	4,721	23,876	101,974,396
Heavy Commercial Vehicles	9,246	19,875	183,764,250
Articulated	12,088	1,014	12,257,232
Buses	10,559	6,889	72,734,062
Motor cycles	1,056	7,573	7,997,088
Subtotal B		344,656	889,592,687
Total A+B		689,312	2,668,754,185

Table B3: Cost of damage to vehicles by degree of severity (1988 Rand) (after Morden)			
1) Severity	2) Number of vehicles involved in accidents	3) Cost per vehicle	4) Total
Damage only	545,659	2,424 (f)	132,281,277 (e)
Slight	95,125	8,157	775,934,625 (a)
Serious	33,707	7,082	238,712,974 (b)
Fatal	14,821	22,353	331,293,813 (c)
Total	689,312		2,668,754,185 (d)

 Calculated from insurance company records

B2.2 Method adopted by de Haan for 1991

Data from a survey of six major short-term insurance companies were used by de Haan to estimate the damages to vehicles involved in road accidents. A similar method to that used by Morden was adopted, with the assumption that 50 per cent of vehicles suffered the full average damage, and 50 per cent of vehicles suffered only half the average damage.

However, a further assumption was also made regarding accidents between vehicles and pedestrians. It was assumed that 50 per cent of motorcars, light delivery vehicles, combis/taxis and motorcycles suffer only a quarter of the average damage cost while the other 50 per cent suffer only an eighth of the average damage when involved in an accident with a pedestrian. It was assumed that heavy commercial vehicles, articulated vehicles, and buses suffer no substantial damage when involved in accidents with pedestrians.

The calculation of values using these assumptions is shown within Table B4 (taken from de Haan). It is not clear how an estimate of the average full vehicle damage by type of vehicle was obtained from insurance company records.

To obtain the average cost of damage to vehicles by the degree of the severity of the accident, de Haan then used the same method as Morden for the accidents involving only vehicles. For the accidents involving pedestrians however, there was a lack of reliable data on how the total cost of R44 338 446 should be allocated between the different severity types. Therefore, it was assumed that the ratio of damage cost per vehicle was 3:2:1:0 for fatal, serious, slight and damage only traffic accidents respectively. Thus, the distribution of vehicle damage costs by road accident severity according to de Haan is given in Table B5.

Damage to property inside the vehicle was not assessed because no reliable information was obtained from the survey used by de Haan. Damage to property outside the vehicle was not assessed because of the scarcity of information and because it was suspected that this item would not have a significant impact on the overall results.

Table B4: Average damage to vehicles by vehicle type (1991 Rand) (after de Haan)

Drivers and passengers							
Vehicle Type	50 per cent suffer full damage			50 per cent suffer half damage			Total
	Number #	Cost/ Veh §	Total	Number #	Cost/ Veh §	Total	
Motor car	236,049	5,923	1,398,118,227	236,049	2,961	698,941,089	2,097,059,316
LDV	47,491	5,963	283,188,833	47,491	2,982	141,618,162	424,806,995
Combis/ Taxi	25,869	10,117	261,716,673	25,868	5,059	130,866,212	392,582,885
Heavy	18,720	27,962	523,448,640	18,719	13,981	261,710,339	785,158,979

Table B4: Average damage to vehicles by vehicle type (1991 Rand) (after de Haan)							
Vehicles							
Artic	997	30,947	30,854,159	996	15,474	15,412,104	46,266,263
Buses	5,179	29,455	152,547,445	5,178	14,728	76,261,584	228,809,029
Motor cycles	5,782	3,457	19,988,374	5,781	1,728	9,989,568	29,977,942
Total	340,087		2,669,862,351	340,082		1,334,799,058	4,004,661,409
Pedestrians							
	50 per cent suffer ¼ damage			50 per cent suffer 1/8 damage			
Motor car	12,482	1,481	18,485,842	12,482	741	9,249,162	27,735,004
LDV	2,506	1,491	3,736,446	2,506	746	1,869,476	5,605,922
Combis/ Taxi	2,784	2,529	7,040,736	2,784	1,265	3,521,760	10,562,496
Heavy Vehicles	565	0	0	564	0	0	0
Artic	32	0	0	32	0	0	0
Buses	391	0	0	391	0	0	0
Motor cycles	336	864	290,304	335	432	144,720	435,024
Total	19,096		29,553,378	19,094		14,785,118	44,338,446
All Status							
Motor car	248,531	5,700	1,416,604,069	248,531	2,850	708,190,251	2,124,794,320
LDV	49,997	5,739	286,925,279	49,997	2,870	143,487,638	430,412,917
Combis/ Taxi	28,652	9,380	268,757,409	28,652	4,690	134,387,972	403,145,381
Heavy Vehicles	19,284	27,144	523,448,640	19,284	13,571	261,710,339	785,158,979
Artic	1,029	29,985	30,854,159	1,028	14,992	15,412,104	46,266,263
Buses	5,570	27,387	152,547,445	5,569	13,694	76,261,584	228,809,029
Motor cycles	6,117	3,315	20,278,678	6,117	1,657	10,134,288	30,412,966
Total	359,181		2,699,415,679	359,178		1,349,584,176	4,048,999,855

Taken from published statistics

§ Values based on survey of insurance company data

Table B5: Distribution of vehicle damage costs according to road collision severity (1991 Rand) (After de Haan)			
1) Severity	2) Number of vehicles involved in accidents #	3) Cost per vehicle	4) Total
Drivers and passengers			
Fatal	5,827	31,450	183,259,150 (a)
Serious	17,268	13,146	227,005,128 (b)
Slight	63,002	9,501	598,582,002 (c)
Damage only	594,072 (g)	5,043 (f)	2,995,815,129 (d)

Table B5: Distribution of vehicle damage costs according to road collision severity (1991 Rand) (After de Haan)			
	680,169		4,004,661,409 (e)
Pedestrians			
Fatal	4,733	2,556	12,096,743
Serious	9,227	1,703	15,713,581
Slight	19,422	851	16,525,122
Damage only	4,808	0	0
	38,190	(ratio 3:2:1:0)	44,338,446
All Status			
Fatal	10,560	18,500	195,355,893
Serious	26,495	9,161	242,718,709
Slight	82,424	7,463	615,110,124
Damage only	598,880	5,002	2,995,815,129
	718,359		4,048,999,855

(d) is calculated thus: d = e-(a+b+c). Then (f) is calculated: f = d/g.
Taken from published statistics

B2.3 Method adopted by Schutte for 1998

Schutte reports that a number of the largest vehicle insurance companies were visited to obtain information, and that in contrast to previous studies, information on the average cost per claim is based on all the claims over a given period rather than a sample of claims. Other than this, the method and calculations used do not differ to that used previously by de Haan.

Table B6 provides the values for the average damage to vehicles by vehicle type with the same assumptions used by de Haan:

- 50 per cent of the vehicles involved in vehicle only accidents suffer the full average damage, and 50 per cent suffer half the average damage; and

- with regard to accidents with pedestrians, it is assumed that for motor cars, LDVs, minibuses and motorcycles, 50 per cent suffer a quarter of the average damage and 50 per cent suffer an eighth of the average damage. For heavy vehicles, articulated vehicles and buses it is assumed that there is no damage.

Table B7 provides the distribution of vehicle damage costs according to collision severity using the assumption that the cost per vehicle involved in pedestrian accidents is distributed between fatal, serious, slight and damage only accidents to the ratio 3:2:1:0.

Schutte reports that because there is no reliable information available for damage to property outside or inside the vehicle, and because these items are less important, they were omitted from the calculations.

Table B6: Average damage to vehicles by vehicle type (1998 Rand) (after Schutte)

Vehicle Type	50 per cent suffer full damage			50 per cent suffer half damage			Total
	Number #	Cost/ Veh §	Total	Number #	Cost/ Veh §	Total	
Drivers and passengers							
Motor car	259,568	10,118	2,626,297,074	259,568	5,059	1,313,148,537	3,939,445,612
LDV	67,771	10,194	690,864,251	67,771	5,097	345,432,126	1,036,296,377
Combis/ Taxi	32,097	17,145	550,316,331	32,097	8,573	275,158,166	825,474,497
Heavy vehicles	21,240	47,783	1,014,916,580	21,240	23,892	507,458,290	1,522,374,870
Artic	1,203	52,649	63,336,925	1,203	26,325	31,668,462	95,005,387
Buses	4,409	49,625	218,798,237	4,409	24,813	109,399,118	328,197,355
Motor cycles	4,288	5,890	25,251,948	4,288	2,945	12,625,974	37,877,922
Total	390,575		5,189,781,346	390,575		2,594,890,673	7,784,672,019
Pedestrians							
	50 per cent suffer ¼ damage			50 per cent suffer 1/8 damage			
Motor car	11,322	2,529	28,637,604	11,322	1,265	14,318,802	42,956,406
LDV	3,020	2,549	7,696,601	3,020	1,274	3,848,301	11,544,902
Combis/ Taxi	2,758	4,286	11,821,762	2,758	2,143	5,910,881	17,732,644
Heavy vehicles	506	0	0	506	0	0	0
Artic	26	0	0	26	0	0	0
Buses	238	0	0	238	0	0	0
Motor cycles	192	1,472	282,704	192	736	141,352	424,056
Total	18,061		48,438,672	18,061		24,219,336	72,658,007
All Status							
Motor car	270,890	9,801	2,654,934,678	270,890	4,900	1,327,467,339	3,982,402,018
LDV	70,791	9,868	698,560,852	70,791	4,934	349,280,426	1,047,841,278
Combis/ Taxi	34,855	16,128	562,138,094	34,855	8,064	281,069,047	843,207,141
Heavy vehicles	21,746	46,671	1,014,916,580	21,746	23,336	507,458,290	1,522,374,870
Artic	1,229	51,556	63,336,925	1,229	25,778	31,668,462	95,005,387
Buses	4,647	47,089	218,798,237	4,647	23,544	109,399,118	328,197,355
Motor cycles	4,480	5,700	25,534,652	4,480	2,850	12,767,326	38,301,978
Total	408,636	12,923	5,238,220,018	408,636		2,619,110,009	7,857,330,027

Taken from published statistics

§ Values based on survey of insurance company data

Table B7: Distribution of vehicle damage costs according to road collision severity (1998 Rand) (after Schutte)			
1) Severity	2) Number of vehicles involved in accidents #	3) Cost per vehicle	4) Total
Drivers and passengers			
Fatal	5,525	50,196	277,334,411 (a)
Serious	17,897	20,982	375,513,048 (b)
Slight	55,520	15,164	841,917,244 (c)
Damage only	749,238 (g)	8,049(f)	6,030,611,080 (d)
	828,180		7,784,672,019 (e)
Pedestrians			
Fatal	3,452	4,184	14,443,263
Serious	9,886	2,788	27,559,433
Slight	17,896	1,393	24,929,750
Damage only	6,989	0	0
	38,223	(ratio 3:2:1:0)	72,658,007
All Status			
Fatal	8,988	32,463	291,777,675
Serious	27,849	14,473	403,072,481
Slight	73,472	11,798	866,846,994
Damage only	756,227	7,975	6,030,611,080
	866,536		7,857,330,027

(d) is calculated thus: d = e-(a+b+c). Then (f) is calculated: f = d/g.
Taken from published statistics

B2.4 Summary

In the past the method to estimate the cost of vehicle damage in South Africa has been based on data obtained from insurance company records. However, this data was acknowledged as not being representative of all vehicle crashes for the following reasons:

1) A large majority of road traffic accidents are damage only accidents, and when the damage to the insured vehicle is less than the excess payable, then often no claim is initiated.
2) It is thought that a large proportion of vehicles in South Africa may be uninsured. For example after discussions with representatives of the insurance industry in 1988 it was thought that, at most, only 1/3 of all vehicles registered in South Africa were insured.
3) Not all vehicles involved in an accident will incur the full damage as ascertained from insurance company data surveys.

For these reasons a number of arbitrary assumptions were made in order to make an estimate of the cost of vehicle damage:

- 50 per cent of the vehicles involved in vehicle only accidents suffer the full average damage, and 50 per cent suffer half the average damage;
- with regard to accidents with pedestrians, it is assumed that for motor cars, LDV, Mini bus and motorcycles, 50 per cent of the vehicles suffer a quarter of the average damage and 50 per cent suffer an eighth of the average damage. For heavy vehicles, articulated vehicles and buses it is assumed that there is no damage, and
- The distribution of vehicle costs according to severity was assumed to be 3:2:1 for fatal, severe and slight accidents involving a pedestrian.

An estimate of the cost of damage to property carried within the vehicle, and property damaged outside the vehicle was omitted from recent estimates due to the lack of reliable data and the fact that these items were considered less important. In 1988, an estimate of the cost of damage to goods in transit was found to be equivalent to only 3 per cent of the total vehicle damage.

ANNEXURE

C METHODOLOGY USED IN CURRENT STUDY

The following methodology was used during the study:

- Review of previous methods and international practices (Annexures A and B)
- Data collection by means of questionnaires, telephone interviews and visits
- Data analysis to estimate unit costs from collected data
- Formulation of method to use the results in measuring cost effectiveness of measures.

C1 Data collection

The major stakeholder groups were identified and questionnaires were developed to suit the relevant stakeholder group and cost item. An effort was made to obtain very detailed data relating to costs items by sending out a large number of questionnaires to a wide spectrum of stakeholders in all the provinces. However, it was envisaged at the time that most institutions would not keep records in a way that would allow effortless extraction of all the required accident cost data items, especially to allow costs to be determined at such a level of detail as required to determine unit costs according to age groups and severity of casualties, vehicle type and type of accident, and urban and rural areas.

Table C1 shows the number of institutions contacted within each stakeholder group and the replies received.

Table C1: Questionnaires sent and received

Cost item	Stakeholders	Number of institutions that received questionnaires	Number of institutions that sent replies	Number of institutions whose data could be used
Casualty costs				
Funeral costs	RAF Road Accident Fund, funeral parlours	10	9	7
Lost earnings, medical, legal, pain and suffering, etc	Road Accident Fund	1	1	1
Vehicle costs				
Vehicle repair, damage to goods, clean up, repair of roadside furniture, etc	Bus and Truck operators	49	8	7
	Company pool vehicles	29	2	2
	Repair shops	25	0	0

Table C1: Questionnaires sent and received				
Cost item	Stakeholders	Number of institutions that received questionnaires	Number of institutions that sent replies	Number of institutions whose data could be used
Vehicle repair, towing, assessor, car hire, etc	Insurance companies, parastatals	19	5	5
Incident costs				
Accident scene attendance, reporting, investigation and reconstruction	SAPS, Local authorities, Emergency services	55	12	5
Accident data capturing and analysis	Traffic authorities	54	2	2
Road damage	Road authorities And fleet owners	60	1	1

C2 Human casualty costs

The one method used to estimate the human casualty unit cost was largely based on the value of lost output or productivity, derived from the average life expectancy, employment rate and income of the population. Other items required to calculate the unit cost of a human casualty were obtained from the Road Accident Fund (RAF). The results using this method are discussed in Annexure D.

During a second method, all the items obtained from the RAF were used to calculate unit human casualty costs (see Annexure F). The data received from the RAF was based on the payments made during 2002. The items included the following:

- Loss of earnings
- Loss of support
- Ambulance, Medical and Funeral costs
- Legal costs (RAF and claimant)
- Pain and suffering
- Other (not specified)

To supplement the data received from the RAF, and in an effort to obtain more detailed data, questionnaires were sent to emergency services and funeral parlours. The ambulance emergency services provided the Board for Health Funders tariffs - these tariffs are fixed and are used when a patient is transported and received the different levels of assistance when attended to at the scene of an accident. One ambulance emergency service provided all costs, i.e. fuel, maintenance, labour per hour, etc. incurred over a three-year period. Funeral parlours provided costs for cremations and funeral services, as well as other costs such as removal and storage, hiring of tents and buses, etc.

For the purposes of estimating the unit cost of a human casualty, two methods were used. The first method estimated the value of future productivity of a person within a specific age group based on the average life expectancy, employment rate and income of the age group and applying these values to the age profile of people killed in road traffic accidents. These results are discussed in Annexure D.

Payments made in 2002 by the Road Accident Fund to victims of road traffic accidents were used in the second method to calculate human casualty costs. Some of the payment items were used during the first method as well. The results using the RAF data are discussed in Annexure F.

C3 Vehicle damage costs

The process to obtain vehicle repair costs according to severity, regions, types of roads, types of accident, etc. relating to the different types of road vehicles proved to be a time consuming but fruitless attempt. No motor vehicle insurance company caters for all vehicle classes - certain companies cater for light motor vehicles while other companies concentrate on heavy duty/commercial vehicles. Many bus and commercial vehicle transport companies do not have contracted insurance cover but do it in-house and have systems to extract the data but were reluctant to respond to the request for accident cost related data.

Those transport companies that contract insurance companies to manage their data are reluctant to provide the name of the insurance company. Often those transport companies that agree to cooperate, supply the name of the broker instead of the insurance company. The broker would refer the surveyor back to the company and this going back and forth between companies resulted in a delay in data collection or even in achieving no results where submission of data is concerned.

Bus and transport companies that were requested to supply data on as many accidents as possible, often supplied data for only one accident, regardless of the fact that they have many vehicles and vehicle classes in their fleet. A request for data was made to the South African Bus Operators Association (SABOA) - this resulted in two bus companies responding to the request for data.

Although the transport companies approached always considered the request for data important and agreed that this type of information is valuable to calculate the cost of an accident, requested data was seldom supplied. The reasons for this were numerous, often including lack of manpower, change in computer systems, inability to provide requested data in the format and detail requested, decisions to provide data must be taken at executive level, etc.

The approach to obtain data from short-term insurance companies also proved problematic. After approaching a number of companies unsuccessfully, one of the larger and well-known insurance companies indicated that it would be better to approach the South African Insurance Association (SAIA) instead of requesting data from each individual insurance company, as this association has access to all their members' data. The request was put to the SAIA, who stated that they did not have direct access to data but that they would be willing to send a request to all their members. This approach yielded a reply from only one company. Eventually SAIA suggested that those insurance companies that have advanced computer programs be approached directly. The identified companies were approached, and after proof of the contract with the National Department of Transport was provided and confidentiality confirmed, three companies supplied data.

None of the data obtained from short-term insurance companies could relate the claim to the severity of the accident or the type of accident. The data that could be obtained on the location from where the claim originated, was in the form of suburbs scattered throughout the country. Due to the amount of effort that would have been required to sort this information into urban or rural area, or even province, this item was disregarded.

Included in the data on claims submitted by the insurance companies were details of the make and model of the vehicle involved in the claim. These were used to determine the price of the latest model available in South Africa in order to classify models into price ranges. Sedan models were also classified into age groups and into a further two categories: ordinary sedans and elevated 4x4 station wagons. Light delivery vehicles were classified into ordinary and double cab categories.

C4 Incident costs

Incident costs included data pertaining to the accident itself, such as attendance of the accident scene by the SAPS, traffic authorities and emergency services such as the fire brigade. Towing costs, insurance administration costs, costs of damage to roads and road furniture, all costs associated accident data management (reporting, recording, capturing, etc), and traffic delay costs form part of incident costs.

Municipalities were approached for data on accident attendance, cleanup and road damage, and accident data management. Questionnaires to fleet owners also included questions regarding cleanup and road repair costs, in addition to vehicle repair costs. Despite intensive follow-up actions response was generally poor. A few emergency services supplied data on attendance of accident scenes.

Towing costs could be obtained from short-term insurance companies.

ANNEXURE

D HUMAN CASUALTY COST BASED ON LOST OUTPUT

The method used to estimate the human casualty unit cost was largely based on the value of lost output or productivity, by making use of the average life expectancy, employment rate and income of the population, similar to the previous method used in South Africa. However, the previous method only provided standardized unit costs by severity of the accident, regardless of the number of injuries sustained per accident, whereas the new method calculates standardised unit costs per human casualty. Costs are also provided for specific age groups.

Table D1 shows the sources of data used for the calculation of unit casualty costs using the value of productivity or output. Some of the data items supplied by the Road Accident Fund (see Annexure F) were used during this method. However, the value of claims made to the RAF was used rather than the actual payments made, because payments were based on a fault-based system where "guilty" parties received less compensation and actual claims were believed to be more representative of actual costs incurred by the victims.

Table D1: Sources of human casualty cost data by cost category – value of productivity method

Category	Source
Lost future earnings	Estimated from earnings, life expectancy, etc (Statistics SA)
Output lost during injury	Estimated from wages data (Department of Labour)
Hospital and medical costs	Road Accident Fund claims (not payments)
Funeral costs	Funeral Parlours
Legal costs	Road Accident Fund claims (not payments)
Loss to family of victim	Road Accident Fund claims (not payments)
Pain and suffering	Road Accident Fund claims (not payments)

D1 Loss of productivity

To calculate the unit casualty cost of a person within a specific age group, the expected proportion of that age group involved in traffic accidents was calculated from available historic data (1997 and 1998). The expected age distribution of road users involved in traffic accidents is shown in Table D2 and Figure D1.

Table D2: Expected age distribution of road users			
Age group	Expected proportion		
	Urban	Rural	Anywhere
0-1	0.28%	0.24%	0.27%
1-4	1.10%	0.95%	1.06%
5-9	2.95%	1.75%	2.62%
10-14	2.58%	1.88%	2.40%
15-19	4.94%	4.26%	4.71%
20-24	14.62%	14.44%	14.51%
25-29	19.22%	19.90%	19.47%
30-34	13.65%	14.85%	13.97%
35-39	9.84%	10.53%	10.03%
40-44	8.02%	8.59%	8.18%
45-49	6.77%	6.89%	6.81%
50-54	5.68%	5.58%	5.66%
55-59	4.97%	4.68%	4.90%
60-64	3.16%	3.27%	3.19%
65-69	1.38%	1.49%	1.41%
70-74	0.44%	0.41%	0.43%
75-79	0.29%	0.17%	0.27%
80+	0.13%	0.12%	0.12%
	100%	100%	100%

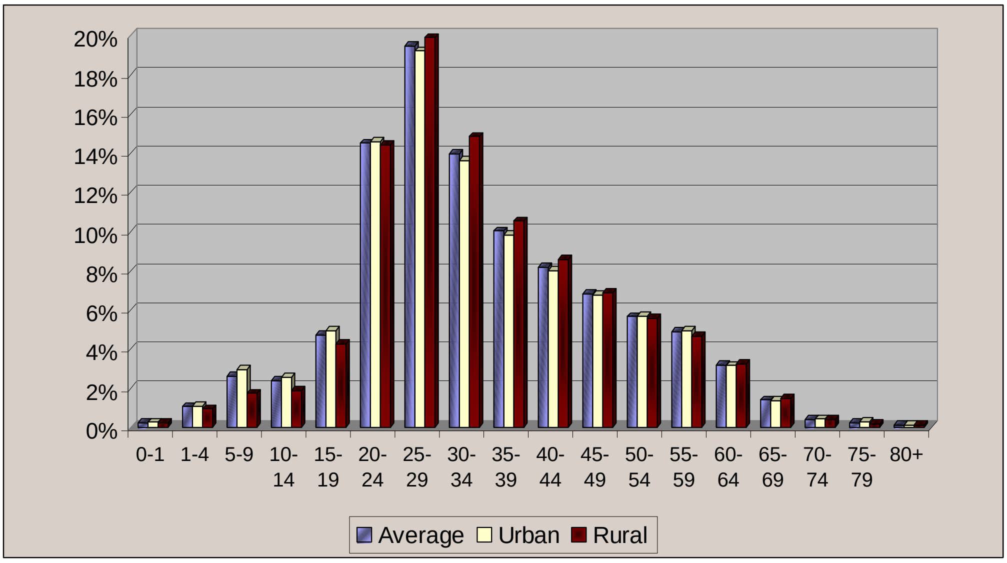

Figure D1: Age distribution of road users involved in traffic accidents

Table D3 shows the value of lost future productivity of road users killed in traffic accidents, based on the expected distributions in Table 33. Figure D2 shows these values graphically

The average value of lost productivity in an urban area due to death is estimated at R 444 171 per person – the value per person in a rural area is R 447 338. The age group 25 to 29 represents the highest proportion of lost productivity due to traffic deaths.

Table D3: The value of lost future productivity due to death, by age group (Rands)

	Average			Urban			Rural		
Age group	Male	Female	Average	Male	Female	Average	Male	Female	Average
0-1	696	924	810	722	959	840	619	822	720
1-4	3 021	3 903	3 462	3 135	4 050	3 593	2 679	3 461	3 070
5-9	7 392	15 132	9 794	9 975	12 072	11 024	5 932	7 180	6 556
10-14	8 202	13 549	9 850	10 104	11 064	10 586	7 362	8 062	7 714
15-19	20 012	23 860	21 082	22 228	22 017	22 121	19 178	18 996	19 086
20-24	73 596	67 504	70 091	74 749	66 645	70 605	73 850	65 844	69 757
25-29	111 143	85 057	98 517	108 159	87 102	97 262	111 999	90 195	100 715
30-34	83 898	57 111	70 546	80 562	58 277	68 910	87 676	63 423	74 995
35-39	63 346	33 140	48 873	58 345	38 740	47 938	62 449	41 465	51 310
40-44	48 578	25 507	37 131	45 434	28 309	36 372	48 650	30 312	38 947
45-49	36 336	19 850	27 762	35 298	20 955	27 603	35 941	21 337	28 106
50-54	25 946	15 508	20 368	26 156	15 340	20 420	25 725	15 087	20 084
55-59	18 491	11 755	14 712	19 149	11 353	14 925	18 044	10 698	14 064
60-64	9 801	6 922	7 909	10 177	6 165	7 839	10 509	6 366	8 095
65-69	3 692	2 479	2 895	3 722	2 288	2 843	4 001	2 460	3 056
70-74	833	803	742	964	641	760	895	595	706
75-79	420	377	375	487	368	412	289	218	245
80+	123	133	113	150	104	119	141	98	112
Total	515 528	383 512	445 033	509 513	386 448	444 171	515 942	386 621	447 338

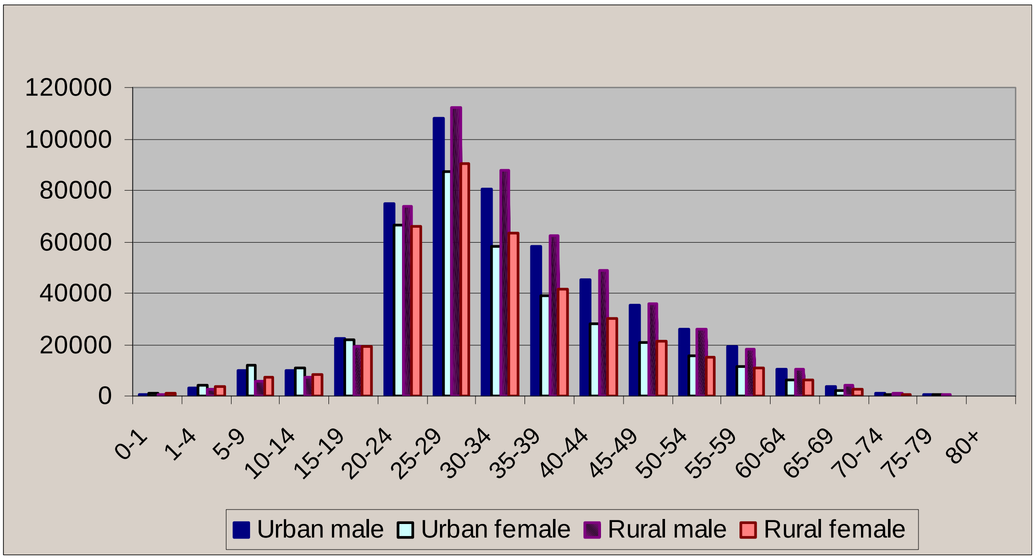

Figure D2: Value of lost productivity due to death by gender and urban/rural area

Table D4 shows the value of lost future productivity due to disability or serious injury. The average value per person is R 55 184.

The value of present lost earnings, i.e. lost income due to time off from work after the accident, was calculated as R 399 per fatality (equivalent to 3 days off work at an average income of R 133 per day – Stats SA), R 3 856 per serious injury (29 days sick leave), R 864 per slight injury (6,5 days sick leave) and R 133 per no injury (1 day off work).

Table D4: Lost future productivity due to serious injury, by age group (Rands)

Age group	Average			Urban			Rural		
	Male	Female	Average	Male	Female	Average	Male	Female	Average
0-1	86	115	100	90	119	104	77	102	89
1-4	375	484	429	389	502	446	332	429	381
5-9	917	1 876	1 214	1 237	1 497	1 367	736	890	813
10-14	1 017	1 680	1 221	1 253	1 372	1 313	913	1 000	957
15-19	2 482	2 959	2 614	2 756	2 730	2 743	2 378	2 356	2 367
20-24	9 126	8 371	8 691	9 269	8 264	8 755	9 157	8 165	8 650
25-29	13 782	10 547	12 216	13 412	10 801	12 060	13 888	11 184	12 489
30-34	10 403	7 082	8 748	9 990	7 226	8 545	10 872	7 864	9 299
35-39	7 855	4 109	6 060	7 235	4 804	5 944	7 744	5 142	6 362
40-44	6 024	3 163	4 604	5 634	3 510	4 510	6 033	3 759	4 829
45-49	4 506	2 461	3 443	4 377	2 598	3 423	4 457	2 646	3 485
50-54	3 217	1 923	2 526	3 243	1 902	2 532	3 190	1 871	2 490
55-59	2 293	1 458	1 824	2 374	1 408	1 851	2 237	1 327	1 744
60-64	1 215	858	981	1 262	764	972	1 303	789	1 004
65-69	458	307	359	462	284	353	496	305	379
70-74	103	100	92	119	79	94	111	74	88
75-79	52	47	46	60	46	51	36	27	30
80+	15	16	14	19	13	15	17	12	14
Total	63 926	47 556	55 184	63 180	47 920	55 077	63 977	47 941	55 470

D2 Casualty costs using productivity value

Table D5 gives a summary of the human casualty costs by cost category, severity of injury and area. The total unit casualty cost for a fatal injury in an urban area was calculated to be R 624 405 and in a rural area R 629 777.

Table D5: Summary of human casualty costs by cost category and severity of injury				
Urban areas				
Category	**Fatal**	**Serious**	**Slight**	**No injury**
Lost future earnings	R 444 171	R 55 077		
Output lost during injury	R 399	R 3 856	R 864	R 133
Hospital and medical costs	R 13 825	R 30 925	R 9 797	
Funeral costs	R 10 676			
Legal costs - RAF	R 44 069	R 44 069	R 44 069	
Legal costs - claimant	R 21 884	R 21 884	R 21 884	
Loss to family of victim	R 32 375	R 21 246	R 6 149	R 200
Pain and suffering	R 57 006	R 59 064	R 31 096	
Total: Urban (Standardised cost)	**R 624 405**	**R 236 121**	**R 113 859**	**R 333**
Rural areas				
Category	**Fatal**	**Serious**	**Slight**	**No injury**
Lost future earnings	R 447 338	R 55 470	R 0	
Output lost during injury	R 399	R 3 856	R 864	R 133
Hospital and medical costs	R 15 069	R 33 708	R 10 679	
Funeral costs	R 11 637			
Legal costs - RAF	R 44 069	R 44 069	R 44 069	
Legal costs - claimant	R 21 884	R 21 884	R 21 884	
Loss to family of victim	R 32 375	R 21 246	R 6 149	R 200
Pain and suffering	R 57 006	R 59 064	R 31 096	
Total: Rural (Standardised cost)	**R 629 777**	**R 239 296**	**R 114 741**	**R 333**

D3 Casualty costs by age group using productivity values

Table D6 and Table D7 show the unit cost of casualties by age group for urban and rural areas respectively. It can be seen that a fatal injury in an urban area to person of age 22, for example, would cost society R 663 318. The cost of a person aged 60 in the same area would amount to R 427 700.

Table D6: Unit Human Casualty Cost according to age group and severity of injury – Urban Table			
Age group	Fatal (killed)	Serious Injury	Slight Injury
0-1	R 479 927	R 214 399	R 112 995
1-4	R 506 457	R 217 689	R 112 995
5-9	R 553 648	R 223 540	R 112 995
10-14	R 590 536	R 228 114	R 112 995
15-19	R 627 581	R 232 708	R 112 995
20-24	R 663 318	R 240 946	R 113 859
25-29	R 686 248	R 243 789	R 113 859
30-34	R 685 154	R 243 653	R 113 859
35-39	R 667 400	R 241 452	R 113 859
40-44	R 633 881	R 237 296	R 113 859
45-49	R 588 077	R 231 616	R 113 859
50-54	R 539 920	R 225 644	R 113 859
55-59	R 480 748	R 218 307	R 113 859
60-64	R 427 700	R 207 923	R 112 995
65-69	R 385 299	R 202 665	R 112 995
70-74	R 353 554	R 198 729	R 112 995
75-79	R 321 039	R 194 697	R 112 995
80+	R 273 091	R 188 751	R 112 995
Unknown	R 624 405	R 236 121	R 113 859

Table D7: Unit Human Casualty Cost according to age group and severity of injury – Rural Table			
Age group	Fatal (killed)	Serious Injury	Slight Injury
0-1	R 482 132	R 217 182	R 113 877
1-4	R 508 662	R 220 472	R 113 877
5-9	R 555 853	R 226 324	R 113 877
10-14	R 592 741	R 230 898	R 113 877
15-19	R 629 786	R 235 491	R 113 877
20-24	R 665 523	R 243 729	R 114 741
25-29	R 688 453	R 246 572	R 114 741
30-34	R 687 359	R 246 437	R 114 741
35-39	R 669 605	R 244 235	R 114 741
40-44	R 636 086	R 240 079	R 114 741
45-49	R 590 282	R 234 399	R 114 741
50-54	R 542 125	R 228 428	R 114 741
55-59	R 482 953	R 221 090	R 114 741
60-64	R 429 906	R 210 706	R 113 877
65-69	R 387 504	R 205 448	R 113 877
70-74	R 355 759	R 201 512	R 113 877
75-79	R 323 244	R 197 480	R 113 877
80+	R 275 296	R 191 534	R 113 877
Unknown	R 629 777	R 239 296	R 114 741

D4 Person costs by accident type using productivity values

The method developed by the Australian Road Research Board to allow explicit costing of specific accident types for the purpose of assessing the cost-benefit of safety countermeasures, was used to calculate the values given in the following sections.

The results of all the calculations are shown in Table D8. Based on the severity distribution of head-on accidents in rural areas, the average person cost of such an accident was calculated at R 339 839. Person costs of a head-rear end type accident in an urban area would cost on average R 145 744. Person costs of an accident involving a pedestrian in an urban area amount to R 128 004.

The average person cost of any accident regardless of severity or area is R 184 348.

Table D8: Person costs per accident (R)			
Accident type	**Urban**	**Rural**	**Anywhere**
Single-Vehicle Accidents			
Overturned	250 094	232 747	261 454
Fixed object	157 718	170 167	160 423
Animal	131 227	142 762	145 279
Pedestrian	128 004	79 079	126 080
Bicycle	102 568	105 317	113 153
Multiple-Vehicle Accidents			
Head-Rear end	145 744	199 775	151 707
Sideswipe same direction	150 014	204 223	154 902
Sideswipe opposite direction	180 723	244 272	198 317
Head-on	328 981	339 839	397 319
Turn from wrong lane	155 542	193 198	154 443
Turn in front of oncoming traffic	181 205	260 712	185 807
Both straight	178 803	269 241	175 778
Both turning	151 572	215 982	153 062
Reversing	123 287	195 540	131 953
Accidents of any category			
Any type	174 070	211 349	184 348

ANNEXURE

E VEHICLE DAMAGE COST

E1 Vehicle repair costs

Data on vehicle repair costs were obtained from short-term insurance companies. Two companies supplied detailed records of the make and model of the vehicle involved in the claim. These were used to determine the price of the latest model available in South Africa in order to classify models into price ranges. Sedan models were also classified into age groups and into a further two categories: ordinary sedans and elevated 4x4 station wagons. Light delivery vehicles were classified into ordinary and double cab categories.

Table E1 shows the average repair costs of various types and categories of vehicle in urban areas. Repair costs in rural areas were typically about nine per cent higher. The "Entry" category refers to less expensive models, which according to 2002 values would typically be in the price range below R 100 000. The "Medium" category refers to price ranges between R 100 000 and R 300 000, and the "Luxury" category to the price range above R 300 000 (2002 values). The average repair cost of a sedan vehicle amounted to R 10 452, but when looking at the models in more detail, the average repair cost of a luxury 4x4 station wagon amounted to more than R 20 000.

Table E1: Average vehicle repair costs obtained from insurance companies

Vehicle type	Category	Repair cost (R)	Sample size
Sedan	Older than 10 years	5 801	448
	Entry	9 867	8 359
	Medium	13 258	3 772
	Luxury	19 583	408
Station wagon (elevated)	Older than 10 years	9 016	2
	Entry	8 675	147
	Medium	15 379	350
	Luxury	21 226	198
Sedan & Station wagon subtotal	Older than 10 years	5 808	450
	Entry	9 846	8 506
	Medium	13 437	4 122
	Luxury	20 120	606
Average Sedan & Station wagon		10 452	55 330
Light Delivery Vehicle	Light Delivery Vehicle	11 620	7 833
	LDV double cab	13 624	682
	Panel van	13 354	130
Average Light Delivery Vehicle		11 478	10 061
Minibus		10 273	721

Table E1: Average vehicle repair costs obtained from insurance companies			
Vehicle type	**Category**	**Repair cost (R)**	**Sample size**
Bus	Midibus	60 198	16
	Bus	63 859	38
Average Bus		45 289	92
Truck	Truck < 6 ton	94 173	352
	Truck 6-10 ton	13 097	5 272
	Large & Articulated	174 309	917
Average Truck		18 098	6 065
Motorcycle		9 960	130
Tractor		12 387	148
Other		10 193	28
Ave All Vehicles		13 313	73 492

E2 Vehicle repair costs by accident type

Vehicle repair costs by accident type could not be established from the insurance claim data provided and therefore the proportional representation of specific vehicle types in different types of accident was used to determine costs. Table E2 and Table E3 show the average vehicle repair costs by single-vehicle accident type for urban and rural areas respectively, calculated by using historic accident data and average vehicle repair costs.

Table E2: Vehicle repair costs calculated for single-vehicle accident types (R) – Urban areas						
Per vehicle		Per Accident				
Vehicle type	Average cost	Overturned	Fixed object	Animal	Pedestrian	Bicycle
Sedan & Station wagon	10 452	15 993	14 127	13 604	549	643
Minibus	10 273	39 572	23 994	16 734	797	1 971
Light Delivery Vehicle	11 478	22 202	17 075	17 320	507	1 120
Truck	18 098	28 685	24 262	18 985	1 706	823
Articulated truck	174 309	217 516	241 487		5 593	16 682
Bus	45 289	164 700	182 098	57 645	4 065	13 101
Motorcycle	9 960	9 595	9 910	9 523	3 679	7 001
Tractor	12 387					
Other and Unknown	10 193	13 901	9 267		4 361	33
Average (any type)	13 313	25 286	19 190	17 747	798	938

Table E3: Vehicle repair costs calculated for single-vehicle accident types (R) – Rural areas						
Per vehicle		Per Accident				
Vehicle type	Average cost	Overturned	Fixed object	Animal	Pedestrian	Bicycle
Sedan & Station wagon	11 393	16 220	14 479	13 814	822	807
Minibus	11 198	42 558	26 823	21 638	948	3 927
Light Delivery Vehicle	12 511	21 765	18 550	13 818	728	834
Truck	19 727	30 007	25 282	26 387	1 414	1 339
Articulated truck	189 997	243 125	184 370		14 182	
Bus	49 365	318 059	182 768		3 779	1 965
Motorcycle	10 856	10 253	9 724	6 483	3 457	7 409
Tractor	13 502					0
Other and Unknown	11 110	13 269	19 904			15 481
Average (any type)	14 511	26 235	20 822	18 720	1 019	1 507

Table E4 and E5 show the repair costs for multiple-vehicle accident types for urban and rural areas respectively.

Table E4: Vehicle repair costs calculated for multiple-vehicle accident types (R) – Urban areas											
Vehicle type	Per vehicle	Head-Rear end	Sideswipe same dir	Sideswipe opp dir	Head-on	Turn from wrong lane	Turn ifo oncoming traffic	Both straight	Both turning	Reversing	Other & Unknown
Sedan & S/W	10 452	7 271	6 587	7 968	10 674	18 696	8 143	7 744	6 984	8 049	12 547
Minibus	10 273	11 919	13 246	15 814	19 887	31 990	17 039	16 782	16 570	15 306	23 158
Light Del Veh	11 478	7 747	7 479	9 301	11 660	21 728	8 883	8 467	8 409	9 970	11 402
Truck	18 098	7 801	8 929	7 882	12 341	19 547	6 703	9 670	8 768	9 158	24 023
Articul truck	174 309	52 204	17 892	48 023	50 045	66 032	52 825	61 630	45 279		
Bus	45 289	37 803	18 716	37 531	87 569	163 280	70 341	47 586	51 218	51 469	14 973
Motorcycle	9 960	8 816	8 756	8 706	9 225	10 920	9 088	8 862	8 958	9 889	14 085
Tractor	12 387										
Other/Unkn	10 193	3 860	4 168	4 192	13 169	12 893	4 036	7 272	7 723	4 295	1 060
Average	13 313	9 595	9 322	11 000	14 886	24 967	11 294	11 016	10 341	11 100	9 837

Table E5: Vehicle repair costs calculated for multiple-vehicle accident types (R) – Rural areas											
Vehicle type	Per vehicle	Head-Rear end	Sideswipe same dir	Sideswipe opp dir	Head-on	Turn from wrong lane	Turn ifo oncoming traffic	Both straight	Both turning	Reversing	Other
Sedan & S/W	11 393	10 857	9 367	12 006	14 463	9 608	11 631	12 021	10 451	8 713	11 376
Minibus	11 198	19 287	24 119	20 798	28 802	17 629	25 941	23 311	7 801	16 189	11 941
Light Del Veh	12 511	10 869	11 224	12 774	15 052	7 622	12 588	11 723	10 128	9 961	7 992
Truck	19 727	9 307	8 236	8 173	10 952	4 851	8 482	8 518	7 952	6 236	8 344
Articul truck	189 997	113 458	90 767	60 066	189 097		37 819	56 729		37 819	113 458
Bus	49 365	48 553	69 211	147 393	284 469		58 957	34 392		14 739	
Motorcycle	10 856	8 276	9 076	7 848	7 480	7 293	10 805	8 798	6 483		6 483
Tractor	13 502										
Other	11 110	11 374	8 046	6 333	17 250	6 635	3 317	9 478	8 846	6 635	8 846
Average	14 511	13 196	13 306	14 791	19 485	10 745	15 513	15 223	11 341	11 311	11 445

E3 Incident costs

Table E6 shows the average costs per vehicle type for incidents costs other than vehicle repair costs in urban areas, as obtained from short-term insurance companies, law enforcement departments, SAPS, etc.

Incident costs for rural areas were calculated at nine per cent higher than those in urban areas. Time delay costs were not included in the incidents cost calculations for rural areas.

No information was obtained on the cost of repair of road furniture, but a figure of R 1000 was added to the incident costs in the case of single-vehicle accidents involving fixed objects.

Table E6 Costs per incident in urban areas, excluding vehicle repairs (R)							
Vehicle type	Per vehicle					Per accident	
	Towing	Car hire	Insurance admin	Assessors	Legal	Accident attendance, reporting, etc	Time delay
Sedan & S/W	1 500	2 500	1 400	300	230	5 800	5 000
Minibus	1 600	2 500	1 400	300	230	5 800	5 000
LDV	1 500	2 500	1 400	300	230	5 800	5 000
Truck	2 000	2 500	1 400	500	230	5 800	5 000
Articulated truck	7 000	2 500	1 400	300	230	13 000	5 000
Bus	4 000	2 500	1 400	1 000	230	12 000	5 000
Motorcycle	1 000	2 500	1 400	300	230	5 800	5 000
Bicycle							
Tractor	1 500	2 500	1 400	300	230	5 800	5 000
Other & Unknown	1 500	2 500	1 400	300	230	5 800	5 000
Average	2 400	2 500	1 400	400	230	7 289	5 000

E4 Accident costs per vehicle type and area

Accident costs, which include vehicle repair costs and incident costs, were calculated for the various accident types and vehicle types, using the proportional representation of each in traffic accidents. The calculations were done for both urban and rural areas.

Table E7 shows the accident costs per vehicle type and single-vehicle accident type for urban areas. The repair plus incident costs of a bus overturning in an urban area were calculated as R 190 830 while a large articulated truck hitting a pedestrian was calculated to cost R 35 023. Human costs relating to victims are not reflected in these costs.

Table E7: Accident costs for single vehicle accidents in urban areas (Rands)

Vehicle type	Overturned	Fixed object	Animal	Pedestrian	Bicycle
Sedan & S/W	32 723	31 857	30 334	17 279	18 373
Minibus	56 402	41 824	33 564	17 627	19 801
Light Del Veh	38 932	34 805	34 050	17 237	18 850
Truck	46 115	42 692	36 415	19 136	19 253
Articulated truck	246 946	271 917	29 430	35 023	47 112
Bus	190 830	209 228	83 775	30 195	40 231
Motorcycle	25 825	27 140	25 753	19 909	24 231
Tractor	16 730	17 730	16 730	16 730	17 730
Other	30 631	26 997	16 730	21 091	17 763
Average	44 505	39 409	36 966	20 017	21 157

Table E8 shows the total accident costs per vehicle type for single-vehicle accident types in rural areas. The cost of a minibus overturning in a rural area was calculated at R 55 188. These figures exclude human casualty costs.

Table E8: Accident costs for single vehicle accidents in rural areas (Rands)					
Vehicle type	Overturned	Fixed object	Animal	Pedestrian	Bicycle
Sedan & S/W	28 750	28 099	26 344	13 352	14 427
Minibus	55 188	40 543	34 268	13 578	17 647
Light Del Veh	34 295	32 170	26 348	13 258	14 454
Truck	43 237	39 602	39 617	14 644	15 659
Articulated truck	269 455	211 790	26 330	40 512	27 420
Bus	340 689	206 488	22 630	26 409	25 685
Motorcycle	22 283	22 844	18 513	15 487	20 529
Tractor	12 530	13 620	12 530	12 530	13 620
Other	25 799	33 524	12 530	12 530	29 101
Average	41 454	37 131	33 939	16 238	17 816

Table E9 and Table E10 show the accident costs for multiple-vehicle accident types in urban and rural areas respectively.

Table E9: Accident costs for multiple-vehicle accidents in urban areas (Rands)										
Vehicle type	Head-Rear end	Sideswipe same dir	Sideswipe opposite dir	Head-on	Turn from wrong lane	Turn in front of oncoming traffic	Both straight	Both turning	Reversing	Other & Unknown
Sedan & S/W	18 601	17 917	19 298	22 004	30 026	19 473	19 074	18 314	19 379	23 877
Minibus	23 349	24 676	27 244	31 317	43 420	28 469	28 212	28 000	26 736	34 588
LDV	19 077	18 809	20 631	22 990	33 058	20 213	19 797	19 739	21 300	22 732
Truck	19 831	20 959	19 912	24 371	31 577	18 733	21 700	20 798	21 188	36 053
Articulated truck	72 634	38 322	68 453	70 475	86 462	73 255	82 060	65 709	20 430	20 430
Bus	55 433	36 346	55 161	105 199	180 910	87 971	65 216	68 848	69 099	32 603
Motorcycle	19 646	19 586	19 536	20 055	21 750	19 918	19 692	19 788	20 719	24 915
Tractor	11 330	11 330	11 330	11 330	11 330	11 330	11 330	11 330	11 330	11 330
Other/Unknown	15 190	15 498	15 522	24 499	24 223	15 366	18 602	19 053	15 625	12 390
Average	22 669	22 397	24 075	27 961	38 041	24 368	24 091	23 415	24 174	22 912

Table E10: Accident costs for multiple-vehicle accidents in rural areas (Rands)										
Vehicle type	Head-Rear end	Sideswipe same dir	Sideswipe opposite dir	Head-on	Turn from wrong lane	Turn in front of oncoming traffic	Both straight	Both turning	Reversing	Other & Unknown
Sedan & S/W	20 237	18 747	21 386	23 843	18 988	21 011	21 401	19 831	18 093	20 756
Minibus	28 767	33 599	30 278	38 282	27 109	35 421	32 791	17 281	25 669	21 421
LDV	20 249	20 604	22 154	24 432	17 002	21 968	21 103	19 508	19 341	17 372
Truck	19 387	18 316	18 253	21 032	14 931	18 562	18 598	18 032	16 316	18 424
Articulated truck	132 738	110 047	79 346	208 377	19 280	57 099	76 009	19 280	57 099	132 738
Bus	64 683	85 341	163 523	300 599	16 130	75 087	50 522	16 130	30 869	16 130
Motorcycle	17 156	17 956	16 728	16 360	16 173	19 685	17 678	15 363	8 880	15 363
Tractor	9 380	9 380	9 380	9 380	9 380	9 380	9 380	9 380	9 380	9 380
Other/unknown	20 754	17 426	15 713	26 630	16 015	12 697	18 858	18 226	16 015	18 226
Average	24 459	24 569	26 055	30 748	22 008	26 777	26 487	22 604	22 575	22 708

ANNEXURE

F HUMAN CASUALTY COST BASED ON RAF DATA

Payments made by the Road Accident Fund (RAF) to victims of road traffic accidents were used to estimate the human casualty unit costs and these were compared to the cost values derived from the lost output method described in Annexure D.

F1 Cost categories

The data received from the RAF was based on payments made during 2002. A total of 317 victims were paid compensation of some kind for 272 road traffic accidents. Table F1 shows the data items used and the average payments made. It should be noted that in some cases several different payments were made to the same victim, hence the larger sample sizes.

Table F1: Human casualty cost data by cost category – RAF data

Category	Average cost (R)	Sample size
Past lost earnings	R 64 545	101
Future lost earnings	R 304 905	103
Past lost support	R 19 346	3
Future lost support	R 210 836	4
Past medical costs	R 7 606	1221
Future medical costs	R 102 968	5
Funeral costs	R 9 792	4
Other costs	R 23 989	10
Pain and suffering (general damages)	R 56 764	354
Legal costs - RAF	R 71 987	665
Legal costs - claimant	R 70 201	915

Past lost earnings are described as lost income due to time off from work after the accident. Future lost earnings are described as potential loss of income as a result of the accident, based on the income of the victim at the time of the accident, or future potential income in the case of children and students.

Compensation for past or future loss of support is generally paid to dependants of deceased or disabled victims, based on the income of the victim, the number of years the children would still be dependent and the number of the years the victim would have worked before retirement.

Past medical expenses are paid for expenses incurred by the claimant for hospitalisation in provincial or private hospitals, and other medical expenses such as ambulance services. Future medical expenses are based on the extent of injuries sustained and type and period of treatment required. Payments for medical costs amounted to 16 per cent of the average compensation paid per victim.

Compensation for other expenses is based on a variety of smaller expenses such as transport to hospitals, attendant care, alterations to houses and vehicles, etc.

General damages are paid for pain and suffering and loss of enjoyment of life as a result of the accident.

Legal costs are categorized by RAF settlement costs and legal costs incurred by claimants. Each of these categories are subdivided into costs for Attorneys, Advocates, Assessors, Actuaries, Medico-legal experts and other experts such as accident reconstruction experts. Legal costs amounted to 20 per cent of the average payment made per victim.

Table F2 shows the average costs per severity of injury as paid by the RAF. The severity of the injury was not stated explicitly but a description of the injuries sustained was given in most cases.

The standardised unit cost for a fatality according to the payments made by the RAF was calculated at R 898 924; the unit cost for a serious injury was calculated at R761 614 and that of a slight injury R 82 306.

Table F2: Summary of human casualty costs by cost category and severity of injury

Category	Fatal	Serious	Slight
Lost future earnings	R 348 384	R 323 728	R 0
Lost past earnings	R 52 643	R 68 616	R 2 743
Value of lost support	R 280 097	R 22 399	
Hospital and medical costs	R 15 940	R 111 631	R 2 312
Funeral costs	R 9 792		
Legal costs - RAF	R 68 901	R 73 803	R 23 768
Legal costs - claimant	R 38 267	R 74 557	R 35 648
Other costs		R 23 989	
Pain and suffering	R 84 900	R 62 891	R 17 835
Total (Standardised cost)	**R 898 924**	**R 761 614**	**R 82 306**

Table F3 shows the legal costs paid by the RAF for settlements and claimant costs in terms of the various categories.

Table F3: Legal costs paid by the Road Accident Fund in 2002

	Average		**Fatal**		**Serious**		**Slight**	
	Cost (R)	n	Cost (R)	n	Cost (R)	n	Cost (R)	n
RAF settlement costs								
Attorneys	34320	154	48839	1	35251	146	12818	7
Advocates	19647	78	8379	1	19793	77		
Medico-legal experts	5167	120	8469	1	5323	108	3335	11
Actuaries	3865	83	2764	2	4180	68	2387	13
Assessors	4220	40			4244	31	4138	9
Other experts	3859	100	450	1	4056	94	837	5
Sundries	909	90			956	84	253	6
Total	71987	665	68901	6	73803	608	23768	51
Claimant legal costs								
Attorneys	22573	423	25745	7	23732	370	12765	46
Advocates	19611	99	587	3	20915	91	7294	5
Medico-legal experts	12865	284	11935	5	14986	217	5518	62
Actuaries	4053	81			4101	78	2793	3
Assessors	2043	2			1596	1	2490	1
Other experts	9056	26			9227	25	4788	1
Total	70201	915	38267	15	74557	782	35648	118

F2 Casualty costs by age group using RAF data

It was not possible to calculate casualty costs by age group, as the sample in the data received from the Road Accident Fund was too small.

F3 Person costs by accident type using RAF data

It was not possible to calculate accident costs by accident type from the data supplied by the Road Accident Fund. The Australian Road Research Board (ARRB) developed a method to allow explicit costing of specific accident types for the purpose of assessing the cost-benefit of safety countermeasures. Andreassen (1992) described the procedures used to calculate accident costs in a series of ARRB research reports. These procedures were used to calculate the values given in the following sections.

Figure F1 shows the assembly of cost components to derive standardised costs, as developed by Andreassen.

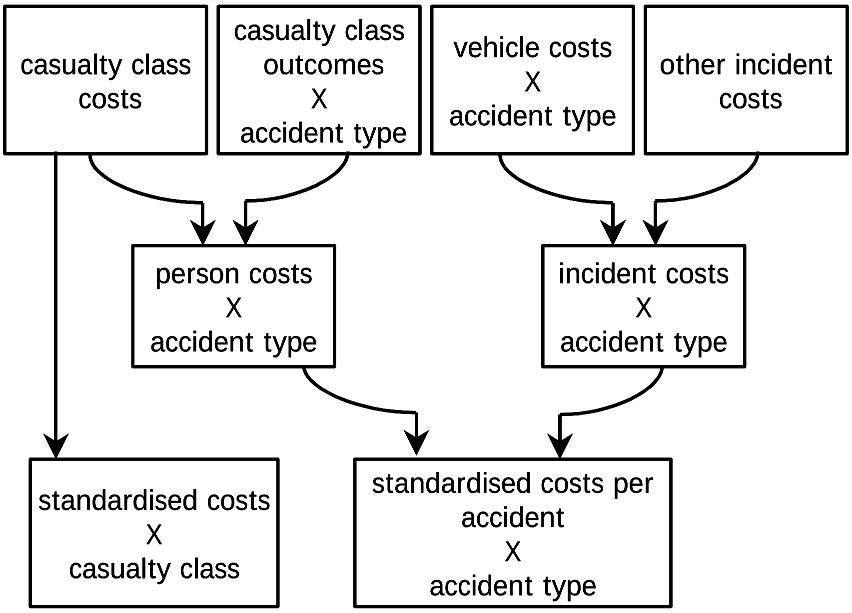

Figure F1: Assembly of costs (Andreassen, 1992)

"Casualty outcomes" were determined for accident types, using historical accident data for South Africa for the years 1997 and 1998. These were divided into single-vehicle accidents and multiple-vehicle accidents and further classified into urban and rural areas. An example of "casualty outcomes" for single-vehicle accidents in urban areas is shown in Table F4. The proportion of casualties to the total number of accidents is calculated for each severity class.

Table F4: Casualty outcomes - single-vehicle accident types – urban areas

Total: 1997 & 1998						
Accident type	Casualties				Accidents	Injury Accidents
	Fatal	Serious	Slight	Total		
Overturned	1489	7824	14803	24116	24674	11116
Tot/Inj Acc	0.1340	0.7039	1.3317	2.1695		
Tot/Acc	0.0603	0.3171	0.5999	0.9774		
Fixed object	791	3990	11715	16496	139838	10946
Tot/Inj Acc	0.0723	0.3645	1.0703	1.5070		
Tot/Acc	0.0057	0.0285	0.0838	0.1180		
Animal	28	249	846	1123	14129	820
Tot/Inj Acc	0.0341	0.3037	1.0317	1.3695		
Tot/Acc	0.0020	0.0176	0.0599	0.0795		
Pedestrian	5207	19871	37255	62333	72107	59349
Tot/Inj Acc	0.0877	0.3348	0.6277	1.0503		
Tot/Acc	0.0722	0.2756	0.5167	0.8645		

Person costs for the various accident types were calculated by multiplying the particular casualty outcome by the standardised casualty costs given in Table F2.

For example, the casualty outcome for fatalities associated with pedestrian injury accidents (0.08773526) was multiplied by the standardised casualty cost determined for fatalities from the RAF payment data (R 898 924) to give a cost value of R 78 867,33. The casualty outcome for serious injuries associated with pedestrian injury accidents (0.33481609) was multiplied by the standardised casualty cost for serious injuries (R 761 614) to give a cost value of R 255 000,46. The casualty outcome for slight injuries associated with pedestrian injury accidents (0.62772751) was multiplied by the standardised casualty cost for serious injuries (R 82 306) to give a cost value of R 51 666,03. The three resultant values were added: 78 867,33 + 255 000,46 + 51 666,03 to give a final average cost value of R 385 534 per injury accident involving pedestrians.

All calculations were done for urban and rural areas separately. Urban areas are defined as all built-up city, town and village areas and rural areas as all areas outside of built-up areas.

The results of the person cost calculations are shown in Table F5 and Table F6. Based on the severity of head-on accidents in rural areas, the average person cost of such an injury accident was calculated at R2,4 million. Person costs of a head-rear end type accident with injuries in an urban area would cost on average approximately R 360 000.

Table F5: Person costs per injury accident

Accident type	**Urban**	**Rural**	**Anywhere**
Single-vehicle Accidents			
Overturned	R 766 080	R 1 916 476	R 842 248
Fixed object	R 430 669	R 1 493 842	R 471 246
Animal	R 346 882	R 1 275 143	R 415 129
Pedestrian	R 385 534	R 582 512	R 405 441
Multiple-Vehicle Accidents			
Head-Rearend	R 360 810	R 1 657 360	R 421 995
Sideswipe same direction	R 397 543	R 1 696 659	R 453 571
Sideswipe opposite direction	R 506 055	R 1 980 658	R 608 953
Head-on	R 1 072 634	R 2 442 224	R 1 353 846
Turn from wrong lane	R 433 497	R 1 563 370	R 473 959
Turn in front of oncoming traffic	R 501 495	R 2 029 358	R 564 903
Both straight	R 489 869	R 2 086 377	R 528 886
Both turning	R 393 184	R 1 727 494	R 441 520

Reversing	R 281 823	R 1 701 319	R 336 232
Accidents of any category			
Any type	R 450 366	R 854 163	R 526 447

Table F6: Person costs per accident

Accident type	**Urban**	**Rural**	**Anywhere**
Single-Vehicle Accidents			
Overturned	R 345 130	R 986 871	R 406 681
Fixed object	R 33 711	R 284 186	R 35 669
Animal	R 20 132	R 113 380	R 29 868
Pedestrian	R 317 321	R 516 038	R 335 681
Multiple-Vehicle Accidents			
Head-Rearend	R 23 523	R 320 953	R 30 463
Sideswipe same direction	R 26 484	R 308 677	R 33 384
Sideswipe opposite direction	R 57 150	R 505 132	R 77 281
Head-on	R 273 129	R 1 323 932	R 407 592
Turn from wrong lane	R 32 177	R 372 293	R 39 092
Turn in front of oncoming traffic	R 97 442	R 797 515	R 115 196
Both straight	R 85 444	R 682 935	R 95 010
Both turning	R 41 283	R 428 785	R 49 255
Reversing	R 3 988	R 134 785	R 5 137
Accidents of any category			
Any type	R 55 245	R 272 529	R 87 360