A Survey of Automobile Drives in a Developing Country

Ademola Dare, Ph.D.[1], S.A. Oke, M.Sc.[2], and Nurudeen Lawal, B.Sc.[3]

[1,3] Department of Mechanical Engineering, University of Ibadan, Ibadan, Nigeria
[2] Department of Mechanical Engineering, University of Lagos, Akoka-Lagos, Nigeria

[2] E-mail: sa_oke@yahoo.com

ABSTRACT

In the past few years, there has been a gradual but progressive trend in the choice of automotive drives in the developing countries of the world. The paradigm shift in vehicle choice decisions is strongly influenced by government policies, the purchasing power of would-be users, and the characteristics of vehicle drive types, among other factors. Vehicle buyers are increasingly interested in vehicle cost effectiveness, optimum performance, and durability. Unfortunately, there appears to be no research documentation that adequately guides decision-making on vehicle purchases in developing nations. Vital information is necessary by governments, individuals, and other organisations in order to aid adequate decision-making. The need to fill this gap has motivated this study. Primarily, the study aims to survey the existing vehicles in Nigeria - the most populous black country of the world - as a case study for other developing nations. The results of our research shows the better choice between the front wheel and the rear wheel drive from the point of view of cost effectiveness and durability.

(Keywords: automobile, car, light vehicles, wheel drives, developing countries, survey, transportation)

INTRODUCTION

Automobile research covers an expanding area both in industry and academia. The area has several hundreds of papers published in the scientific literature in the past few years. The field of automobile research has repositioned itself as one of the most advanced bodies of knowledge in modern times. This advancement is aided by international competition and the sophisticated technologies related to automobile production and maintenance.

Governments are mandating, and customers are demanding, that the air quality in motorised environments must be at adequate safety levels. Clearly, despite the increased number of vehicles available in recent times, environmental pollution must be controlled in order to guarantee the safe health of the population. As such, governments the world over have tightened environment regulations in relation to vehicles in order to protect the life of its citizenry. In consonance with government efforts, some vehicle associations had been promoting and setting standards and criteria for low pollution vehicles.

In a review of the literature, we observed that several journals, conferences, symposia, and group meetings all over the world have concentrated on diverse areas of vehicle research [1-6]. Thus, researchers have made extensive studies in design, development, manufacture, operation, servicing and repair of cars, commercial vehicles, public service vehicle, industrial and agricultural tractors throughout the world. The scope of research has included auxiliary equipment systems, components, and complete vehicles for automotive transportation.

Specifically, the topics treated in the literature have included vehicles and components; engines and fuels; structures; mechanisms; lubrication; dynamics; primary safety controls and information systems; vision and lighting; vehicles operation reliability; servicing and repair; economics; legislation and management; comfort; refinement and secondary safety; manufacturing technology and systems; and electronic and traffic information systems.

Again, vehicle research is not restricted to an isolated area, but concerns many areas as ergonomics (man-machine interaction), artificial neural networks, fuzzy logic, genetic algorithms, modelling and simulation, robotics, and artificial

intelligence. This has made vehicle technology a truly scholarly field with opportunities for academic and applied research and advancement.

The vehicle technology literature distinguishes two levels of vehicle types: 1) heavy vehicle systems and 2) light vehicle systems. Investigations into heavy vehicle systems focus on "on/off" heavy vehicle systems including commercial trucks and vehicle combinations, conventional and hybrid buses, heavy military vehicles, and integrated heavy vehicle systems.

Research in this area placed great emphasis on increasing efficiency and for protection of infrastructure and the environment. Heavy vehicle systems are facing greater challenges than ever before. Scholars in this area have promoted the science and practice of heavy vehicle design and safety with major contribution from engineers and applied scientists. The range of technology has been broadened with new developments appearing daily in such fields as modelling and simulation, control and performance, field and laboratory testing, and stability and control of individual vehicles as well as the overall highway system.

While most researchers have concentrated on the traditional perspectives of vehicle research, recent developments in the area of light vehicle systems have shed new and interesting light on why there is need for a survey that characterises vehicles in developing countries. Thus, the authors of this paper envision a new area for which vehicle studies could be made. It is therefore necessary to carry out a scientific survey on the subject, in particular, in the case of a developing country. For all practical purposes, it is as if this subject did not exist or was not important in the context of a developing country. To be clear, we are not saying that a vehicle survey is somehow more important or fundamental than the traditional perspective of vehicle research, rather we are saying that the current descriptions and approaches to studying vehicles are one-sided and incomplete.

Indeed, both the traditional approaches and our current proposal need one another. Studies on vehicle surveys in totality gives a comprehensive understanding of all aspects of the systems. Thus, we advocate an integration of the existing methodologies to our current study.

SURVEY RESULTS AND DISCUSSION

Since the main aim of the work is to analyze the two prominent types of automobile drives in developing countries, we compared the front wheel drive (FWD) and rear wheel drive (RWD) in many ways in order to ascertain which one is better for transportation systems in developing counties. The key factor analysed includes cost, effectiveness, and durability. In addition we analysed the associated problems with each of these drive types and the relevant solutions. Hence, suggestions on how the maintenance of these automobiles can be improved are made by the authors in the conclusion of this paper.

The data analysis for this wok can be divided into three main parts. The first part presents the data gathered from the survey while the second part represents the gathered oral interviews done with technicians/mechanics. The third part represents the data collected from questionnaires. This third part is further sub-divided. These sub-divisions represent the data gathered from questionnaires for the car user/owners, auto-dealers, and auto-technicians/mechanics.

Table 1 shows an analysis of FWD and RWD vehicle systems. Primarily, seven brands of vehicles were considered as representatives of the front wheel drive category with each vehicle having different models. The RWD category was represented by five main brands of vehicles. After going through the different models of the various brands and classes of both FWD and RWD vehicles available in the target area, the data of the population of technicians involved in the repair of either drives was obtained and is displayed in Table 2.

This shows that 62.5% of the technicians considered by the survey could repair both FWD and RWD. Twenty percent of them could only repair FWD vehicles while 17.5% could repair only RWD vehicles. We may safely conclude that majority of the auto-mechanics can repair both FWD and RWD. Only a few (20%) deal strictly with FWD and fewer (17.5%) of the technicians repair only RWD vehicles.

We further investigated the educational qualifications of the sampled technicians. These results are displayed in Table 3.

Table 1: Analysis of FWD and RWD Vehicle Systems in Study Area.

Front-Wheel Drive	Rear-Wheel Drive
Toyota: Corolla, Carina, Tercel, Camry, Corona, Cellica, Supra, etc.	Mercedes Benz: 200, 200E, 230E, 190E, etc.
Nissan: Sunny, Maxima, 300zx, Altima, Blue- bird, etc.	Peugot: 504, 505, 305, 404, etc.
Honda: Accord, Legend, Prelude, Civic, Quintet, etc.	BMW: 3-series and 7-series.
Volkswagen: Santana, Passat, Jetta, Vento, Bora, Golfs, Polo, etc.	Opel: Kardett, Omega, Rekorde etc.
Mitsubishi: Gallant, Lancer, Colt, etc.	Renault: Laguna, etc.
Daewoo: Racer, Espero, Cielo, Prince, etc.	
Hyundai: Sonata, Elantra, Excel, Accent, etc.	

All Brands and Models represented above are Registered Trademarks of their respective Auto Makers.

Table 2: Local Technician's Ability to Repair Certain Drive Types.

Number of Technicians	FWD		RWD		Both	
	No.	%	No.	%	No.	%
80	16	20	14	17.5	50	62.5

Table 3: Education Qualifications of Sampled Local Technicians.

Level of Education	Primary	Secondary	Technical College
Number	43	28	9
Percentage	53.75%	35%	11.25%

The conclusion from this investigation is that more than half of the technicians sampled (53.5%) have just a primary school certificate. Only 35% of them went through secondary school, while 11.25% of them attended technical colleges.

During our investigations and oral interviews carried out with the technicians/mechanics, the primary questions asked were tailored to the choice of drives (Table 4).

Table 4: Technician's Choice of Drives.

Suggested Answers	No.	%
Front-wheel drive	23	58
Rear-wheel drive	17	27

Here, out of the forty technicians interviewed, 58% preferred the FWD to the RWD for roads and infrastructure in developing countries.

The third part of our investigation considers the data gathered form questionnaires. The questionnaires were directed at four-target audiences: (i) car users/owners (ii) auto-dealers (iii) FWD auto-technicians/mechanics (iv) RWD auto-technicians/mechanics. For the car owners 13 main questions were asked with the results tabulated in 13 different tables.

The first question concerns the brand of car used by the respondents. From Table 5, the majority of respondents' uses cars that utilise the FWD (i.e. 52%). Another question of interest is the respondents' car age distribution. This is shown in Table 6. The information from the table is that majority of the respondents' car are old. Usually between 13 and 20 years, the reason behind this may be the poor economic situation in developing countries where most cars affordable by users are in the *used types* brought from advanced countries. Most of the vehicles were made in the early and mid 1980s.

Table 5: Car Drives Used.

Suggested Answers	No.	%
Front-wheel drive	13	52
Rear-wheel drive	12	48

Table 6: Age of Automobiles.

Suggested Answers	Response	%
2-4 yrs	3	12
5-7 yrs	5	20
8-12 yrs	8	32
13-20 yrs	9	36

The third question centred on whether the car bought was new or used at the time of purchase. Only 4% of the respondents bought their cars brand-new. This may also be attributed to the poor

economic situation of developing countries. Of interest to us are the different periods that respondents' cars have been used. The results are shown in Table 7. From the table, most of the respondents' cars are *second new* (95.83%) with only (4.17%) being in third new. A further investigation was made to understand the various drive-related problems associated with the cars is illustrated in Table 8.

Table 7: Different Periods Respondents' Cars have been in Use.

Suggested Answer	Response	%
Once	23	95.83
Twice	1	4.17
Thrice	-	-

Table 8: Drive-Related Problems.

Suggested Answers	Response	%
Noise from shaft	11	84.62
Inability to move well	3	25
Shaft breakage	3	25
Noise from the wheels	6	46.15

Table 9: Respondents' Problems with RWD.

Suggested Answer	Response	%
Chassis problem	3	12
Joint problem	16	64
Both	6	24

Noise from the shaft forms the major problem usually encountered by respondents (84.62%). While this is followed by *noise for the wheels* (46.15%). This is followed by *inability to move well* and *shaft breakage* (25% each). We align these results with another from the perspective of the respondents' problem with RWD. From the respondents' point of view, the most rampant problem is *noise from underneath* with 83.33%, while the other two problems i.e. *noise from wheel* and *inability to move well* have 66.66%.

The next question answered is with respect to frequency distribution of these problem. We classified the respondents' option in a range of time, usually, 2-5 months, every year, etc. This is presented in Table 10.

Table 10: Frequency of Problems.

Suggested Answers	Response (FWD)	%	Response (RWD)	%
2 - 5 months	2	15.38	-	-
5 - 12 months	7	53.81	2	16.67
Every year	2	15.38	6	50.00
Every 2 years	1	7.69	3	25.00
Btw 2 - 5 years	1	7.69	1	8.33

It can be seen that with FWD the above mentioned problems occur more often (with one respondent's car) between 5-12 months (53.84%) and with the rear wheel, it is likely the problems occur once in a year (50%). This suggests that it take more time for the rear-wheel drive to develop a problem than the front wheel drive.

In another question, the usual diagnoses from technicians for the FWD were investigated. From the respondents' point of view, we can see that joint problems constitute most of the diagnosis with 64% (Table 11).

Table 11: Usual Diagnosis from Technicians (FWD).

Suggested Answers	Response	%
Chassis problem	3	12
Joint problem	16	64
Both	6	24

An analysis of repair/replacement cost was carried out (Table12). The results show that 36% of respondents replace parts when affected, 40% repaired the part, and 6% repair and replace the parts. We could infer that more respondents prefer repairs to replacement since it is cheaper.

Table 12: Repair and Replacement Costs.

Suggested Answer ($)	Repair		Suggested Answer ($)	Replace	
	Response	%		Repair	%
2 - 8	7	35	15 - 19	3	20
8 - 12	7	35	19 - 27	7	46.6
12 - 15	6	30	27 - 38	5	33.3

Further, we investigated into repair frequency distribution of cost (Table 13).

Table 13: Repair Frequency Distribution

Drive Shaft			Propeller Shaft		
Suggested Answer	Resp.	%	Suggested Answer	Resp.	%
Every month	-	-	Every 5 months	-	-
Every 2 months	1	8.3	Every 1 year	2	16.6
Every 5 months	7	58.3	Every 2 years	5	41.6
Every 1 year	5	41.6	Every 5 years	5	41.6

From the table, 58.33% (majority) of our respondents repair their drive shaft every 5 months. Also, 41.1% of respondents (with RWD) repair their propeller shaft every two years. Another 41.1% repair theirs every five years. This shows that the repair of either drive shaft or the propeller shaft is dependent on the user.

Comparing propeller shaft and drive shaft repairs, it can be seen that it takes a longer time for a propeller shaft to be worked on again after being repaired than a drive shaft. As a further step in understanding the different drives, we investigated the relative advantages of one drive over another. Looking at Table 14, we see that the front wheel drive is both more economical and more effective than the rear wheel drive.

Table 14: Respondents' Views of Relative Car Drive Advantages.

Front-wheel		
Suggested Answer	Response	%
Cost of maintenance	11	84.6
Stability at high speed	9	69.23
Speed	13	100
Fuel consumption	7	53.85
Case of maintenance	9	69.85
Case of manoeuvring	8	61.54
Rear-wheel		
Suggested	Response	%
Cost of maintenance	4	33.33
Stability at high speed	5	41.66
Speed	3	25
Fuel consumption	3	25
Case of maintenance	3	25
Case of manoeuvring	7	58.33

The last question that car users/owners were asked relates to comparing FWD and RWD in a developing country (Table 15). From the table it can be seen that respondents (60%) prefer the FWD to the RWD for road transportation in the developing countries.

Table 15: Preference of FWD vs. RWD.

Suggested Answers	Response	%
Front-wheel	15	60
Rear-wheel	10	40

The data gathered from auto-dealers in this study is reported in Tables 16-22. Table 16 shows that the majority of our respondents have between 6-10 years working experience.

Table 16: Dealer Years of Experience.

Suggested Answer	Response	%
1-5yrs	3	15
6-10yrs	6	30
11-15yrs	5	25
16-20yrs	3	15
21-25yrs	2	10
26-30yrs	1	5

In Table 17, we present the results of the brand of automobile sold by auto-dealers by drive types. We observed that majority of respondents sells both FWD and RWD vehicles (i.e. 70%), only a few sell only RWD vehicle (10%).

Table 17: Drive Types Sold by Dealers.

Suggested Answer	Response	%
Front-wheel	4	20
Rear-wheel	2	10
Both	14	70

We were also interested in understanding the level of demand of the two type of wheel drives from the auto-dealers. Our results indicate that most customers demand more FWD (55%) than RWDs (45%). This is obvious from Table 18.

Table 18: Level of Demand for Drive Types.

Suggested Answer	Response	%
Front-wheel	4	55
Rear-wheel	9	45

Table 19 shows the reasons why customers prefer FWDs. Six (6) reasons were advanced in our research. The majority of customers prefers FWD to RWDs because they are faster. The second strongest reason was that the parts are cheaper and readily available. Another reason is due to fuel economy (50%).

Table 19: Customer Respondents' Reasons for Preferring FWD.

Suggested Answer	Positive (T)		Negative (F)		Nil	
	Resp.	%	Resp.	%	Resp.	%
Faster	15	72	2	10	3	15
Fuel economy	10	50	5	25	5	25
Stronger	4	20	10	50	6	30
Parts cheap & available	13	65	3	15	4	20
Ease of driving	7	35	4	20	9	45
Carry more loads	5	25	11	55	4	20

The results obtained shows that the majority of automobile consumers in our study prefers to use RWD since they perform better in rough road (85%). This is indicated in Table 20.

Table 20: Customer Respondents' Reasons for Preferring RWD.

Suggested Answer	Positive (T)		Negative (F)		Nil	
	Resp.	%	Resp.	%	Resp.	%
Carry more loads	7	35	7	35	6	30
Better on rough roads	16	80	4	20		
Fuel economy			12	60	8	40
Cheap maintenance	6	30	8	40	6	30

In Table 21 the result shows that 70% of auto-dealers interviewed perceived RWD to be more expensive than FWD. Only 30% of the respondents indicated that RWD vehicles are less expensive than FWD.

Table 21: Perceptions of Greatest Expense.

Suggested Answers	Response	%
Front-wheel	6	60
Rear-wheel	14	70

The results in Table 22 indicate that FWD is the preferred vehicle drive type after considering all advantages.

Table 22: Preference of FWD and RWD Vehicles for Nigerian Roads.

Suggested Answers	Response	%
Front-wheel	13	65
Rear-wheel	7	35

The next 8 tables represent the results obtained from the auto-technicians and mechanics that specialise in FWDs. Table 23 indicates the possible problems that are noticeable with FWD. A large percentage of the population indicated that the possibility of a bad boot is the biggest problem of for FWD.

Table 23: Possible Problems of FWD Vehicles.

Suggested Answers	Response	%
Warn-out drive	23	92
Circuit pin	24	96
Basket ball (Rzeppa CV)	23	92
Shaft breakage	8	32
Bad boot	25	100

In the next table (Table 24) the cost of drive shaft replacement is indicated. Here, the majority of the respondents (60%) indicated that drive shaft costs between $19 and $31.

Table 24: Cost of Replacement of Drive Shaft.

Suggested Answer ($)	Response	%
12-19	2	8
19-31	15	60
31-54	5	20
54-65	2	8
65-77	1	4

Table 25 indicates the frequency of drive shaft problems. It can be seen that majority of those surveyed (40%) replace their drive shaft between 1 year and 2 years. This varies depending on the user. In Table 26, all the technicians identified welding (100%), filling (96%), and change of bearings (86%) as alternative methods of repair.

Table 25: Frequency of Replacement of Drive Shaft.

Suggested Answer	Response	%
1 year-2 years	10	40
2 years-3years	5	20
3years-4years	7	28
4years-5years	3	12

Table 26: Alternative Repair Methods.

Suggested Answer	Response	%
Changes of Bearings	21	84
Filling	24	96
Welding	25	100

Table 27 treats the choice of two corrective measures (i.e., complete replacement or repair). Here, 96% of the technicians prefer complete replacement of parts to repair (40%). This saves more time which could be used for other work and would grantee that the problem would not resurface in a longer time.

Table 27: Choice of Corrective Measures.

Suggested Answer	Response	%
Complete replacement	24	96
Repair	1	4

In Table 28, we investigated the possible causes of drive shaft problems. From the table, it can be seen that major causes of break down of drive (FWD) are rough roads and negotiation of bends (both 96% agree), then lack of maintenance of parts (88%).

Table 28: Causes of Break-Down of Drives Due to Shaft Problems.

Suggested Answer	Response	%
Rough road	24	96
Lack of maintenance	22	88
Excessive loading (pats)	6	24
Negotiation of bends	24	96
Bad movement of vehicle	20	80

Table 29 shows the possible ways of preventing the causes of breakdown stated above. All of the respondents stated that careful driving on rough roads could go a long way in preventing shaft problems. The least percentage (32%) is due to the suggestion that driving slowly always could solve the problem. In Table 30, the cost of replacement of the propeller was investigated on the average. Forty percent of the respondents stated that costs run from $19 - $23. Note that 20% of them agreed that the costs range between $62 - $92. Next, a comparison was made between FWD and RWD on their performance on roads in developing counties. The majority of the respondents (76%) preferred the FWD to RWD for roads in developing counties. This is shown in Table 31.

Table 29: Possible Ways of Prevent Drive Problems.

Suggested Answer	Response	%
Careful driving on rough roads	25	100
Proper mtce. of parts	24	96
Carrying less loads	14	56
Careful negot. Of bends	24	96
Correct movement of vehicles	22	88
Driving slowly always	8	32

Table 30: Cost of Replacement of Propeller.

Suggested Answer ($)	Response	%
19 -23	10	40
23 - 38	6	24
62 -92	5	20

Table 31: Comparison of FWD and RWD.

Suggested Answer	Response	%
FWD	19	76
RWD	6	24

In Table 32 the possible causes of problems of RWD vehicles were analysed. Improper teeth, the use of universal joint, and worn-out crown wheels are equally weighted in the ranking of problems associated with RWD.

Table 32: Possible Causes of Problems of RWD.

Suggested Answer	Positive		Negative	
	Response	%	Response	%
Universal joint	25	100	-	-
Improper teeth	25	100	-	-
Worn - out crown wheel	25	100	-	-
Worn - out pinion	24	96	-	-
Bad gearing system	5	20	20	80

In Table 33, the frequency of replacement of the propeller shaft was analysed. The table shows 5-7 years (40%) as the highest result while every year 8% is considered the minimum. Next in the table series is the result of alternative repair methods, the highest value (100%) was attached to replacement of universal point. While the replacement of crown wheel pinion took equal weight.

Table 33: Propeller Shaft Replacement.

Suggested Answer	Response	%
Every year	2	8
2-5yrs	6	24
5 -7yrs	10	40
7 -10yrs	7	28

Table 34: Alternative Repair Methods.

Suggested Answer	Response	%
Change of propeller teeth	24	96
Replacement of Universal joint	25	100
Change of Universal joint kit	25	88
Replacement of crown wheel	22	84
Replacement of Pinion	21	84

In Table 35 the choice among two corrective measures is made. Those are complete replacement and repair. Complete replacement was chosen by 45% or the respondents, while repair was selected by 36%.

Table 35: Choosing Between Two Corrective Measures.

Suggested Answers	Response	%
Complete replacement	16	64
Repair	9	36

In Table 36, the problems encountered in RWD, other than propeller shaft, were all measured at equal weight. One of these responses relates to a worn-out pinion. In Table 37, the possible ways of preventing occurrence of the problems illustrated in Table 36 are explored. Two items, namely, proper lubrication and general maintenance of parts carry equal weight (100%). Table 38 compares the FWD and RWD. The survey respondents favour of FWD 60% to 40%.

Table 36: Problems Encountered in RWD Vehicles Other Than the Propeller Shaft.

Suggested Answers	Response	%
Worn-out crown wheel	25	100
Worn-out pinion	25	100
Damaged universal joint	25	100
Damaged propeller teeth	25	100

Table 37: Possible Ways of Preventing the Occurrence of Above Problems.

Suggested Answers	Response	%
Proper lubrication	25	100
Careful driving	17	68
Carrying less loads	13	52
General maintenance (parts)	25	100
Ability to move correctly.	15	60

Table 38: Comparison of FWD and RWD.

Suggested Answers	Response	%
FWD	15	60
RWD	10	40

CONCLUSIONS AND FUTURE DIRECTIONS

This paper has investigated various vehicle types by wheel drive. Our analyses clearly revealed that the front wheel drive (FWD) vehicles are more beneficial in many ways than the rear wheel drive (RWD) within the infrastructure of developing nations like Nigeria. One of the most beneficial ways is in the cost effectiveness of driving FWD vehicles, their efficiency, and the improvement in its features. Some of these interesting features include the take off speed, higher sustained speeds, and stability at high speed, among others. This accounts for the reason why most manufacturers now shift from RWD to FWD vehicle manufacturing.

The design of front wheel drives has brought about some technological advancements and innovations over the years. Unfortunately, some other characteristics make the FWD less desirable than the RWD in some communities. The most conspicuous of these features is the *clucking* noise in the FWD that creates noise nuisance and discomfort for the driver and other road users. Also, FWD vehicles seem not to be as durable as the RWD. Nevertheless, after considering all the merits and demerits of both the FWD and RWD using the analyses carried out, we may conclude that front wheel drive (FWD) vehicles are better for the roads in developing countries than the RWD vehicles.

In order to make the FWD more effective, the noise that comes from the drive shaft must be eliminated or reduced to its minimum. The noise is heard only when the bellows boots that protect the CV joints at the end of the drive shaft gets broken, dusty, or when muddy water enters the joint. The noise is also heard when the lubricant of the joint escapes thereby leaving room for friction on the surface. Bellows get broken for a number of reasons: (i) subjection to complication deformation (ii) responding to the bending movement of the CV joint; (iii) at high vehicle speed, expansion of the bellow boot occurs by the weight of bellow from centrifugal forces; and (iv) driver's skill also influences the durability of bellow boots.

REFERENCES

1. Sokoloskij, E. 2002. “The Analysis and Statistical Research of Damages of Car Wheels Appearing Just Before and During an Accident”. *TRANSPORTAS* (Transport engineering) *Vilnius, Technika.* 15(3):118-122.

2. Liu, Z., Yang, J., and Liao, D. 1993. “The Optimisation of Electric Power Assisted Steering to Improve Vehicle Performance”. *Proceeding of the IMech E Part D Journal of Automobile Engineering*. 217:639-646.

3. Lukoserviciene, O. and Sokolovskij, E. 2001. “Movement of a Vehicle after Losing the Touch of the Wheels with Road Surface.” *TRASPOTAS (Transport Engineering) Vilniu, Techikal*. 16(1):29-34.

4. Sadauskas, V. and Pukalskas, S. 2002. “Selection of Optimal Speed Depending on Accident Data and Ecology”. *TRANSPORTAS (Transport Engineering) Vilnius. Technikas.* 15(3):133-137.

5. Sadausvskij, V. 2003. “Car Passive Safety Body”. *Transport Engineering*.

6. Lukoservicius, V. and Zarnovskij, A. 2001. “The Restoration of an Automobile Deformed Side Member”. *TRASPORTAS (Transport Engineering) Vilnius, Technika.* 16(1):35-38.

ABOUT THE AUTHORS

Ademola Dare, earned his B.Sc., M.Sc., and Ph.D. degrees in Mechanical Engineering from the University of Ibadan. Currently, he lectures in the same department. His research interests include automobile research and fluid mechanics.

S.A. Oke, graduated in Industrial Engineering from the University of Ibadan, Nigeria with bachelor and Master's degrees in 1989 and 1992 respectively. He worked for the IDM Services Limited as a consultant. Oke lectures in the Department of Mechanical Engineering, University of Lagos. Oke has reviewed papers for several international journals.

Nurudeen Lawal, earned his B.Sc. (Hons) degree in Mechanical Engineering from the University of Ibadan. His research interests include automobile research.

SUGGESTED CITATION

Dare, A., S.A. Oke, and N. Lawal. 2007. "A Survey of Automobile Drives in a Developing Country". *Pacific Journal of Science and Technology*. 8(1):17-25.


Pacific Journal of Science and Technology