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K A R O L I N S K A I N S T I T U T E T

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Impact of Safety Promotion Interventions and Enforcement of Traffic Legislations On Road Accidents in Mauritius 1992-2002

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Summary

The purpose of this comparative and exploratory research was to compare whether safety promotion interventions and the enforcement of traffic legislations have had any impact on road accidents in Mauritius for the period 1992-2002 by measuring the incidence and severity of accidents on the following parameters:

- (i) Light conditions
- (ii) Weather conditions
- (iii) Day of week
- (iv) Time of day
- (v) Apparent causes of accidents
- (vi) Type of road
- (vii) Road characteristics
- (viii) Type of vehicle & nature of damage
- (ix) Driving experience and sex
- (x) Casualties by class of road users
- (xi) Casualties by degree of injury and class of road users
- (xii) Casualties by age group
- (xiii) Pedestrian casualties by age group

The methods employed were literature search, interviews with key persons in various relevant organizations and documentation.

The findings revealed that though the number of fatalities has increased from 119 in 1992 to 158 in 2002 and an overall increase of 25.4% in accidents on all types of roads registered for the same period, safety promotion interventions and the enforcement of traffic legislations have had an impact on the above parameters where significant percentage changes have been noted. In the absence of these interventions and enforcement, the situation could have similar to the period 1982-1992 where the increase in registered vehicles was 116.4% in 1992 as compared to 1982 and the increase in accidents was 202.6%. In 2002, the increase in registered vehicles was 71.1% as compared to 1992 and the increase in accidents was 25.4%.

In the light of the above, the researcher came to the conclusion that safety promotion interventions and the enforcement of traffic legislations have had an impact on road accidents in Mauritius for the period 1992-2002.

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CHAPTER 1

1.1 Introduction

On hearing of the death of his eldest son in a road accident in 1969, Nelson Mandela said "I do not have words to express the sorrow or loss I felt. It left a hole in my heart that can never be filled." This is the same feeling which is being experienced by parents and relatives of the 3000 daily road victims throughout the world. Many authorities do recognise nowadays that traffic accident is a public health problem but an eminent personality, namely, John.F. Kennedy. U.S. President, 1960-1963, already said it in the early 60s "Traffic Accidents are one of the greatest, perhaps the greatest of the Nation's Public Health Problems".

Globally, injuries account for more than 5 million deaths each year, of which more than one fifth are attributable to Road Traffic Injuries (Murray & Lopez, 1996). Road Traffic Injuries (RTIs) are the ninth leading cause of all disability adjusted life years (DALYs) lost and account for 2.8% of global disability according to estimates for 1998 by a World Bank Group (undated). By 2020, it is expected that RTIs will be the third leading cause of all DALYs cost worldwide (Murray, Lopez, Mathers & Stein, 2001).

According to the Road Traffic Injuries Research Network (2003), in addition to human suffering, the estimated costs of Road Traffic Injuries (RTI) are between 1-2% of GNP per annum in low and middle-income countries

The Republic of Mauritius is a group of islands in the South West of the Indian Ocean, consisting of the main island of Mauritius, Rodrigues and several outer islands located at distances greater than 350 km from the main island. Mauritius has been successively a Dutch, French and British colony. It became independent of Britain on the 12th March 1968 and acceded to the status of the Republic within the Commonwealth on 12th March 1992. The country has a Westminster type of Parliamentary government. The official language is English, French is widely spoken and various oriental languages too are spoken in specific communities with different cultural background.

The population, estimated at 1.2 million, comprises Indo-Mauritians, General population, i.e. people of mixed European and African origin and Sino-Mauritians.

The islands of Mauritius and Rodrigues, with a total area of 1,969 sq km, have an overall population density of 618 persons per sq km. About 46% of the area is allocated to agriculture, 20% is occupied by built-up areas and 2% by public roads; the remaining consists of forests, scrub land, grasslands and grazing lands, reservoirs and ponds, swamps and rocks. The climate is generally sub-tropical (21-27 C) and 4-5C higher on coastal regions.

1.1.1 Economy and Human Development

During the past thirty years, the Mauritian economy has diversified from a sugar-cane monocrop economy in the 1970's to one based on sugar, manufacturing (mainly textiles and garments) and tourism in the 1980's. Global business (offshore) and Freeport activities have also been growing continuously since the mid 1990s. (*Central Statistics Office 2002*).

Mauritius ranks among countries of Medium Human Development Level. The country has achieved constant progress in its Human Development Index Level from 0.655 in 1980 to 0.721 in 1990 and 0.765 in 1999. The maintenance of free health care and free primary and secondary education has been fundamental in the high level of human development in these fields.

The economic performance of Mauritius has been one of the most remarkable in the Sub-Saharan Africa. Real GDP growth has averaged 5.4% per year from 1990-2001.

Economic growth has been accompanied by an improvement in the overall level of social development in Mauritius as mentioned above. Per Capita GNP increased from US\$ 3,637 to US\$ 3,800 from 1999 to 2000, and Mauritius is now classified as an upper-middle income country, implying a sharp fall in overseas development assistance. Life expectancy at birth has increased from 61 years in the 1960s to 71 in the 1990s.

The literacy rate (population aged 12 yrs and over) was 81.4% in 2000 (source: *Ministry of Education and Scientific Research:2000*)

Road Safety Campaigns and Enforcement

Road Safety campaigns through both the mass media and community interventions have played a key role with the aim to

- (i) Create awareness of road traffic threats and vulnerability of certain road users;
- (ii) educate road users as to what constitutes safe road user behaviour;
- (iii) change attitudes and beliefs to a more positive road safety approach; and
- (iv) inform road users of changes in traffic regulations or operating conditions.

The media campaigns comprised of billboards, radio and television spots, press adverts and communiqués, posters, pamphlets, stickers and booklets.

The community interventions were generally talks & lectures in primary and secondary schools, seminars/workshops on worksites, training programmes for teachers and youth leaders and organization of rallies and carnivals with participation of the general public

Traffic law enforcement is meant to achieve the safe and efficient movement of all road users, including pedestrians. It seeks to do so by enforcing legislation. Although driver discipline and respect for traffic laws are reasonably good in industrialized countries, this is not always the case in developing world. The Transport Research Laboratory (TRL) in the United Kingdom conducted studies in a number of developing countries which revealed that driver behaviour at traffic signals, pedestrian crossings and priority intersections is generally poor. Traffic law, if it is to stay relevant to the needs of rapidly motorizing societies, needs to be updated periodically and the traffic police need to be capable of enforcing it.

Aims and objectives of the research

According to the World Report on road traffic injury prevention published by the World Health Organisation and the World Bank (2004), public education and information campaigns/safety promotion interventions, in isolation, do not deliver tangible, sustained reductions in road traffic deaths and serious injuries. However, public education information campaigns have proven to be highly effective when they accompany laws and law enforcement. Hence the aim of the research is to find out whether safety promotion interventions and enforcement of traffic legislations have had any impact on road accidents in Mauritius between 1992 and 2002 by measuring the incidence and severity of accidents on the following parameters:

- (1) Light conditions
- (ii) Weather conditions
- (iii) Day of week
- (v) Time of day
- (vi) Apparent causes of accidents
- (vii) Type of road
- (viii) Road characteristics
- (ix) Type of vehicle & nature of damage

- (x) Driving experience and sex
- (xi) Casualties by class of road users
- (xii) Casualties by degree of injury and class of road users
- (xiii) Casualties by age group
- (xiv) Pedestrian casualties by age group

For the purpose of this study, the main island Mauritius of an area of **1865** sq.km will be considered.

CHAPTER 2

Methods

The chosen methods to carry out this study are **Literature Search, Interviews** and **Documentary Methods**. In order to have access to well documented data in the different organizations personal contacts had to be made with heads of departments and key persons and obtained their consent before proceeding for the literature search. Then appointments were fixed with key persons and stakeholders in the various relevant organizations such as the Ministry of Health and Quality of Life, the Road Safety Unit/Mauritius Police Force, the Ministry of Public Infrastructure, Land Transport and Shipping, the Central Statistics Office which falls under the Ministry of Economic Development, Financial Services and Corporate Affairs. Regarding data on road, vehicles and accidents, they were well documented in the various Digests mentioned below but this was not so for the Safety Campaigns.

Besides, the Statistical Section of the Ministry of Health and Quality of Life has been publishing since 1975 an Annual Digest of Vital and Health Statistics. As from 1981, analysis of the health situation has been incorporated with the Digest, and the Publication has since been known as the Report of the Principal Medical Statistician.

Mauritius adopted the 9th Revision of the International Statistics Classification of Diseases, Injuries and Causes of Death (I.C.D. 1975 Revision) as from 1st January, 1980, for purposes of morbidity, and as from 1st January, 1981, for purposes of mortality.

Data relating to population and vital statistics and to causes of death have been obtained from the Central Statistics Office. Data relating to the other health fields have been either collected directly by the Medical Statistics Section, or obtained from other Sections/Units/Divisions of the Ministry.

The following documents were reviewed and analysed:

- Digest of Road Transport Statistics 1991-1994
- Digest of Road Transport and Accident Statistics 1995, 2000, 2002
- Road Traffic Regulations of The National Transport Authority, August 1999
- Island of Mauritius Health Statistics Annual 2002
- Millennium Development Goals Status Report – Mauritius 2002

Definitions

Safety promotion can be defined as a process that aims to ensure the presence, and maintain the conditions, that are necessary to reach and sustain an optimal level of safety. Organised efforts by individuals, organizations, communities and nations are needed to achieve that ultimate goal. (Welander *et al*-2000)

For the purpose of this research, safety promotion interventions mean all public education and information campaigns conducted through the mass media and in the community through talks, seminars, forums, conferences and training programmes.

CHAPTER 3

Results

Faced with the threats of road accidents, the Mauritian Authorities had to work out strategies in order to address the problems. Due to the fact that the human factor is responsible for 95% of all road accidents, the need to empower all categories of road users has been a priority in many safety promotion programmes globally, especially in the developed and semi-developed countries.

Road safety education has made a long way in Mauritius since the 60s and a lot remains to be done.

With the constant increase in the number of road traffic accidents over the years resulting in high mortality and morbidity especially among young Mauritians, the Mauritius Police Force in collaboration with the Joint Child Health Project and the Ministry of Education, launched the Traffic Playground Project in 1982 with technical assistance from DANIDA, Denmark to cater mainly for public education on traffic safety. The project started initially in the urban areas, more precisely in the municipalities complex, which were readily accessible to the young children and their parents. Gradually the Traffic Playground were decentralized to the rural areas. Though the project was an initiative of the Mauritius Police Force, it got right at the start the collaboration of the local government authorities for the implementation of the project. The former was responsible for the operation of the project under the supervision of a policeman and the latter was responsible for the maintenance of the playground. Agreements were reached with the Ministry of Education and the management of private schools for the release of the pre-school children and primary school children to send their pupils at specific times to be exposed to the real traffic situations with traffic lights and road signs. Due to the popularity of the project among young children and their parents, it received the sponsorship of the private sectors for the purchase of the small cars and bicycles and for their repairs.

Since it is a fact that practically everybody is a road user at one time or the other, so everybody has to be targeted. Hence in 1988, The Mauritius Police Force set up the SOS Road Safety Unit. At a time in Mauritius as in many other cultures worldwide, many people had the impression that accidents, particularly road accidents, were acts of God. Fortunately information and education over a long period of time have been able to clarify this misconception to a great extent in such a way that many people now are aware that adopting risky behaviours may lead to disability and death. In countries where the literacy level is high, as in Mauritius, there is a great probability that people are not unaware of the risky behaviours but they have to be reminded from time to time about potential dangers. Knowledge is one thing and practice is another thing.

Besides, the SOS Road Traffic Unit has made use extensively of the mass media such as radio, television, and print materials like posters, pamphlets, leaflets, stickers. (Appendices 1-8)

Lately in 1999, the Traffic Management and Road Safety Unit (TMRSU) was set up and it consists of a structured team of engineers and technicians. Its Communication Section has as mission to deliver talks and lectures on Road Safety in the community at large. The TMRSU works in close collaboration with the Police Road Safety Unit on matters pertaining to road safety. The TMRSU embarked on the Action Plan formulated

under the National Road Safety Strategy. Action was geared on three fronts, namely Engineering, Education and Enforcement through concerted efforts from different stakeholders. According to the figures for the period 1999-2002 years, there has been a continual improvement of road safety in Mauritius. This may be due to a combination of factors. The goal of the Traffic Management and Road Safety Unit is to reduce the number of killed and seriously injured by one third by the year 2010 compared to the average 1996-2000. (TMRSU magazine 2004)

Traffic law enforcement is meant to achieve the safe and efficient movement of all road users, including pedestrians. It seeks to do so by enforcing legislation. Although driver discipline and respect for traffic laws are reasonably good in industrialized countries, this is not always the case in developing world. The Transport Research Laboratory (TRL) in the United Kingdom conducted studies in a number of developing countries which revealed that driver behaviour at traffic signals, pedestrian crossings and priority intersections is generally poor. Traffic law, if it is to stay relevant to the needs of rapidly motorizing societies, needs to be updated periodically and the traffic police need to be capable of enforcing it. For example, in Mauritius the Road Traffic Regulations 1954, referred to as "Principal Regulations" were in a way the basis of the Traffic Regulations which have been subject to various amendments throughout the years in order to keep pace with time and meet the different needs at various points in time. Subsequently many traffic regulations have come into force to address various issues such as the Road Traffic (Conductors and Drivers of Public Service Vehicle) Regulations 1954, Road Traffic Act, GN 194 of 1992, (Prohibition of child under 12 to sit on front seat of vehicles), Road Traffic (Paid Parking) Regulation 1993, Road Traffic (Immobilisation of vehicles) Regulations 1997, Road Traffic Act 1967 (coming into force in 2000) prohibiting Goods

Vehicles exceeding 3.5 tons to travel on motorways between 07.30 and 0900 hrs on week days. Road Traffic (Pedestrian Crossings) Regulations 2002, Road Traffic (Amendment Act – Fog Lamp & Bull Bar) 2002 (GN197), Road Traffic (Seat Belts) Regulations 2002, Road Traffic (Helmet Use) 1991, Road Traffic (Use of Lanes) Regulations 2002. Similar legislations exist for Drink and Drive, Use of Helmets by motor cyclists and Speeding.

The availability of health services & Selected Health Manpower as at 31.12.2001 were as follows:

5 Regional (Principal) General Hospital totalizing **2,530** beds

3 District General Hospital totalizing **139** beds

694 doctors employed by the Min.of Health & Quality of Life (population/grade: **1737**)

245 out of the 694 were Specialists (population/grade: **4,920**)

413 doctors were in the private practice (population/grade: **2,919**)

2,672 were qualified Nurses and Midwives employed by the Min .of Health & QL (population/grade:**451**)

The development of the fleet of vehicle during the period 1992-2002

Based on the above post-independence socio-economic developments, the fleet of vehicle in Mauritius has been on the constant rise from 155,320 (excluding pedal cycles) in 1992 to 265,841 in 2002 thus representing an increase of 71% over a period of ten years. The road network development has not kept pace with the increase in the fleet of vehicle. The length of road which was 1831 km in 1992 has been increased to 2000 km in 2002, thus representing an increase of only 9.2% over a period of ten years. It is worth to note that besides the motorised vehicles, 32,861 non motorized cycles were imported in 1992 as against 104,848 in 2002. Moreover the number of vehicles that were put off the road yearly were on average 4049 from 1992 to 2002, thus representing 9% per year. Consequently this has resulted in

high traffic density ,from 85 motorised vehicles per km of road in 1992 to 133 motorised vehicles per km of road in 2002., traffic congestions and traffic accidents. The number of traffic accidents registered in 2002 were 18,022 as compared to 14,371 in 1992 with high rate of severely injured (216) and fatalities (158) without forgetting the high rate of disabilities and long lasting sufferings left behind.

Table 1

Number of accidents by severity of accident and light conditions-1992 & 2002											
Light conditions	1992 Severity of accident					2002 Severity of accident					% change
	Fatal	Serious	Slight	No Injury	Total	Fatal	Serious	Slight	No Injury	Total	
Day Light	74	195	2158	9399	11826	79	121	1361	13001	14762	24.8
Dark-no street lighting	16	27	233	457	733	4	4	31	84	131	-82.1
Dark- street lighting on	20	52	399	1236	1707	53	44	459	2757	3410	99.8
Dark-street lighting off	-	2	38	65	105	1	-	1	22	25	-76.1
All conditions	110	276	2828	11157	14371	137	169	1852	15864	18328	27.5

Generally an overall 28% increase in accidents in all conditions was noted in 2002 as compared to 1992. The percentage changes noted in the different light conditions are as follows:

Daylight

A 25.0% increase in accidents was noted in 2002 as compared to 1992 especially in fatal and no injury accidents whereas significant decreases of 38.0% and 37.0% were noted in the serious and slight accidents respectively.

Dark- No street lighting

A 82.1% reduction in accidents was noted in 2002 as compared to 1992 irrespective of the degree of severity.

Dark- Street lighting on

A 94% increase in accidents was noted in 2002 as compared to 1992 especially in the fatal and no injury accidents amounting to 165% and 89% respectively.

Dark-Street lighting off

A 77.1% reduction in accidents was noted in 2002 as compared to 1992 especially in the serious, slight and no injury accidents.

Table 2. Number of accidents by severity of accident and weather conditions. 1992-2002

Weather conditions	1992 Severity of accident					2002 Severity of accident					
	Fatal	Serious	Slight	No injury	Total	Fatal	Serious	Slight	No injury	Total	% Change
Fine	103	239	2576	10385	13303	123	161	1795	15514	17593	32.2
Rainy	4	34	236	761	1035	14	8	57	350	429	-58.5
Fog/mist	1	2	8	4	15	-	-	-	-	-	-100.0
Other	2	1	8	7	18	-	-	-	-	-	-100.0
All conditions	110		2828	11157	14371	137	169	1852	15864	18022	25.4

A 32.2% increase in accidents was noted in fine weather as compared to 1992 whereas a 59.0% reduction was recorded in rainy weather during the same period. No accident was recorded in foggy/misty weather.

Number of accidents by day of week, 1992 & 2002

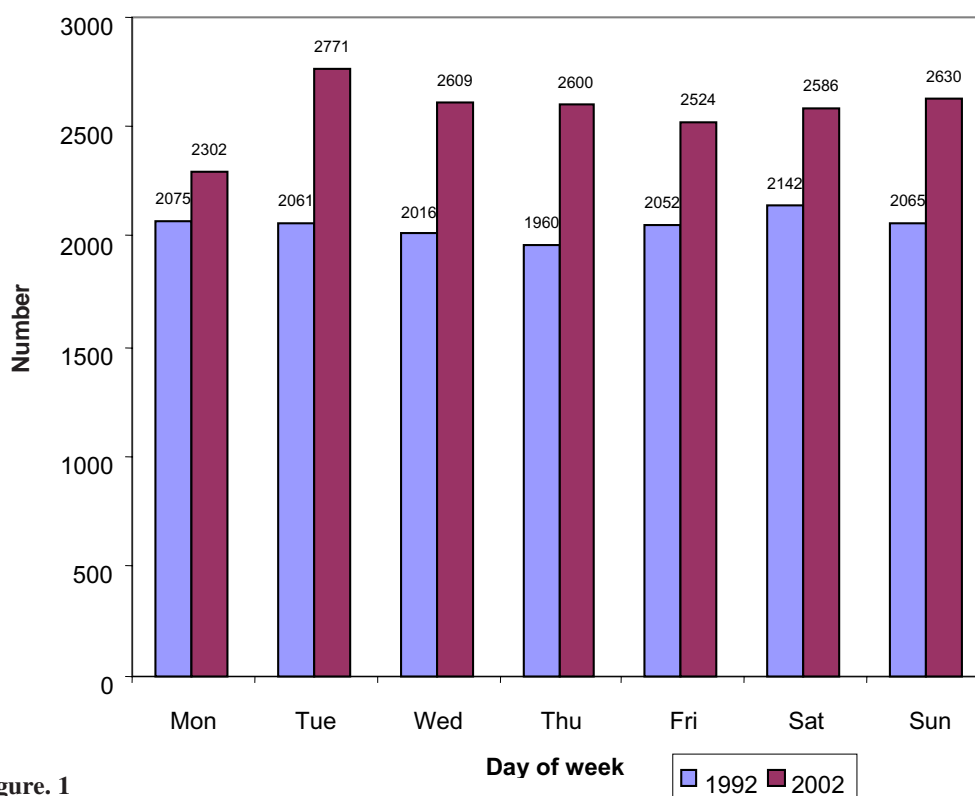
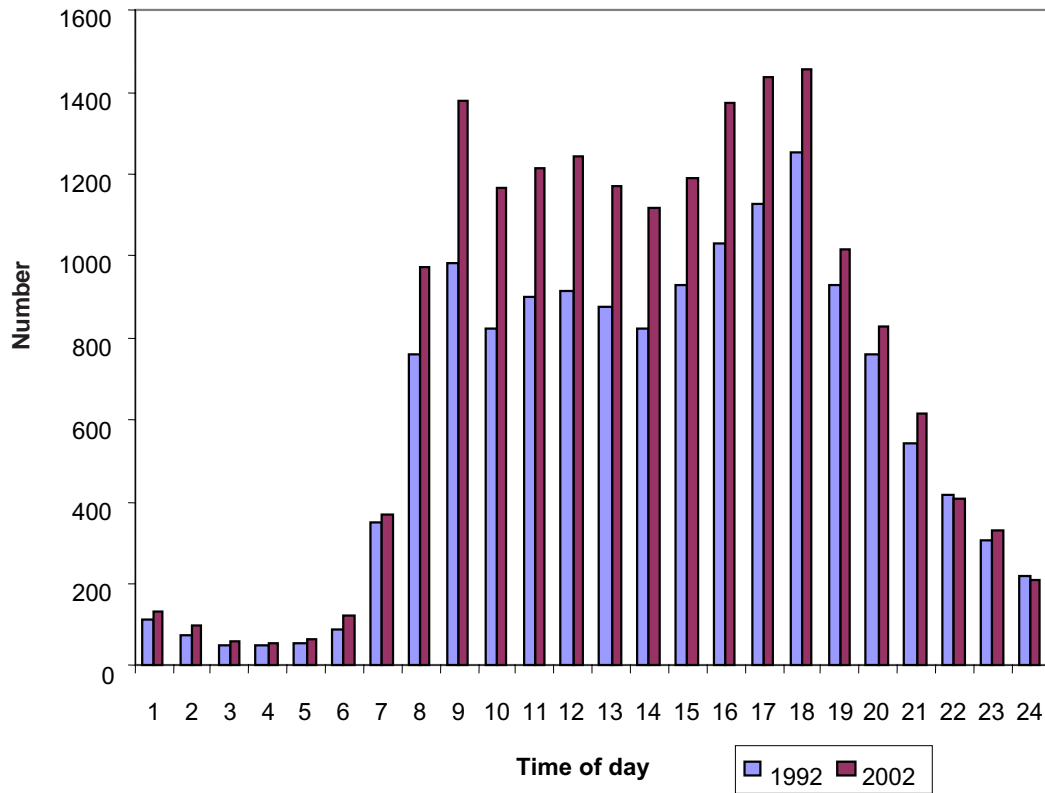


Figure. 1

There has been an overall percentage increase in accidents by day of week in 2002 as compared to 1992, the highest was on Tuesdays (34.4%), followed by Thursdays (33.0%), Wednesdays (30.0%), Sundays (27.3%), Fridays (23.0%), Saturdays (21.0%) and Mondays (11.0%).

Number of accidents by time of day, 1992 & 2002



The greater number of accidents occurred between 7.00 a.m. and 11.00 p.m. with peaks between 8.00 a.m. and 8.00 p.m. The number of accidents between this period of time in 2002 has exceeded that in 1992.

Table 3. Number of accidents by severity of accident and apparent cause of accident, 1992-2002

Apparent cause of accident	1992 Severity of accident					2002 Severity of accident					
	*Fatal	*Serious	Slight	No injury		*Fatal	*Serious	Slight	No injury		% change
				Total	Total				Total	Total	
Speeding	11	28	149	304	492	9	8	46	146	209	-57.5
Improper overtaking	2	11	64	371	448	3	4	17	72	96	-78.6
Signal violation	1		13	16	30		1	3	21	25	-16.7
Followed too closely		4	40	421	465	1	2	10	170	183	-60.6
Vehicle skidded	3	25	193	468	689	2	3	35	108	148	-78.5
Improper signing		3	20	60	83			11	62	73	-12.0
Inefficient brake	1		10	19	30	1	1	4	5	11	-63.3
Burst tyres		1	5	19	25			6	10	16	-36.0
Careless driving	62	143	1460	8243	9908	108	142	1639	15262	17151	73.1
Negligence of pedestrian	21	30	499	85	635	13	8	79	3	103	-83.8
Other mechanical defect		4	26	50	80			1	2	3	-96.3
Others causes	9	27	349	1101	1486			1	3	4	-99.7
All causes	110	276	2828	11157	14371	137	169	1852	15864	18022	25.4

Based on definition of fatal accidents where death occurred within 7 days

The significant percentage changes in the apparent causes of accident in 2002 as compared to 1992 may be due to the following causative/responsible factors:

Table 4.

Apparent Cause	% Change	Enforcement of traffic legislations	Behaviour modification as a result of safety promotion interventions
Speeding	-57.5	X	X
Improper overtaking	-78.6	X	X
Signal violation	-16.7	X	X
Followed too closely	-60.6	X	X
Vehicle skidded	-78.5	X	X
Improper signing	-12	X	X
Inefficient brake	-63.3	X	X
Burst tyres	-36	X	X
Careless driving	73.1	?	?
Negligence of pedestrian	-83.8		X
Other mechanical defect	-96.3	X	X

Table 5. Number of accidents by severity of accident and type of road, 1992-2002

Number of accidents by severity of accident and type of road, 1992-2002													
Type of road	1992 Severity of accidents						2002 Severity of accidents						
	Length of roads (Km)	Fatal	Serious	Slight	No injury	Total	Length of roads (Km)	Fatal	Serious	Slight	No injury	Total	% Change
Motor-way	29	12	17	130	832	991	60	21	7	105	1,298	1,431	44.3
Main road	886	49	111	920	3,212	4,292	950	30	61	581	3,314	3,991	-7.0
Secondary road	577	26	81	862	2,390	3,359	592	44	47	483	4,157	4,731	41.0
Other road	339	23	67	916	4,723	5,729	398	42	49	683	7,095	7,853	37.0
All roads	1831	110	276	2,828	11,157	14,371	2,000	137	169	1,852	15,864	18,022	25.0

Generally there has been an overall increase of 25.4% in accidents on all types of roads in 2002 as compared to 1992.

Motorway

A 44.3% increase in accidents was noted in 2002 as compared to 1992. A 75.0% increase in fatalities was also noted in 2002 as compared to 1992.

Main Road

Reductions of 7.0% in accidents, 39.0% in fatalities and 45.0% in serious injuries were noted in 2002 as compared to 1992.

Secondary Road

A 40.8% increase in accidents and a 69.2% increase in fatalities were noted in 2002 as compared to 1992 whereas a 41.9% reduction in serious cases was noted during the same period.

Other Road

A 37.0% increase in accidents and a 82.6% increase in fatalities were noted in 2002 as compared to 1992 whereas a 26.8% reduction in serious cases was noted during the same period.

Table 6. Number of accidents by severity of accident and road characteristics, 1992-2002

Road characteristics	Number of accidents by severity of accident and road characteristics, 1992-2002										
	1992 Severity of accident					2002 Severity of accident					%Change
	Fatal	Serious	Slight	No injury	Total	Fatal	Serious	Slight	No injury	Total	
Straight	84	205	2,141	9,205	11,635	120	146	1,680	15,134	17,080	47.0
Curve	9	36	361	887	1,293	13	14	82	326	435	-66.3
Roundabout	0	5	52	217	274	1	2	8	109	120	-56.2
Hill crest	3	4	28	83	118	0	1	13	44	58	-50.8
Signalised intersection	0	1	16	59	76	1	2	14	60	77	1.3
Uncontrolled junction	6	9	103	267	385	2	4	53	172	231	-40.0
Road works present	1	3	18	63	85	0	0	0	5	5	-94.1
Defective road surface	1	4	46	88	139	0	0	2	14	16	-88.4
Other	6	9	63	288	366	0	0	0	0	0	-100.0
All Characteristics	110	276	2,828	11,157	14,371	137	169	1,852	15,864	18,022	25.4

Generally there has been a 25.4% increase in accidents in 2002 as compared to 1992 with a 47% increase on straight roads and significant percentage reductions on curve roads, at roundabouts, on hillcrest, at uncontrolled junctions, near road works and on defective road surfaces.

Table 7. Number of motor-vehicles involved in accidents by type of vehicle and nature of damage, 1992- 2002

Type of vehicle	1992 Severity of accident				2002 Severity of accident				
	Seriously damaged	Slightly damaged	No damage	Total	Seriously damaged	Slightly damaged	No damage	Total	% change
Private car	210	9571	369	10150	108	14448	296	14852	46.3
Taxi car	40	1736	65	1841	21	2866	34	2921	58.6
Bus	44	1945	197	2186	11	2359	50	2420	10.7
Lorry	35	1429	251	1715	14	1895	73	1982	15.5
Van	81	3099	138	3318	42	6877	86	7005	111.1
Moto/Auto cycle	95	4857	168	5120	52	3525	79	3656	-28.3
Other motor vehicle	12	150	40	202	3	271	9	283	40.0
All vehicles	517	22787	1228	24532	251	32241	627	33119	35.0

* Only three main vehicles have been considered in accidents involving more than three vehicles

An increase of 46.3% in private cars involved in accidents was registered in 2002 as compared to 1992, followed by taxi car (59.0%), bus (11.0%), lorry (16.0%), van (111.1%) and other motor vehicle (40.0%). On the other hand, there has been a significant percentage decrease in motor/auto cycle (29.0%). Pedal cycle and other non-motor vehicle accounted for (43.1%) and (50.0%) respectively.

Table 8. Number of casualties by degree of injury and class of road users, 1992-2002

Number of casualties by degree of injury and class of road users, 1992 & 2002									
Class of Road Users	1992 Degree of injury				2002 Degree of injury				%Change
	Fatal	Seriously injured	Slightly injured	Total	Fatal	Seriously injured	Slightly injured	Total	
Pedestrian	49	77	1,062	1,188	51	55	639	745	-37.2
Passenger	17	102	973	1,092	27	63	630	770	-29.4
Driver	13	50	282	345	47	71	750	868	152
Rider (auto/m.cycle)	33	128	1,274	1,435	15	25	256	296	-79.3
Pedal cyclist	7	21	307	335	11	9	205	225	-33.0
All road users	119	378	3,898	4,395	151	223	2,530	2,904	-34.0

There has been an overall 34% decrease in casualties in all categories of road users in 2002 as compared to 1992, with significant decreases in pedestrians (37.2%), passengers (29.4%), riders (auto/motor cycle) (79.3%), pedal cyclist (33.0%) but a remarkable increase in drivers (152 %).

Table 9. Pedestrian Casualties by age-group, 1992-2002

Age-group (years)	1992			2002			% Change
	Population (mid-year)	Pedestrian Casualties		Population (mid year)	Pedestrian Casualties		
		Number	Per 100000 Population		Number	Per 100000 Population	
under 7	137183	90	66	132705	52	39	-42.2
12-Jul	122132	178	146	125687	75	60	-58.0
13 – 20	159126	118	74	149175	92	62	-22.0
21 – 40	371393	489	132	397663	252	63	-48.4
41 – 50	110031	125	114	165897	131	114	5.0
51 – 60	67871	88	130	102013	69	68	-22.0
over 60	82231	100	122	100881	74	73	-26.0
All Ages	1049967	1188	113	1174021	745	63	-37.2

There has been remarkable percentage reductions in all age groups in 2002 as compared to 1992 except in the age group 41-50 where an increase of 5% has been noted.

CHAPTER 4

Discussion

Type of research

It is both a comparative research and an exploratory research.

Comparative because the researcher is interested to identify any behaviour modification in all categories of road users in 2002 as compared to 1992 following safety promotion interventions and enforcement of traffic legislations during that period. The basis for the comparison will be the number and severity of accidents between the two periods.

Exploratory because there is actually not enough information available about the research subject. Reliable data are made available through digests and reports by the Mauritius Police Force, the Central Statistics Office and the Ministry of Economic Development, Financial Services and Corporate Affairs but no study has been conducted so far in Mauritius to assess the impact of safety promotion interventions and enforcement of traffic legislations on the incidence of road traffic accidents in 2002 as compared to 1992. Therefore this study is a first research document in Mauritius which may provide a basis for further research.

In Mauritius the cost of road accidents was estimated to be approximately Rs 1.5 Billion in 1999 which represented 1.2 of GNP. This is a bit similar to Western Australia where the cost of road crashes was estimated at \$1.02 billion by the Road Accident Prevention Foundation.

Validity

Validity in quantitative research.

Attainment of validity is one of the basic principles of social research. Validity means the ability to produce findings that are in agreement with theoretical or conceptual values; in other words to produce accurate results and to measure what is supposed to be measured.

There are two ways of checking the validity of an instrument: empirical validation and theoretical validation. In the former, the validity of a measure is checked against empirical evidence. In the latter, the validity of an instrument is ascertained through theoretical or conceptual constructs. In both cases, validity is claimed if the findings produced through the measure in questions are supported by empirical evidence or by theoretical principles. (Sarantakos 1998)

Empirical validation

Here in the context of this research, since all positive and negative percentage changes which had an effect on the various parameters as a result of safety promotion interventions and the enforcement of traffic legislations in 2002 as compared to 1992 are supported by official data, the research therefore has pragmatic validity.

Reliability

Reliability in quantitative research.

Reliability refers to the ability of an instrument to produce consistent results; reliability is equivalent to consistency. Thus a method is reliable if it produces the same results

whenever it is repeated by other researchers. Without precision and objectivity, reliability cannot be achieved. (Sarantakos 1998).

Hence the researcher is of opinion that if this research is conducted by other researchers, the same results may be obtained. Therefore this research can be considered to have achieved reliability.

Generalisability

Generalisability of findings gathered by means of an instrument in question is a form of *external validity*. There are many types of generalisability (Firestone, 1993; Maxwell, 1992) a number of which apply fully to qualitative research (Sarantakos 1998). Since this research has revealed that safety promotion interventions and the enforcement of traffic legislations have had an impact on the incidence of road accidents, more precisely on the change in behaviour of road users, the researcher is rather cautious in generalising the findings based on the specific situations in which it has been carried out, unless the same conditions are met elsewhere.

Generally there were more fatal, serious and slight accidents during daylight and in dark streets with lighting on than in dark- no street lighting on and dark- street lighting off.

This may be attributed to negligence and risky behaviour of all categories of road users. The factors that were responsible could be speeding and high traffic density due to commercial and social activities, thus increasing collisions. In the dark-no street lighting and dark-street lighting off where significant reductions in accidents were noted, this could be explained by the fact that road users were more cautious for fear of accidents.

It can also be due to the fact that vehicles with their light on are easily seen and from far by all road users especially by pedestrians and hence safety behaviours are observed e.g. in crossing the roads.

The 32.2% increase in accidents in fine weather in 1982 as compared to 1992 can be attributed to unsafe behaviour of all road users such as speeding, reckless driving and riding, negligence especially by pedestrians. The decrease of 58.5% in accidents in rainy weather can be explained by the fact that road users were more cautious to avoid accidents meaning that they were all aware of potential dangers in rainy weather. The same explanation is plausible for the foggy/misty weather where no accident was registered in 2002. Edwards (1999) found that traffic on the M4 motorway in South Wales travelled at a lower speed both in wet weather and in misty conditions than it did in dry conditions (ACC 2000).

The overall percentage increase in accidents by day of week in 2002 as compared to 1992 may be due to the high density of vehicles on the roads, 133/km in 2002 against 85/km in 1992 which consequently increased the probability for collisions.

The greater number of accidents which occurred between 8.00 a.m. and 8.00 p.m. can be explained by the fact that most of the socio-economic activities took place during this time. However the increase in the number of accidents in 2002 as compared to 1992 may be due to the significant increase in the fleet of vehicles between the two periods.

The significant percentage reductions in the severity of accidents and apparent cause of accident shows that enforcement of traffic legislations and behaviour modification as a result of safety promotion interventions have had a remarkable impact in the reduction of accidents due to the above mentioned apparent causes except in careless driving where an increase of 73.1% in accidents was noted. This may be attributed to the absence/ lack of traffic legislations enforcement on 'speeding' and 'drink and drive' in some particular areas/zones/regions at some specific times of the day. For example, the enforcement of Random Stopping Programmes in New Zealand at the end of the 70s where the Police were empowered to make breath tests on the drivers stopped, accompanied by publicity in

the mass media, has reduced the number of fatal accidents during "main drinking hours" (Hurst & Wright 1981). It may also due to the inadequacy of safety promotion/road safety publicity & education campaigns emphasizing on the consequences of such irresponsible behaviour.

The significant increases of 44.3 % in accidents and 75.0% in fatalities on the motorway in 2002 as compared to 1992 may be attributed to speeding and reckless driving. Grime (1987, cited in Varhelyi, 1996) found that in New Zealand, the population of drivers exceeding the speed limit was 40% on motorways with a speed limit of 70 mph (113 kph) (ACC 2000). Contrary on the main road, reductions of 7% in accidents, 38.7% in fatalities and 45% in serious injuries during the same period were recorded and might be attributed to frequent speed checks and high traffic density where the impact of collisions were not too great. This is supported by Oppenlander (1973); Rankin and Hill (1974); and Armour (1983)-(ACC) who stated that as traffic volume and speed increases, travel speed decreases. The secondary road too registered a 40.8% increase in accidents and a 69.2% increase in fatalities. This may be due to high flow of traffic on narrow roads where the probabilities for collision was much greater than on the motorway and on the main road. The same explanation is relevant to the other road where increases of 37% in accidents and 82.6% in fatalities were recorded.

The 47.0% increase in accidents on straight roads may be due to careless driving and speeding whereas the significant percentage reductions on curve roads (-66.3%), at roundabouts (-56.2%), on hill crest (50.8%), at uncontrolled junctions (-40.0), near road works (-94.1%) and on defective road surfaces (88.4%) and other roads (100.0 %) can be attributed to cautiousness on the part of drivers and riders.

This may be due to the high percentage increases in the age composition of cars and dual purpose vehicles under fifteen years in 2002 as compared to 1992 thereby favouring speeding, amongst other factors.

Table 10.

Age composition of cars and dual purpose vehicles 1992-2002			
Age group (years)	1992	2002	% change
	Number	Number	
<5	19594	34183	74.4
5<10	9118	27858	205.5
10<15	4059	12921	218.3
>=15	21171	26474	25.0
Total	53942	101436	88.0

No Licence

This could be due to the fact that during routine checks of vehicles on the roads for defects or absence of safety gadgets, drivers, especially the young ones, were not requested to present their drivers licence on the spot or to produce them at the nearest police station to their residence within five days in conformity to the normal practice in case of involvement in any accident. If this was the practice, the number would **not** have doubled.

Learner driver's licence

The 45.0% reduction in this category of road users involved in road accidents in 2002 as compared to 1992 could be due to the fact that most of these learners went to Driving Schools and learned the right driving skills prior to 1992 where many learners were receiving their training from relatives and friends who were licence holders but who did not possess the teaching skills. Overseas research has shown that learner drivers with over 100 hours of driving practice have a significantly lower crash risk after becoming independent drivers (Ivett Linda Ms) (undated).

Licence with less than 2 years experience

The reduction of 38.0% noted in this category of road users involved in accidents in 2002 as compared to 1992 could be due to the acquisition of the right driving skills at the Driving Schools.

Licence with more than 2 years

The increase of 45.0% in this category of road users involved in accidents in 2002 as compared to 1992 could be due to the overzealous driving practice, especially among young drivers, or they might have not acquired the right driving skills as taught at the Driving Schools. It might also be that they were involved in accidents due to speeding based on the fact that the age composition of cars and dual purpose vehicles has shown a 74.4% increase in those aged than five years and a 205.5% increase in those aged than ten years in 2002 as compared to 1992. It may also be due to driving under the influence of alcohol or to distractions such as mobile phones, music and passersby. "Distraction of drivers by secondary tasks or events can result in general withdrawal of attention (e.g. eye glances away from the road) or in selective withdrawal of attention in which "automatic" behaviours (such as those involved in vehicle speed control and lane position) are maintained but event detection is degraded.(Tijerina, 2000).

The overall 34% decrease in casualties by class of road users in 2002 as compared to 1992 is a significant indicator that both the Safety Promotion Interventions and the Enforcement of Traffic Legislations paid dividends, that is they have been able to bring about significant reductions in the percentage of different categories of casualties based on the 1992 data. The road safety campaigns had focused on the adoption of safety behaviours by pedestrians, drivers, riders (auto/motorcycle), passengers and pedal cyclists such as proper use of car seat belts by drivers and passengers where applicable, use of motorcycle helmets, use of headlights and reflectors on bicycles at night, good maintenance of motorized vehicles and non motorized cycles. Regarding the enforcement of traffic legislations, focus was made on speed checks, routine vehicle checks to detect defects in the maintenance of vehicles that may cause accidents, unsafe behaviours such as overtaking on no overtaking centre lines.

It clearly indicates that all the human, material and financial investments made in the road safety campaigns in view to bring about behaviour modification/ adoption of safe behaviour in all road users with the aim to decrease the number of road accident casualties together with the enforcement of traffic legislations on use of seat belts, helmet use by motorcyclists, speed checks and drink & drive have paid dividends in bringing significant reductions in casualties in all categories of road users.

The 5% increase in pedestrian casualties in the age-group 41-50 represents a significant loss in the economically active group leaving behind families with unaccomplished goals and objectives that may have serious socio-economic consequences.

CHAPTER 5

Conclusion

The overall increase of 25.4% in accidents on all types of roads in 2002 as compared to 1992 is **fortunately** not proportionate with the 71.1% increase in registered vehicles (excluding pedal cycles) for the same period. Stepping back to the period **1982-1992** where the increase in registered vehicles was 116.4% and the increase in accidents was 202.6% in 1992 as compared to 1982, there is no doubt to conclude that the Safety Promotion Interventions and the Enforcement of Road Traffic Legislations have had a great impact in braking to a great extent the incidence of road traffic accidents during the period **1992-2002**. Without proper Safety Promotions initiatives and Enforcement of Road Traffic Legislations, the situation could have been worst during the study period. Elliot (1993) reviewed those evaluations of mass media campaigns targeting key areas of road user behaviour such as drink-driving, pedestrian safety and seat-belt use. When examining the effect of such campaigns, he concluded that on average that the mass media campaigns would generate a 7.5% reduction in the outcome measure of effect. Delhomme (1999) on his part, estimated that on average a road safety mass media campaign will result in an 8.5% reduction in crashes during the operation of the campaign. Following campaign completion, the reduction in crashes is expected to increase on average to 14.8%. Several studies have examined the combined use of publicity/safety promotion and speed enforcement. For example, Riedel, Rothengatter, and de Bruin (1988) examined speeding behaviour on the open road following publicity and enforcement. They found that publicity alone produced some speed reductions. However, the combined use of publicity and enforcement had a much larger effect (ACC 2000). Hence more investments should be made in the field of Safety Promotion interventions such as Publicity and Education campaigns to ensure sustainability and continuous exposure of all road users to potential dangers and to new traffic codes and also in the enforcement of traffic legislations such as trained personnel and new equipment in order to take necessary measures against contraveners.

It is a known fact that road accidents cost a country huge sum of money, time & effort, besides human sufferings but all these are preventable if more efforts are done jointly by governments, communities, NGOs, and individuals in safety promotion, the enhancement of community participation, and the enforcement of traffic legislations.

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Appendices

Appendix 1. Safety measures for pedestrians (recto)



**Appendix 2 . Focus on individual responsibility to reduce road accidents
(verso)**



Appendix 3. Motorcyclists – 10 safety measures to reach your destination alive (recto)

✓ Check to life... Avant to sorti
ek to Bicycleete, Mobylette ou Moto

Check to freins ● Eski N'has ?

Check to la roue ● Eski pression bon ? Trop gonflé? Trop plat ?

Check to la chaîne ● Eski il trop laxe ? Trop tendu ?

Check to reflecter ek to phare ● Eski bonne reflecter sale ?
 ● Eski to phare allumé bien ?
 ● Eski to lanternes rouge arrière allumé ?

Check to conditione physique ● Eski to ditour ou to alcool ?
 ● Eski avec autre maladie ?
 ● Eski comment pi cadre to ditir ?
 ● Eski to fine belt ou to deux cintre ?

ek to Mobylette ou Moto

Check to chain to lanternes ek to flasher ● Eski to l'ampoule bon ?
 ● Eski to retroviseur bien ajusté ?

Check to helmet ● Eski il correcte bien attache to la tête ?
 ● Eski to fine bien attache AT ?

ek to Bicycleete

Check to la cloche ● Eski il correcte courir bien ?

Check to guidon ek to la selle ● Eski cel bien ajusté pou to hauteur ?

✓ Check to life... Kan to pi rouler lor nimin
ek to Bicycleete, Mobylette ou Moto

TO BISH ● Bete signalé et contrôlé
 ● Prendz sempre route de la route
 ● Devez bonne signalé clair et sans ambiguïté
 ● Batez des vitesse raisonnable selon condition
 et condition de route
 ● Mettez bonne l'habileté pour conduire claire et sagement


ek to Moto

TO BISH ● Allume to phare ek to lanternes

ek to Bicycleete, Mobylette ou Moto

TO PAS BISH ● Dribble à gauche et zig zag
 ● Dribblez vite lor Main Road
 ● Faire rallye ek courir
 ● Assise dans conduit le mot (poutre bonne relié)
 ● Cadre trop près avec les bras serrés
 ● Transporte plus aléatoire qui to gage ditir avecé

Ar 2 la roues ... 2 fois pliss précautions



Appendix 4. The ten measures (verso)


*L'année dernière
63 motocyclistes, cyclistes
et passagers '2 roues'
sont trouves la mort lors simin.*

*1163 sont blessés.
Ladon 921 motocyclistes et 242 cyclistes*






Bonne chiffres là faire gagne peur

*Donc... Sécurité bonne '2 roues' azorü
Linn vin ène MUST.*

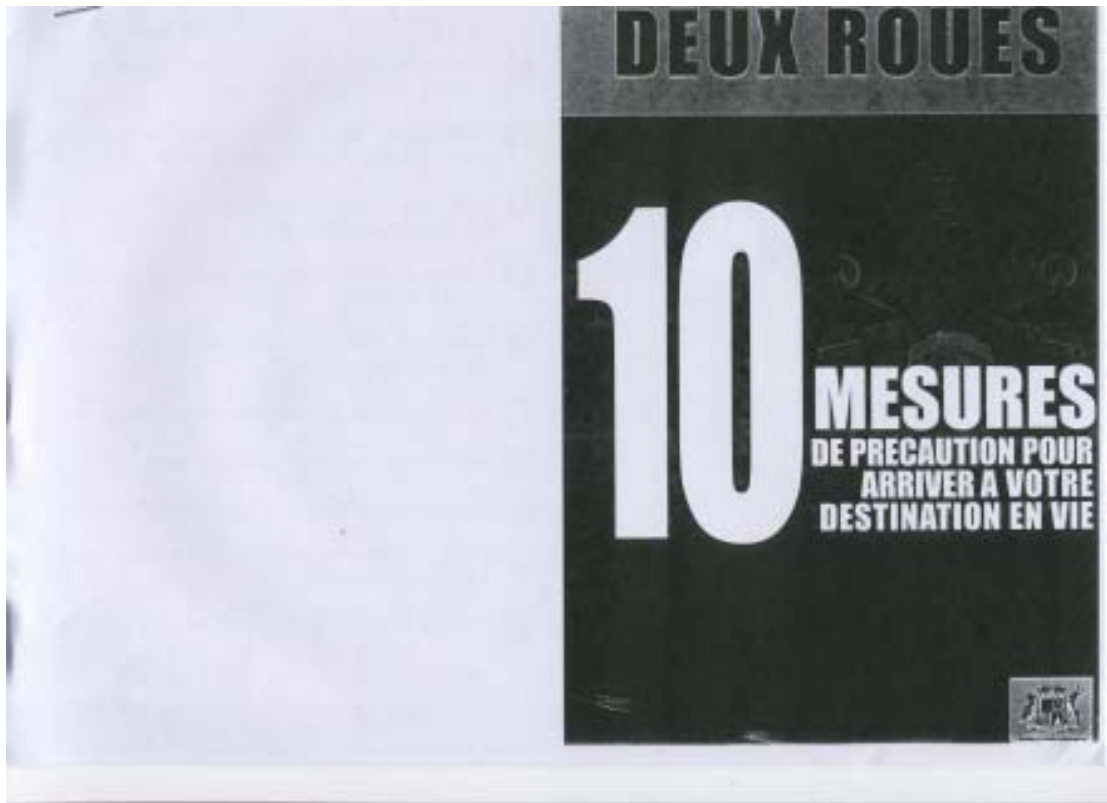
*Ar 2 la roues
nous bisin prend 2 fois pliss précautions.*




Road Safety Research
The Road Safety World Centre - Port Louis
Tel. 22 8 9754



Appendix 5. Protect your life- General advice to two wheelers (recto)



Appendix 6. On two wheels- two times more precautions (verso)



A black and white illustration of a motorcyclist from a rear perspective. The rider is wearing a helmet and a light-colored jacket. A large sign with the word 'FRAGILE' is superimposed over the rider's chest. The motorcycle is positioned on a dark surface against a light background.

- 1 Assurez-vous que la taille de votre casque protecteur est convenable et qu'il est bien attaché.
- 2 Soyez toujours vigilant quand vous roulez - anticipez les fausses manoeuvres des autres usagers de la route.
- 3 Faites usage de votre rétroviseur ou regardez à l'arrière avant de changer de direction.
- 4 N'essayez jamais de rouler entre les véhicules - la route n'est pas un circuit.
- 5 Roulez à une vitesse raisonnable selon les conditions de zone et du trafic.
- 6 Adoptez la position qui vous permet de voir et d'être vu.
- 7 Signalez clairement votre intention à temps.
- 8 Soyez toujours vigilant en ce qui concerne l'état de la route.
- 9 Portez des vêtements de couleurs claires et voyantes qui vous protègent.
- 10 Maintenez votre cyclomoteur ou moto en bonne condition.

Appendix 7. Drivers- safety measures (recto)



Appendix 8. Safe driving on motor way, crawler lanes etc

