Quantitative Analysis and Study on the Evolution of Road Safety in Morocco

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Abstract: *This paper describes the problem of road accidents and ways from listing corrected. It appeals to fundamental traffic rules and their application in various fields. We examined the magnitude of the potential of these systems for prevention against accidents, as the focus is on assessing human error, bad behavior and the influence of various risk factors on the probability of an accident.*

In addition, we studied the technical measures on vehicle assistance systems that are given high expectations and hopes. Finally, this multidisciplinary research related to the health, quality, management, applied statistics as well challenges engineer's automotive industry, road safety officers, traffic engineers, instructor's code and finally the public policies by the countries in the area.

Keywords: *Mechanical Engineering, Simulation, statistics, road safety*

1. INTRODUCTION

The road safety policy, conducted in Morocco for decades, seem to suffer from a progressive "depoliticization" of its purpose, although it has been able to acquire a proper political value. Addressed in a timely manner by the authorities, road safety would become a commoditized product and confined to administrative and technical circles.

However, it still retains its relevance, since statistics on the number of road accident victims are routinely provided by the specialized agencies and the media. In addition, road safety has long been seen as a recurring phenomenon and an inherent fatality mobility of needs of the individuals. As such, if the administration of this problem appears to be continuous, it carefully excluded the concerns and questions of politics.

For example, Le Monde is indignant that "according to the authorized estimations 1012 000 people lost their lives in traffic accidents in the United States since the beginning of the century. The association of insurance companies said that this figure is higher by seven thousand than the losses in the wars since 1715 [1]. The thousand automobile became more deadly than the war in the United States, the World, April 19, 1979.

The road accidents have always been a challenge to the public authorities through the investigation of traffic accidents. Indeed the first surveys dating from 1895 Marschall [2]. In addition to the USA MHH Bliss [1] was the first American to die in a road accident.

Moroccan road network covers 41 466 km, consisting of 736 km of expressways, 1416 km of motorway network. The fleet reached three million vehicles with a circulation of 88.42 million vehicle kilometers per day [3]. Each year the road accidents causes more than 4,000 dead and an estimated 14 billion dirhams in material damage, or about 2% of gross domestic product GDP damage. This scourge has a negative impact on foreign investment and the goal of 10 million tourists set by the Ministry of Tourism [4].

Given the magnitude of the problem of road safety and to fight against the increase in traffic accidents on the road, several national road safety strategies have been implemented and adopted by the government. Several targets have been set to record in a sustainable manner, declining road safety indicators. Indeed, since 2003 the priority areas such as legislation, training of inspectors, improving urban infrastructure and urban roads, traffic education, and finally, the scientific research and technological watch on road safety have been set targets and strategic areas of road safety [4].

In addition, poor infrastructure and corrupt state vehicles are always presented as the main causes. However, the human factor is the cause of most of these accidents by 80%. More than two thirds of accidents occur 7.7% in the urban area for various reasons including non-compliance with traffic lights, the Moroccan government has revealed that accidents in this range are a third of the deaths and serious injuries. The renewal of the fleet during the past decade has contributed to the decline in accidents, because a third of the vehicles involved in these accidents were only a length of 5 years. The majority of vehicles do not comply with international norms and standards in terms of safety and approval.

However, human responsibility in road accidents must not be confined to road users, but also shared by officials in charge of traffic control including the police, the Royal Canadian Mounted Police, the officers of the Ministry Transport and Equipment, owners of driving schools, technical inspection centers and other stakeholders.

We will examine the extent of the potential of these systems for prevention against accidents, as the focus is on assessing human error, bad behavior and the influence of various risk factors on the probability of an accident.

2. THE CONCEPT OF ROAD SAFETY

Before beginning the analysis of road accidents, it should account for a semantic and historical difficulty implied by the same concepts of safety and road insecurity.

The layout of the road safety object is born of a quantitative input to apprehend the number of road accident victims in relation to costs incurred. This statistical data processing of accident, on the initiative of the insurance companies and, moreover, widely reported by the media, adds a new dimension to the issue of road safety. Various simple facts, it now rose to the rank and societal issue of public interest. The concept of road safety is defined as the set of rules and services that are designed to ensure the safety of road users. It can be divided into primary (or active), secondary (or passive) and tertiary. Safety is the primary driver assistance to avoid potential accidents (brake lights / brake and turn signals). Secondary safety seeks to minimize the consequences of an accident when it occurs (airbags, seat belts). Then, the security service said aims to reduce the consequences arising out of an accident (stop fuel supply, for example, to avoid fire.

In addition, road safety is determined by signs, horizontal and vertical and respect for users of the highway; drivers towards pedestrians and vice versa. Signaling role to guide road users while helping them learn how to behave as they encounter new obstacles.

Dramatization and theatricality of road accidents in the media quickly played a catalytic role in the transformation of the problem of road safety policy issue, then public policy issue itself. In fact, the theme of road safety is seen as a technical product and not as a political object. The acquisition of this policy consistency requires some maturation, as discussed in the following.

3. MATERIALS AND METHODS

3.1. Data Collection

Data collection began in 1968 through statistics on road accidents under the law. On one hand, the Royal Gendarmerie collects data on traffic accidents in urban environment outside and the other hand by the General Directorate of National Security Committee that collects data on traffic accidents in urban areas. Finally, these data will be collected by the Highways Agency for the consolidation and development of statistical reports. We collected the statistics of the Directorate of Roads since 1968. We will explore and analyze in order to follow the evolution of accidents means of tables and figures. We will assess the impact and seek the first attempts to explain the origins of accidents.

The statistical study on road accidents since 1968 has been narrated in the table below shows that accidents have increased significantly in a linear fashion with the population growth and the increasing number of vehicles. The numbers remain high and continue to rise.

Table1. *Statistical data from Transport Minister*

year	dead	wounded	Accidents	vehicles	Population
1968	1305	20470	16079	278112	14177926
1969	1472	20601	15962	292661	14559236
1970	1559	23382	17651	321029	14952419
1971	1838	25306	19438	347438	15379259
1972	1858	27055	20721	373169	15771617
1973	2121	29395	22617	402970	16196215
1974	1865	28606	22323	426402	16629849
1975	2088	30465	23659	453737	17071786
1976	2319	40155	26711	497966	17521282
1977	2659	37420	29265	540370	17977582
1978	2593	37874	27319	572863	18439923
1979	2381	33820	24539	602655	18907530
1980	2256	32987	23875	629747	19379618
1981	2320	32224	24238	652167	19855395
1982	2232	33654	24975	679500	20419555
1983	2110	33710	25048	703600	20814781
1984	2071	32192	24109	723800	21296753
1985	2112	33269	24408	748429	21779134
1986	2218	34286	25009	774960	22261080
1987	2269	36902	27154	812129	22741736
1988	2494	40692	29172	857445	23220237
1989	2588	43788	30673	910457	23695709
1990	2777	47301	32992	955843	24167267
1991	3103	53205	36443	1006675	2463016
1992	3524	61205	41331	1096947	25095051
1993	3359	61750	41821	1187994	25549457
1994	3605	65058	43681	1297358	26073717
1995	3323	60922	41552	1359680	26434672
1996	2807	57285	38646	1404465	26863601
1997	3081	60577	40782	1458449	27282140
1998	3242	62722	41701	1524339	27689325
1999	3394	70331	46717	1600892	28084180
2000	3627	74265	48350	1675457	28465720
2001	3644	77925	50235	1740178	28832949
2002	3761	81365	52137	1807597	29184862
2003	3878	84522	53814	1874869	29520444
2004	3894	80150	51687	1950802	29891708
2005	3617	77264	51559	2036329	30172000
2006	3754	82651	54492	2146621	30506000
2007	3838	89264	58924	2284060	30841000
2008	4162	98907	64715	2437813	31345903

3.2. Statistical Analysis of the Parameters Related to Accidents

3.2.1. Analysis of the Number of Actual Accident

The analysis of the annual evolution of accidents shows a tendency to increase as the number increased to 16,000 in 1968 to 98,000 in 2008. To assess the significance of this increase during the 40 years of the study; we built the simple linear regression model. The resulting model explained 90% of the total variation in the number of accidents over the years. If this trend continues we could estimate the number of accidents in 2020 of about 2,131,483 accidents. This increase in the number of accidents is attributed firstly to road infrastructure and secondly to errors in the conduct and / or condition of the vehicle.

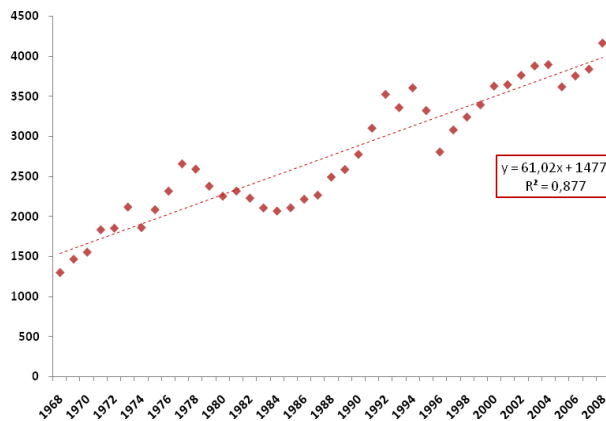*3.2.2. Analysis of the Actual Number of Killed*

Figure1. *Evolution of the number of accidents during the period (1968-2008)*

In Morocco, since 1968 the number of deaths due to road accidents, has known an increase. The average number of deaths is 2827 ± 780 cases with extremes of 1305 and 4162 cases observed respectively in 1968 and 2008. The linear regression model explained 87% of the increase in deaths.

3.2.3. Analysis of the Number of Injured

Over the period of 41 years from 1968 to 2008, the number of injuries increased 3.82% from 20470 to 98907. This increase shows that 90% of the variability in the number of wounded is explained by years.
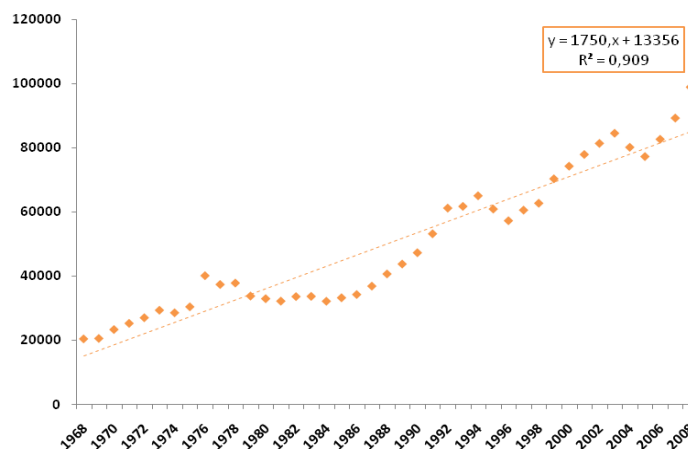

Figure2. *Evolution of the number of casualties during the period (1968-2008)*

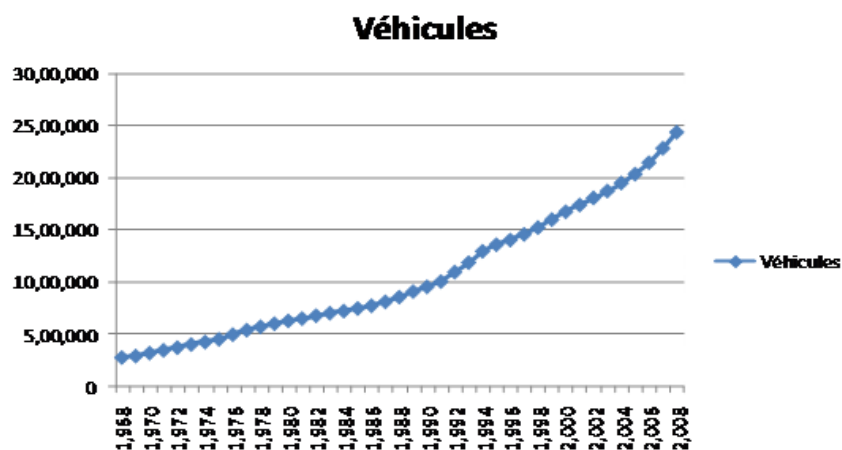*3.2.4. Analysis of the Evolution of Vehicles*

Figure3. *Evolution of the number of vehicles during the period (*1968-2008*)*

The analysis of the evolution of the number of vehicles in Morocco shows a steady increase of 4.97% during the 41 years of the study, with 95% of the total variation of vehicles based on years.

3.3. Analysis of Indicators of Road Traffic Accidents

To better understand the role of indicators of road traffic accidents we studied the statistics given in the period 2000-2011, the results in the form of table were operated through curve evolution, the results are very consistent.

Table2. *Key indicators of road traffic accidents during the years 2000- 2010*

Year / Rate	2000			2010		
	En aggl.	Hors aggl.	Total	En aggl.	Hors aggl.	Total
Fatalities per day	3,1	6,9	9,9	3,3	7,1	10,4
Fatalities per week	21,5	48,3	69,8	23,1	49,6	72,7
Fatalities per month	93,1	209,2	302,3	100,1	214,8	314,8
Number of fatalities per 100 accidents	3,2	19,3	7,5	2,5	14,8	5,8
Number of serious injuries per 100 accidents	10,1	77,4	28,2	8,1	43,2	17,4
Number of minor injuries per 100 accidents	120,8	137,7	125,3	125,4	154,1	133,0
Number of fatalities per 100,000 people	7,2	19,3	12,7	6,5	19,1	11,9
Number of cases per 100,000 people	23,2	77,2	47,9	21,3	55,8	35,8
Number of minor injuries per 100,000 people	276,7	137,4	213,0	327,9	198,8	273,3

These data were provided by the Directorate of Roads in Morocco and operated by means of statistical calculation. Their analysis showed that the rate of gravity measured by the number of fatalities per 100 accidents has decreased significantly by 23% in a decade from 7.5 in 2000 to 5.8 in 2010. Moreover, the number of fatalities for a population of 100,000 people has experienced a decline of 6.3%. it went from 12.7 people in 2000 and 11.9 out of town in 2010, The same was also recorded for the number of serious injuries that happened BG 47.9 per 100 000 population in 2000 to 35 only 8 in 2010, a decrease of 25.3%. However, the number of Wounded Light to 100,000 inhabitants experienced an increase of 213 BL - BL 273.3 in 2010, an increase of 28.3%.

4. CONCLUSION

The accidents and serious consequences can be explained by a combination of factors related to the driver, the vehicle, the traffic conditions, technical control, test driving license etc. To contribute to a better improvement, statistical study demonstrated the need to address the design of roads and vehicles, by first improving care for the injured, the training of professional drivers and vehicle controllers, license examiners, but also by modifying the behavior of users of the road wearing a seatbelt or helmet, speed limits, alcohol content, training, awareness etc. Concrete steps can still be taken to fight against the main causes of road accidents as well as the speed alcohol, telephone, fatigue, etc. and improve the safety of road user's most vulnerable motorcyclists, pedestrians and cyclists.

In conclusion, we can see that during the last ten years, in respect of changes in the various indicators, the government has mastered the claims and severity of accidents. The number of victims killed in the category and avoided serious injuries were shifted to the category minor injuries. The design and improvement of vehicle registrations, technical control and vehicle construction in Morocco. However, further factors or combination of factors responsible for accidents study should be conducted to identify risk factors for severe accidents and categorize a quantitative manner as the driver, the vehicle, the road, the alcohol, speed, drowsiness.

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