ROAD TRANSPORT ACCIDENTS IN NIGERIA AND THE ROLE OF AUTOMOTIVE ACTIVE SAFETY SYSTEM

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Review article

Abstract: Analysis of road traffic accidents revealed that most accidents are as a result of drivers' errors. Over the years, active safety systems (ASS) were devised in vehicle to reduce the high level of road accidents, caused by human errors, leading to death and injuries.This study however evaluated the impacts of ASS inclusions into vehicles in Nigeria road transportation network. The objectives was to measure how ASS contributed to making driving safer and enhanced transport safety. Road accident data were collected, for a period of eleven years, from Lagos State Ministry of Economic Planning and Budget, Central Office of Statistics. Quantitative analysis of the retrospective accident was conducted by computing the proportion of yearly number of vehicles involved in road accident to the total number of vehicles for each year. Results of the analysis showed that the proportion of vehicles involved in road accidents decreased from 16 in 1996 to 0.89 in 2006, the injured persons reduced from 15.58 in 1998 to 0.3 in 2006 and the death rate diminished from 4.45 in 1998 to 0.1 in 2006. These represented 94.4 %, 95 % and 95 % improvement respectively on road traffic safety. It can therefore be concluded that the inclusions of ASS into design of modern vehicles had improved road safety in Nigeria automotive industry.

Keywords: Automotive, active safety systems, road accidents, antilock braking system, injuries, proportion.

Introduction

Motor cars are a very common means of transportation, especially when compared to other forms of transport. Automotive vehicles is the most common form of transportation and it clearly bring great value to the society, providing a cost-effective means of transporting goods and people all over the world (DigiKit 2010; Rode, 2014). Road journeys are made without; the constraints of a timetable, tied to rail routes, and having to carry heavy baggage. Detracting from this convenience, road traffic accidents have become a problem. Unfortunately, there are corresponding number of automotive accidents and fatalities which continue to increase worldwide. In USA, there were 16,885 fatalities in alcohol-related crashes reported in 2005 (NHTSA, 2005). This is a decrease of 0.2 percent compared to 2004 (16,919 fatalities), and it represents an average of one alcohol-related fatality every 31 minutes (NHTSA, 2005). The 16,885 alcohol-related fatalities in 2005 (39 % of total traffic fatalities for the year) represent a 5-percent reduction from the 17,732 alcohol related fatalities reported in 1995 (42 % of the total). NHTSA (2005) estimated that alcohol was involved in 39 percent of fatal crashes and in 7 percent of all crashes in 2005.

According WHO (2004), there are several factors that contribute majorly to the occurrence of accidents. This includes among others, driving under the influence of alcohol or drugs, inattentive driving, crash compatibility between vehicles, driving while fatigued or unconscious to mention few. However, among the factors those that are directly related to people – the so – called "human errors" were widely reported. Analysis of road traffic accidents shows that most accidents are as a result of driver errors i.e. drivers make mistakes in their cognition of the external world and in judging between safe

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or not safe (NHTSA, 2011). Human errors are grouped into three categories, namely, cognitive errors (errors caused by oversights), judgment errors (wrongly judging that the other vehicle will stop) and operations error (failing to apply brakes strongly enough in an emergency) (Umemura, 2004).

Safety systems protect the driver whilst driving by compensating on the limited information and using the information derived from its system to make driving safer (Suen, 2003). Safety is the protection from, or not being exposed to, the risk of harm or injury. Automotive safety is the reduction of the harmful effects on human life, property and health due to accidents.This involves the prevention and future eradication of vehicle accidents (WHO, 2994). Over the years, traditional vehicle safety systems have been largely focused on passenger protection (Philip, 2005). But in the efforts at reducing frequency of life loss through road accident which are caused by human error, efforts are on going in the field of automotive safety, one of which is the development of active safety system (ASS) (Husnain and Andry, 2008; Roman and Hannes, 2013). ASS is being performed to develop driver support technologies that take the characteristics of a driver's cognition, judgment and actions into account (Mazda, 2012).

Automotive safety systems can be categorized into two, namely- passive safety and active safety. Passive safety systems allow the protection of the passenger in the event of an accident (i.e. seatbelts and airbags). On the other hand, ASS work towards the prevention of accident occurrence (Jing, 2009). Among other ASS available in the modern vehicle, six are common: Antilock Braking Systems (ABS) prevents a motor vehicle's wheels from locking up (or ceasing to rotate) while braking. ABS is now available on over 90 percent of all new vehicles (Burton et al., 2004); Traction Control System (TCS) limits the amount of wheel spin or 'slip' of a driven wheel due to acceleration. It monitors the speed of the wheels and applies brake torques and control engine torque to the driven wheels as necessary to restrict spinning during acceleration. Thereby enhancing the vehicle's stability, steer ability and acceleration are also improved (Stability Enhancement Systems, 2008; ESP, 2008); Electronic Stability Control (ESC) detects loss of steering control, it automatically applies the brakes to help "steer" the vehicle where the driver intends to go (Lie et al., 2005; Headly, 2005; Lie et al. 2005; Bosch, 2010); Lane Departure Warning System (LDWS) monitors the position of a vehicle in a roadway lane and warns the driver when the vehicle swerves or is about to deviate outside the lane Kozak et al., 2006; Xiangjing et al., 2006; Bing-Fei et al., 2006); Driver's Drowsiness Control (DDC) System reduces the number of unintended lane departures. It is however a common knowledge that each driver has his or her own individual driving behaviour. Therefore, this can be problematic for the automatic recognition of drowsiness through the measuremnet of parameters like lateral positions. Consequently, having just one parameter to detect drowsiness in drivers is not seen as sufficient (Kircher et al., 2002; Ayoob et al., 2002; Hong and Qin, 2007; Kircher et al., 2002; Rau, 2005); Connected Drive (CD) helps to keep driver fully in the control loop but he or she is well informed and vital information from the co-pilot (connected drive systems) which consists of sensors for the recognition of driver and vehicle behaviour as well as the driving environment with the road and possible object in the area(Bachmann and Bujnoch, 2001).

It was the main goal of this study to evaluate the impact(s) and role(s) of ASS in Nigeria road transport safety.

Materials and Method

Data Collection

Available information relevant to frequency of road accident was collected from Lagos State Ministry of Economic Planning and Budget (LSMEPB), Central Office of Statistics. The choice of Lagos is due to the fact that the area is highly congested with both automobiles with ASS and those without.

Quantitative analysis of ASS impacts on transport system

According to Markus et al., (2009), the most impressive method to prove and quantify the efficiency of an Active Safety System in real world accident scenarios is clearly the retrospective accident analysis. The proportion of yearly number of vehicles involved in road accident to the number of vehicles for each year was computed. Descriptive statistics was used for results presentations.

Results

Tab. 1, 2, 3 and 4 were the available records of vehicles involved in accident, number of injured persons, number of persons killed and number of registered vehicles in the study area from 1996 to 2006.

Tab. 1 revealed an increase in the number of road accidents from 4597 in 1996 to 7238 in 2006, representing (57.5 %). In a similar trend, Tab. 2 and Tab. 3 indicated increases in the numbers of persons injured from 1712 in 1996 to 2454 in 2006 and in the numbers of persons killed from 575 in 1996 to 782 in 2006. These represented 43.3 % and 36 % respectively. The rate at which vehicles were used increased from 28644 in 1996 to 812168 in 2006 (Tab. 4) with a wide difference of 783524 vehicles in 2006 above that of 1996.

Tab. 1 Monthly numbers of vehicles involved in road accidents in Lagos State from 1996 to 2006

MONTH	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
JAN	371	349	318	424	308	431	431	431	508	615	541
FEB	360	360	391	309	387	459	524	565	634	607	592
MAR	363	372	396	422	385	514	352	453	612	718	468
APR	369	405	364	447	344	544	416	588	615	745	533
MAY	357	393	421	338	502	497	506	659	452	731	576
JUN	337	369	323	305	318	348	696	987	537	761	719
JUL	370	422	348	452	417	394	543	523	570	718	864
AUG	398	393	392	370	417	437	636	447	528	475	658
SEP	421	418	422	378	769	487	597	751	747	655	560
OCT	433	441	419	455	365	506	563	782	721	248	590
NOV	392	419	398	336	450	403	577	597	742	747	601
DEC	426	397	405	242	385	524	602	748	698	464	536
TOTAL	4597	4738	4597	4478	5047	5544	6443	7531	7364	7484	7238
Source: (LSMEPB, 2006)											

Tab. 2 Monthly Number of persons injured in Road Accident in Lagos State from 1996 to 2006

MONTH	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
JAN	130	137	164	178	134	140	176	192	183	252	116
FEB	141	132	159	136	149	200	162	226	232	227	136
MAR	149	143	181	186	155	243	126	75	202	333	172
APR	140	153	157	224	138	254	203	163	250	244	168
MAY	133	149	170	170	162	180	180	130	232	206	249
JUN	122	131	137	154	123	117	269	181	230	290	255
JUL	123	189	169	197	135	143	185	151	228	333	168
AUG	138	181	168	148	135	192	200	113	290	228	262
SEP	143	185	199	162	157	210	243	273	306	290	216
OCT	170	162	160	177	180	215	213	209	291	112	208
NOV	159	154	171	143	174	176	209	190	255	206	256
DEC	164	159	172	134	140	227	191	273	291	197	248
TOTAL	1712	1875	2007	2009	1782	2297	2357	2176	2990	3018	2454
Source: (LSMEPB, 2006)											

Tab. 3 Monthly Number of persons killed in Road Accident in Lagos State from 1996 to 2006

MONTH	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
JAN	48	54	42	59	47	60	51	57	52	83	60
FEB	45	47	63	37	50	59	68	63	75	85	34
MAR	43	45	61	71	83	69	50	66	47	77	48
APR	51	46	41	40	46	91	82	94	54	72	54
MAY	48	44	46	56	73	74	56	58	58	63	69
JUN	46	47	30	52	40	55	59	73	57	74	84
JUL	47	49	38	35	43	68	56	80	60	77	84
AUG	45	50	54	47	43	64	81	59	74	60	97
SEP	47	42	53	43	38	67	84	76	89	70	59
OCT	49	43	41	64	58	51	64	52	83	48	61
NOV	51	45	45	61	56	52	60	66	65	89	53
DEC	55	47	60	46	59	62	65	90	71	62	79
TOTAL	575	559	574	611	636	772	776	834	785	860	782
Source: (LSMEPB, 2006)											

Tab. 4 Total number of registered vehicles in Lagos State from 1996 to 2006

Years	Number of vehicles
1996	28644
1997	15011
1998	12879
1999	140850
2000	172891
2001	305987
2002	410616
2003	522449
2004	589825
2005	670903
2006	812168
Source: (LSMEPB, 2006)	

Fig. 1 described the proportion of yearly number of vehicles involved in road accident to the total number of vehicles for each year. The analysis showed that the proportion of vehicles involved in accident yearly dropped from 16 in 1996 to 0.89 in 2006 representing 94.4 % improvement on road safety. Also Fig. 2 indicated the proportion of person injured to the total number of vehicles while Figure 3 was that of persons killed in road accident to the total number of vehicles.

From the figures, the proportion of the numbers of injured persons reduced by 95 % when comparing 2006 with 1996. Also, that of the numbers of persons killed in road accidents reduced by same percentage (95 %) within the space of the 10 years studied.

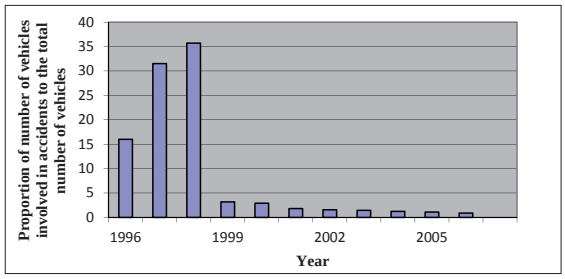

Fig. 1 Proportion of the yearly number of vehicles involved in accidents

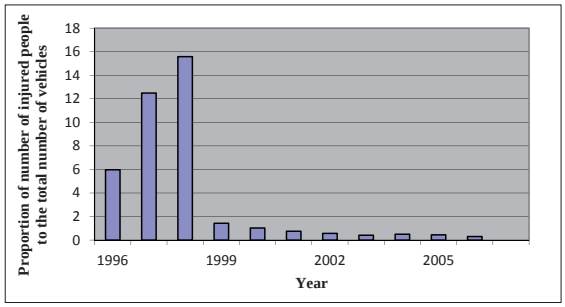

Fig. 2 Proportion of yearly number of persons injured

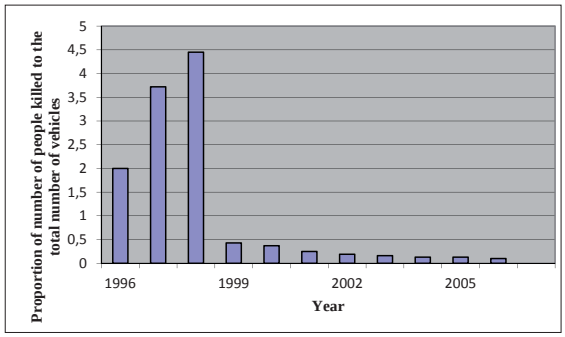

Fig. 3 Proportion of yearly number of persons killed

Discussion

From the analyses the low number of automobiles in the earlier years notwithstanding, accident rates in terms of proportion of vehicles involved in accidents, persons injured and the persons killed were higher compared to the later years where the numbers of automobiles have increased (Fig. 1, 2 and 3). It could also be seen that the rates of accident decreased from the earlier years to the recent years and it kept decreasing as the year increased with the use of vehicles designed with ASS multiplied. Looking at the year 2000 to 2006 as presented in Fig. 1, 2 and 3, it can be observed that the impacts of automotive ASS was significant and differed from the trend at the early years where the types of vehicles in circulation were not equipped with ASS. With the awareness of automotive safety, it is logical to say that in the nearest future, automobiles without active safety systems would be minimal and this is expected to go a long way at reducing the rate of accidents, injuries and deaths in Nigerian roads. Hence the incorporation of ASS in modern automobiles had reduced human cognitive errors by transferring some salient decisions to be taken by these safety systems. For instance, traction control system automatically applies brake to wheels during hard maneuvers where the wheels cannot both steer and drive the car at the same time. Though operations of some of the safety systems do not actively prevent accidents, they help towards the reduction of the fatality of the accidents.

There were limitations faced in this study. Among others were the difficulties in identifying relevant statistical changes in accident behavior between cars with ASS and the ones without in respect of accident data. Recent data of road vehicle accidents in the study area shows no sufficient records of models of vehicles involved in accidents and the causes. Therefore, comparison between the rates of accident of vehicles designed with ASS and the ones without it was difficult. Development of up-to-date data in this study area is a fall-out of this study. It is therefore strongly recommended that relevant bodies like Ministry of Economic Planning and Budget should include in reporting vehicle accidents, the model of the vehicles involved, causes of the accident, location of accident and other important information.

Conclusion

The impacts of automotive active safety systems in Nigeria transport system have been reported. Between the periods of 10 years, the proportion of vehicles involved in road accidents decreased, that of the persons injured reduced and those killed in road accidents diminished by 94.4 %, 95 % and 95 % respectively. It can therefore be concluded that the inclusions of active safety system into modern vehicles had improved road safety in Nigeria automotive industry.

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