Identification of Cycles and Periodic Oscillations of Road Traffic Accidents Over Lagos State, Nigeria

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Abstract

The purpose of this study is to examine the identification of cycles and periodic oscillations of road traffic accidents over Lagos State, Nigeria and to suggest preventive and corrective safety measures towards reducing the traffic accidents in the study area. The power spectra for Ajeromi/Ifelodun, Epe, Ikeja, Mushin, Lagos Island and Lagos Mainland Local Government Areas show no regularity in the occurrence of road traffic accident patterns, although, 32.00 years is the most dominant cycle. Incidentally, these are local governments that are prone to accidents in Lagos State. The reported road traffic accidents over Lagos State were compared using analysis of variance (ANOVA) techniques. The results showed that for the two factors, Local Government Areas and years, the f-calculated of 11.84 and 27.63 respectively were higher than the F-tabular of 1.57 and 1.46 respectively at 0.05 level of significance. It then implies that the means for each of the factors, reported road traffic accidents across all the Local Government Areas in Lagos State and across different years, 1970-2001, were significantly different. Based on the findings, policy recommendations were proffered on how to reduce the ugly incidence of road traffic accidents in Lagos State and Nigeria in general.

Keywords: Traffic accidents; roads; cycles; periodic oscillations; Lagos State

Introduction

At the global level, road accidents have been ranked as the 9th leading cause of mortality (World Health Organisation, 1998). The World Health Organisation (WHO) estimated that 1.17 million deaths occur each year worldwide due to road traffic accidents. Succinctly, this accounts for about 70% of deaths in developing countries such as Nigeria. The increased rate of fatal road traffic accidents worldwide has been attributed to population explosion and increased motorization (Atubi, 2008 and 2012d). Increased motorization may be characterised briefly as the "automotive revolution", that is, the motorizing of urban population especially in the developing countries. As in other developing countries, road traffic accidents in Nigeria are one of the most serious problems in need of pragmatic solutions. Yet this problem has been difficult to address probably because of the country's level of development. Nigeria is said to have the highest road traffic accident rate in Africa and second in the world (Akpoghomeh, 1998; Obinna, 2007, p. 35; Atubi, 2012c).

Thus, Nigeria's annual 8,000 to 10,000 traffic accident deaths between 1980 and 2003 were a major personal and traffic safety problem as well as a terrible waste of human resources for the country. In terms of the personal safety problem, Nigeria and in deed Lagos State is a high risk region with an average of 32 traffic deaths per 1,000 people (Filani et al 2007; Atubi, and Onokala, 2009; Atubi 2012e). This is very high compared with the United States' 1.6 traffic deaths per 1,000 population and with the United Kingdom's 1.4 deaths per 1,000 people (Trinca et al, 1988). In terms of traffic safety, there are on average 23 accidents per 1,000 vehicles in Nigeria (i.e. 230 per 10,000 vehicles) far in excess of the accident rate in the USA (2.7 accidents per 10,000 vehicles) and the UK (3.2 accidents per 10,000 vehicles). (Trinca et al, 1988; Tshohos, et al, 1985).

According to data from the Nigerian Federal Road Safety Commission, the country has the highest rate of death from motor accidents in Africa; leading 43 other nations in the number of deaths per 10,000 vehicle crashes (FRSC, 2006; Obinna, 2007, p. 35).

Nigeria is followed by Ethiopia, Malawi and Ghana with 219, 183 and 179 deaths per 10,000 vehicles respectively (Daramola, 2004; Atubi and Onokala, 2009; Atubi, 2012f). The number of reported cases of fatal road traffic accidents in Nigeria has shown an increasing trend from 12,212 cases of accidents in 1995 to 1996 (Central Bank of Nigeria, 1997). Fatal road accident figures across the federation of Nigeria rose sharply in 1992 resulting in 22,992 deaths (CBN, 1994). According to the Annual Abstract of Statistics (2008), between 2003 and 2007, a total of 225,891 accident cases were reported by the Nigeria Police Force, out of which 29,490 were fatal, 39,065 were serious cases, 23,380 were minor cases.

Dramatic increases in the proportion and absolute number of traffic fatalities have been witnessed in a number of developing countries, while they decreased by more than 20% in industrialised nations (Ross et al, 1991). In both Nigeria (Oluwasanmi, 1993; Ezenwa, 1986; Atubi, 2009b and 2010a) and Kenya (National Road Safety Council of Kenya, 1992), for example, a fivefold increase in traffic-related fatalities was observed over the last 30 years. African and Asian countries, with relatively low vehicle densities, are experiencing substantially higher fatality rates per 10,000 vehicles than the industrialised European and North American States (Jacobs and Sayer, 1983; WHO, 1984). Human error is estimated to account for between 64 and 95% of all causes of traffic crashes in developing countries (Atubi, 2009b). A high prevalence of old vehicles that often carry many more people than they are designed to carry, lack of safety belts and helmet use, poor road design and maintenance and the traffic mix on roads are other factors that contribute to the high rate of fatalities in less developed countries.

Other researchers concentrated on the factors affecting road safety (Ajedi, 1980; Perrow, 1984; Agunloye, 1989; Golias et al, 1997). For instance, Ajedi (1980) and Atubi (2010b) reported that the poor inter connections of existing Nigerian roads and poor maintenance of these roads were responsible for the chaotic urban transportation, which in turn leads to accidents and irreparable looses in human lives and physical resources   International comparison indicates that the chance of a vehicle killing someone in Nigeria is 47 times higher than in Britain. The proportion of fatalities to injuries reported is also very low. For example, while Czech Republic has only one death in 175 accidents, France one death in 175 accidents, Nigeria has one death in 2.65 accidents (Atubi, 2010b).

Road traffic accidents' statistics in Nigeria reveal a serious and growing problem with absolute fatality rate and casualty figure rising rapidly. In majority of developing countries, accident occurrence and related deaths are relative to either population or number of vehicles. Ironically, in Nigeria, studies have indicated that better facilities in terms of good quality and standardized roads have been accompanied by increasing number of accidents (Onakomaiya, 1998; Ghadamosi, 2002; Atubi, 2012g).

It is also evident that Nigeria is worse than most other countries in terms of traffic accidents in-spite of her relatively good road network. As in 2004 World Bank report asserts "from the view-point of road development, Nigeria would no longer be regarded as a developing country" (World Bank, 2007, p.27). But unlike in most countries where improved road development and vehicle ownership (as barometers of economic advancement) is accompanied by better traffic management, higher road safety awareness, and a relative decrease in the number of motor accidents, the opposite is true of Nigeria.

According to the Nigerian Federal Road Safety Corps (2006), between 1970 and 2001, Nigeria recorded a total of 726,383 road traffic accidents resulting in the death of 208,665 persons and 596,425 injuries. In that period, each succeeding year recorded more accidents, deaths, and injuries. Also between 1997 and 2002, Lagos State alone recorded a total of 39,141 road accidents resulting in the death of 10,132 persons and 18,872 injuries (Atubi, 2006; 2011a).

Indeed, the Nigeria accident seems to suggest that the better the road, the higher the accident and fatality rate as well as severity and non-survival indices because of driver non compliance with speed limits (Onakomaiya, 1988; Gbadamosi, 1994; Filani and Gbadamosi, 2007; and Atubi, 2011b).

Research Methodology

This study, in a broad sense, undertakes an analysis of cycles and periodic oscillations of road traffic accidents over Lagos State for a period of 32 years (i.e. 1970-2001). This attempt to conduct a detailed investigation of accident phenomenon more than the ones that had hitherto engaged the attention of researchers and academic scholars.

Secondary data were collected from various sources, which include the records of the Federal Road Safety Commission, the Nigerian Police, Federal Ministry of Transport and the Federal Office of Statistics. The data collected were analysed using both descriptive and inferential statistics.

Data Analysis

Initially, the study data were collected and organised into graphs and tables such as those presented. Then the analysis of variance statistical (ANOVA) techniques were uses to test for the significance of variability in spatial pattern of road traffic accident in Lagos State. Analysis of variance allows us to compare simultaneously three or more sample means in order to determine whether the differences between the samples are significantly higher than the differences that can be observed within each sample. Onokala (1995) and Atubi and Onokala (2009) used it for the study of the effects of landuse on road traffic accidents in Benin City and contemporary analysis of variability in road traffic accidents in Lagos State, Nigeria respectively.

Study Area

Lagos State is a suitable case study because it hosts metropolitan Lagos, Nigeria's major traffic centre, fastest growing city, and most heavily motorized urban area in the country. Consequently, the state has one of the highest accident and casualty rates in the country (Federal Republic of Nigeria, 1997, p. 6). Moreover, the traffic situation in Lagos State is bad because of the absence of effective planning, vehicle-misuse, poor management, inadequate street parking, traffic congestion, delays and accidents among other contributory factors.

Lagos State is situated in the South Western corner of Nigeria. This elongated state spans the Guinea Atlantic coast for over 180km, from the Republic of Benin on the west to its boundary with Ogun State in the east (figure 1), while Lagos State is the smallest in Nigeria, it has over 5 percent (i.e. 9,013,534) of the country's estimated 140 million people (National Population Census, 2006). Its rate of population growth has been in excess of 9 percent per annum, or 25,000 per month or 833 per day or 34 per hours in the last decade (Lagos urban Transport Project, 2002). This population increase has been accompanied by a corresponding increase in motor vehicles and traffic accidents. However, accident rates in Lagos State are still very much on the high side compared to other states in the federation. But, fatalities and non-survival indices for the state are on the decline. This is attributable to its high level of traffic congestion (which reduces the probability of the high fatality accidents resulting from over speeding) and accessibility to good post – crash medical care in the Lagos metropolitan area.
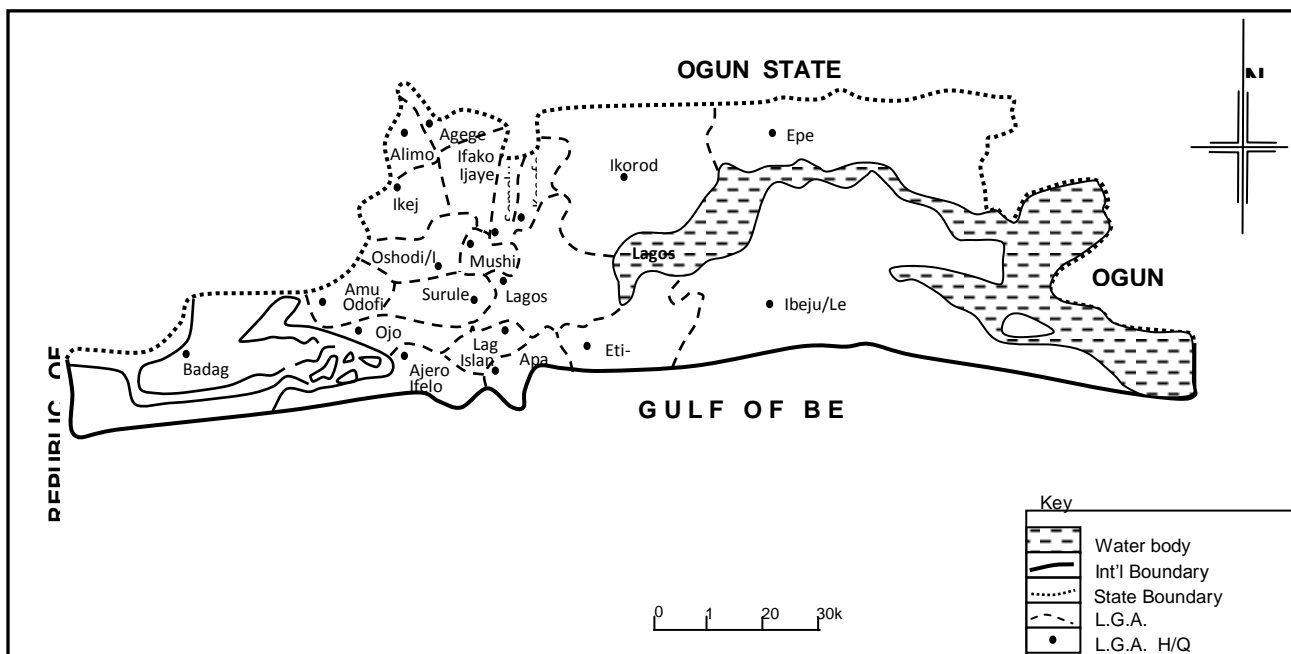

FIG. 1: MAP OF LAGOS STATE SHOWING THE 20 L.G.AS

Source: Lagos State Ministry of Environment and Physical Planning (1999)

Discussion of Findings/Results

Examination of table 1 shows that for Lagos State as a whole, dominant cycles of road traffic accidents observed have periodicities of 32.00, 16.00 and 10.67 years with the most dominant being 32.00 years. This means that in other words, that the dominant and strongest road traffic accident pattern over Lagos State repeats itself every 32 years. This also means that if the situation is not given due attention by the relevant authorities, high rates of road traffic accidents will repeat itself by the year 2033 in the first instance and the year 2017 and 2011 respectively. However, it appears nothing was done by the relevant authorities hence, Nigeria was declared recently at the close of the 2011 as the second highest in terms of road traffic accident fatalities by the World Health Organisation (WHO) in 2012.

Table 1: Dominant Road Traffic Accident Cycles in Lagos State

Location		Cycles (Years)	% Variance	Amplitudes
Lagos State	1st	32.00	75.11	3362.45
	2nd	16.00	5.51	910.95
	3rd	10.67	4.85	854.69
Lagos Island	1st	32.00	47.73	110.15
	2nd	16.00	27.97	84.32
	3rd	3.00	6.11	39.42
Ikorodu	1st	32.00	46.25	80.09
	2nd	16.00	25.40	59.35
	3rd	10.67	6.46	29.93
Ajeromf/lfelodun	1st	32.00	46.89	77.83
	2nd	16.00	18.05	18.05
	3rd	8.00	7.66	7.66
Badagry	1st	32.00	63.73	82.36
	2nd	16.00	15.73	40.92
	3rd	5.33	3.97	20.54
Epe	1st	32.00	51.18	64.63
	2nd	16.00	16.89	37.13
	3rd	10.67	7.20	24.25
Ikeja	1st	32.00	34.86	43.15
	2nd	5.33	11.93	25.24
	3rd	10.67	11.33	24.59
Mushin	1st	16.00	29.72	48.55
	2nd	32.00	25.80	45.24
	3rd	8.00	17.30	37.05
Lagos Mainland	1st	32.00	43.39	62.18
	2nd	16.00	18.78	40.90
	3rd	8.00	13.17	34.25

For Local Government Areas such as Lagos-Island, Ikorodu, Ajeromi/Ifelodun, Badagry, Epe, Ikeja and Lagos Mainland Local Government Areas, a dominant cycle of 32 years is observed. Other strong cycles, a fairly short one of 16.00 years and a short period ones of 3 years are also observed.

Variance spectra explaining the percentage variance explained by each harmonic have been drawn for the state as a whole as well as each Local Government Area (Figs. 2-10).

An inspection of the power spectra for Ajeromi/Ifelodun, Epe, Ikeja, Mushin, Lagos Island and Lagos Mainland Local Government Areas (Fig. 3, 5, 7, 8, 9 and 10) shows no regularity in the occurrence of road traffic accident patterns, although, 32.00 years is the most dominant cycle. Incidentally, these are local governments that are prone to accidents in Lagos State (see Atubi and Onokala, 2009; Atubi, 2010a; 2010c and 2011a). Also, an inspection of the power spectra for Ikorodu and Badagry Local Government Areas (Figs. 4 and 5) shows some regularity in the occurrence of road traffic accident patterns. These Local Government Areas are not prone to accidents in Lagos State.
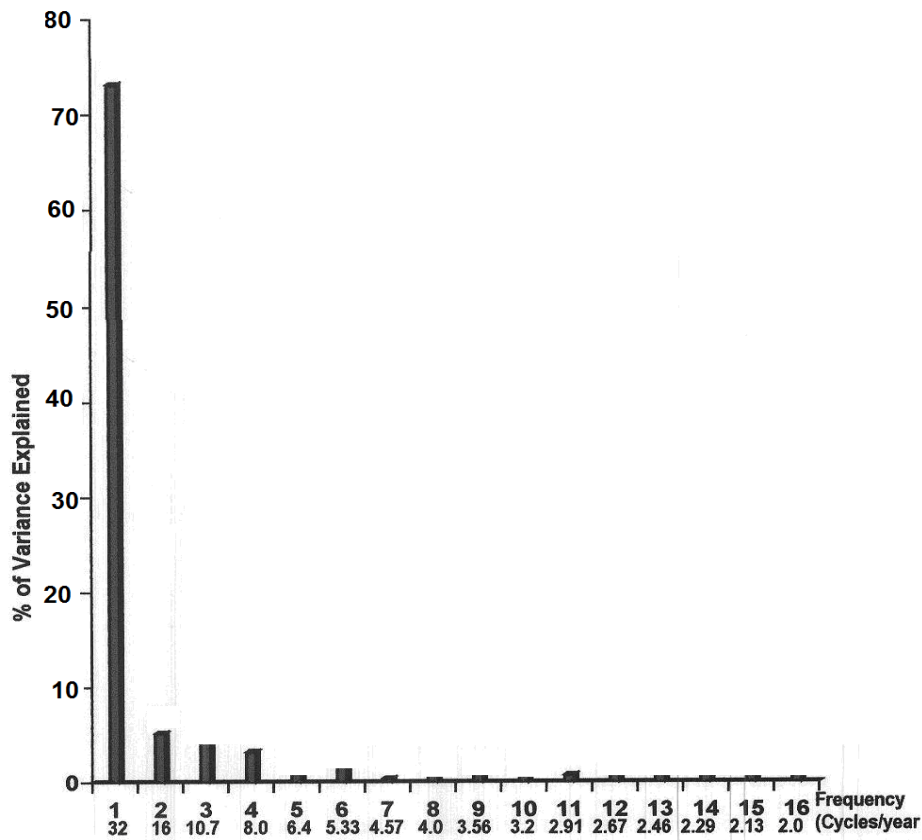
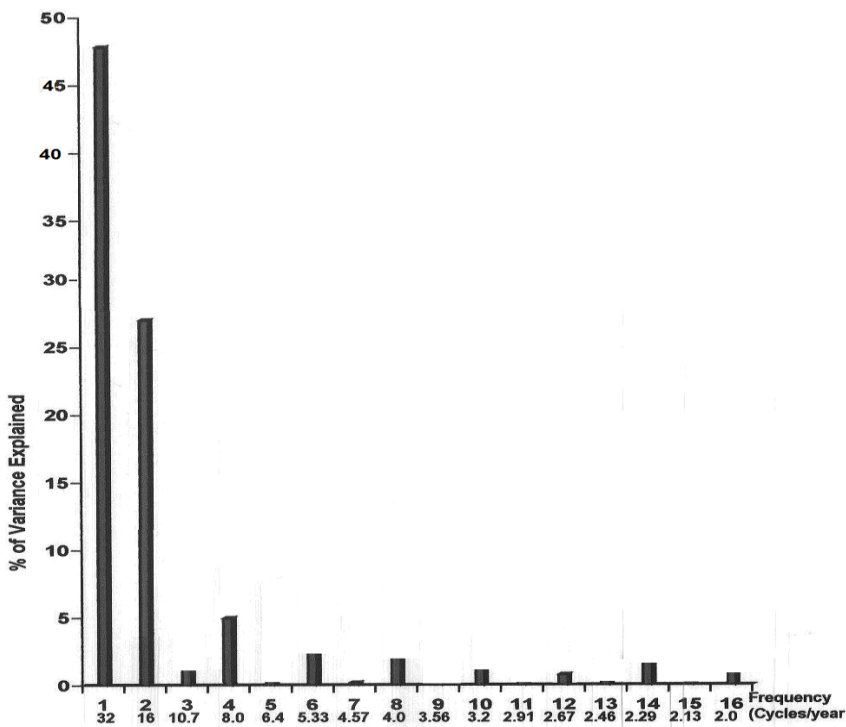**Fig. 2:** Variance Spectrum for Lagos State

Fig. 3: Variance Spectrum for Lagos Island Local Government Area
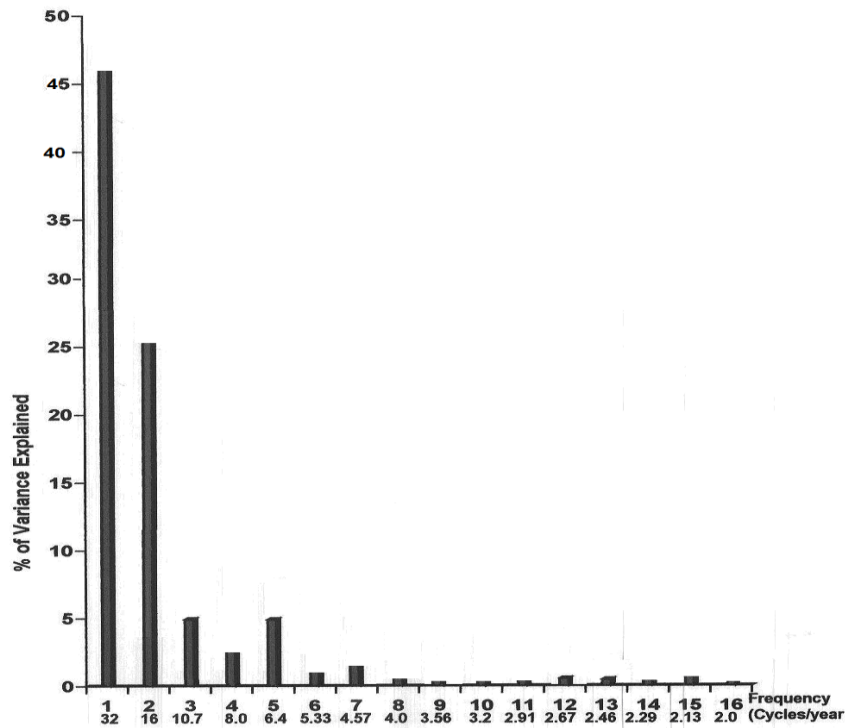
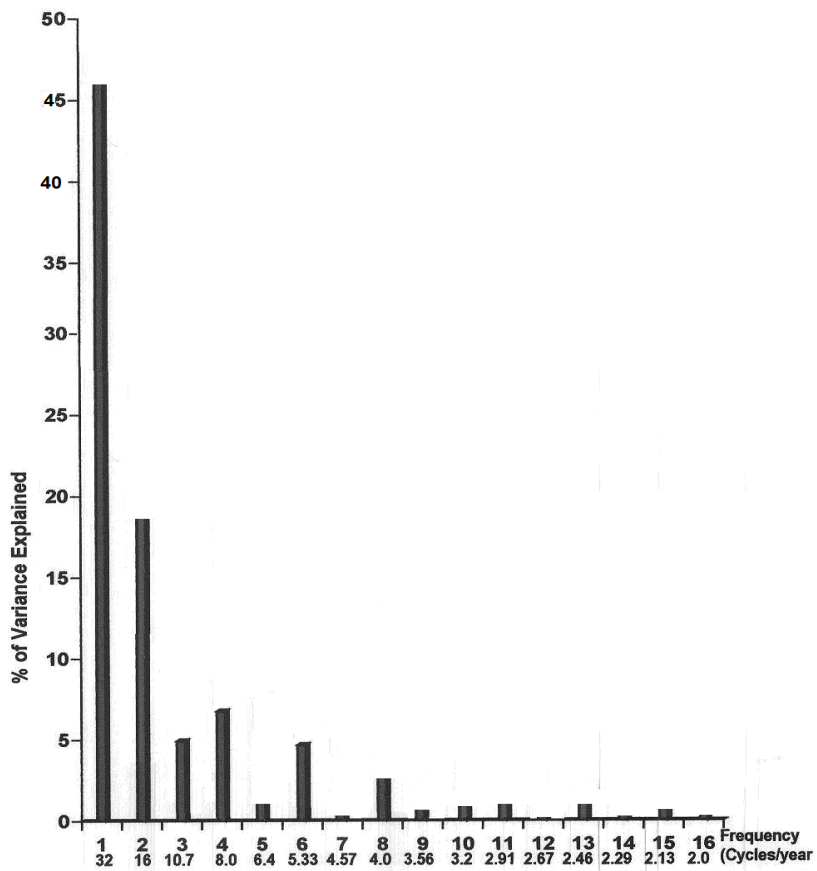**Fig. 4:** Variance Spectrum for Ikorodu Local Government Area

Fig. 5: Variance Spectrum for Ajeromi/Ifelodun Local Government Area
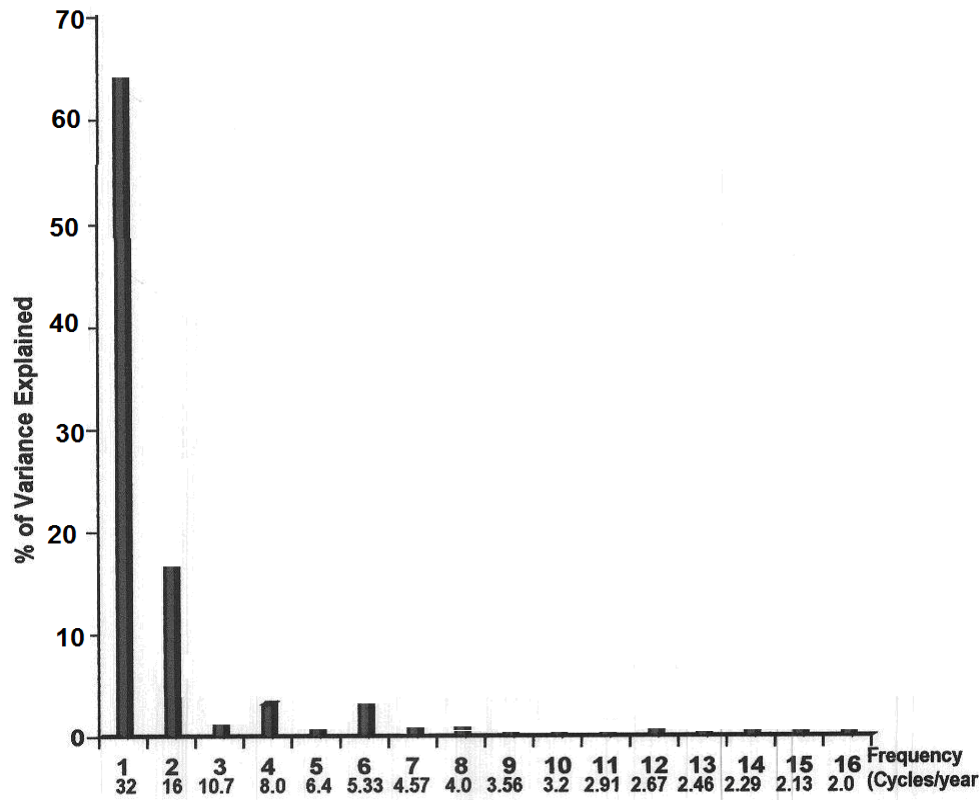
Fig. 6: Variance Spectrum for Badagry Local Government Area
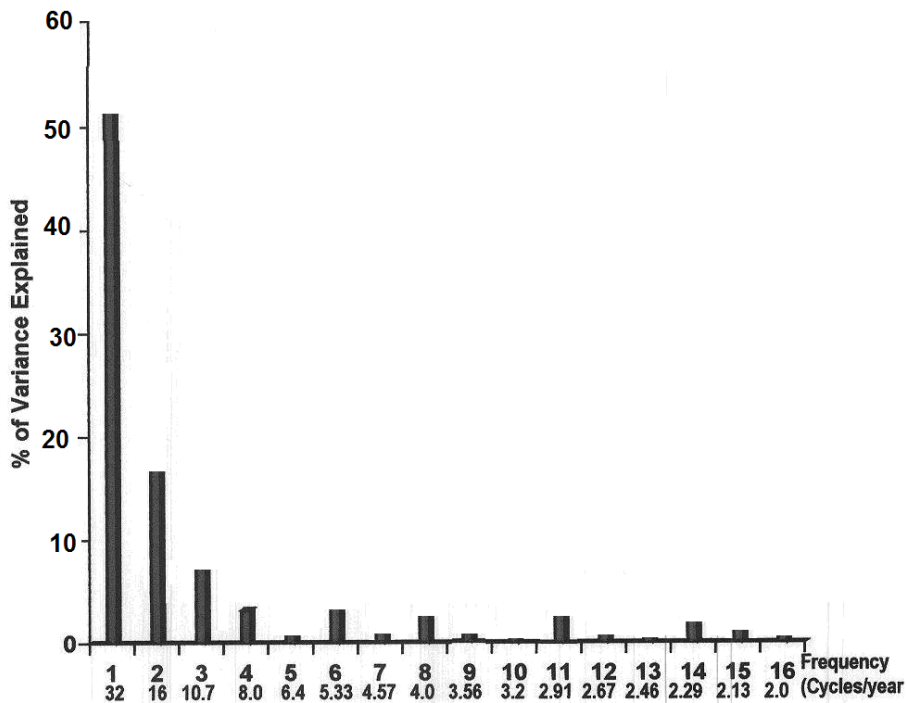

Fig. 7: Variance Spectrum for Epe Local Government Area
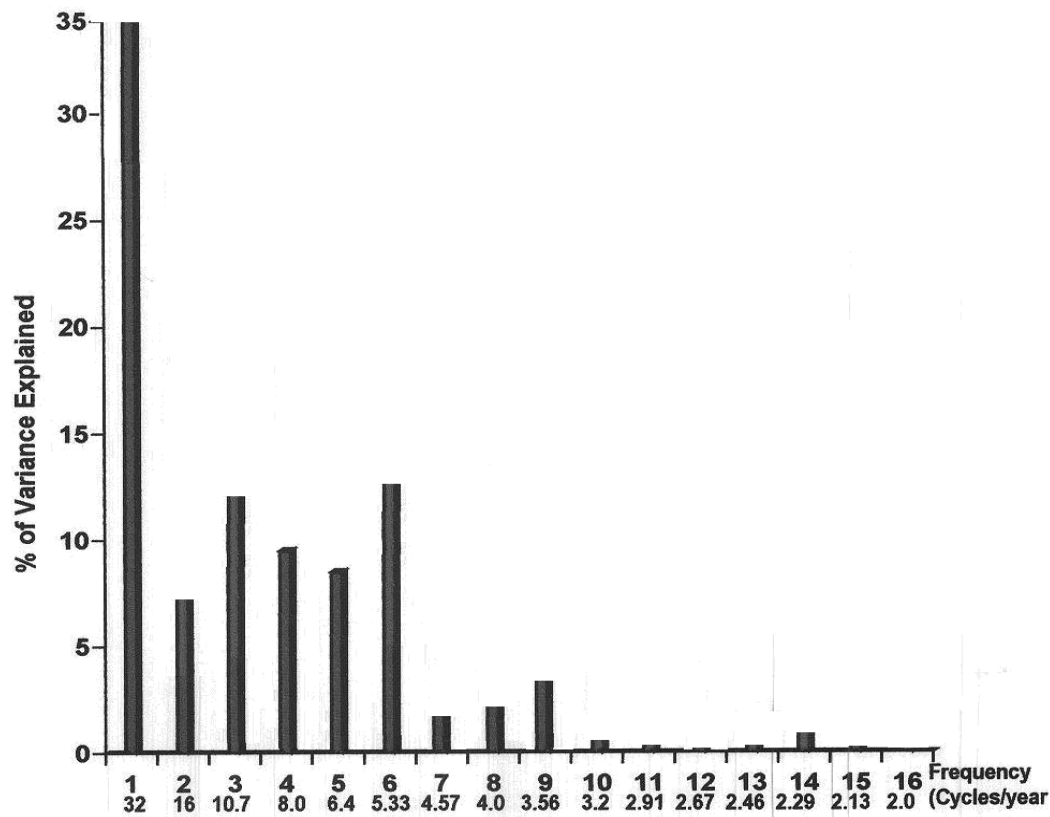
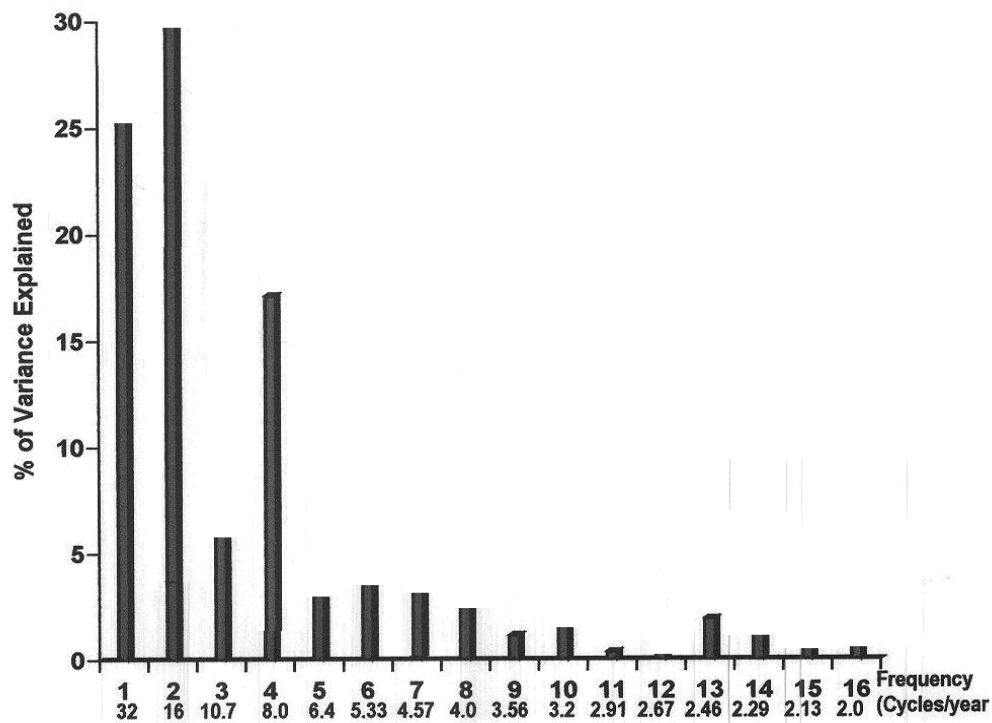**Fig. 8:** Variance Spectrum for Ikeja Local Government Area

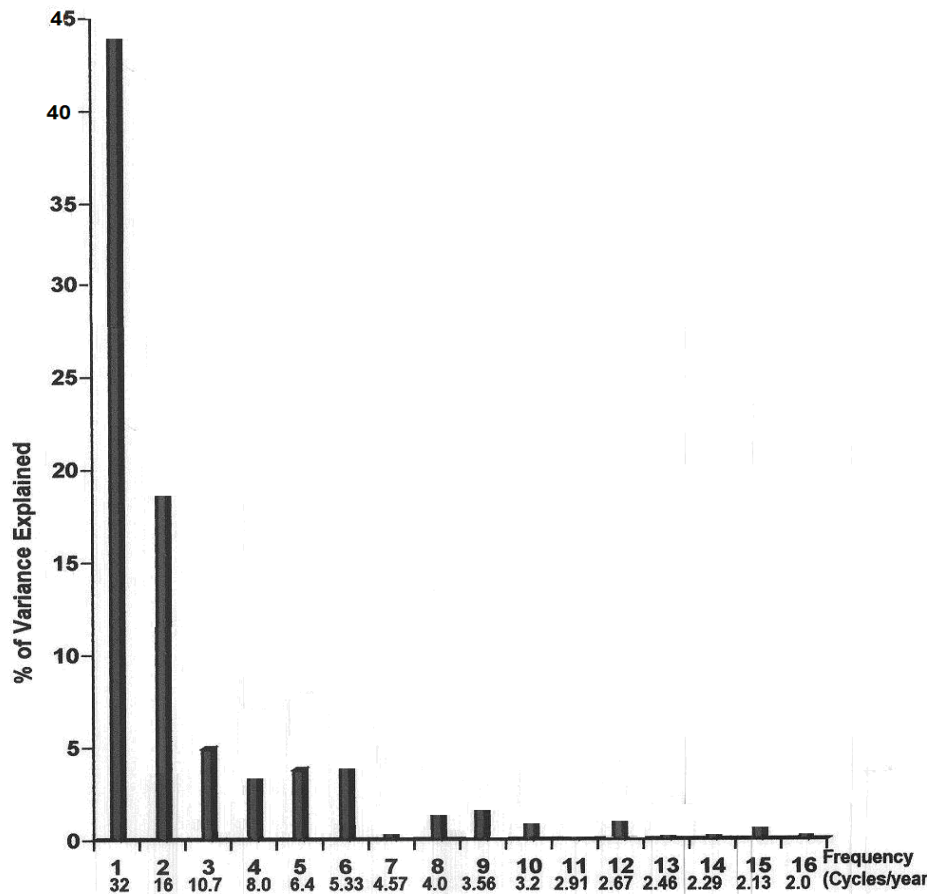**Fig. 9:** Variance Spectrum for Mushin Local Government Area

Fig. 10: Variance Spectrum for Lagos Mainland Local Government Area

A general over view of the road traffic accident occurrence over Lagos State (Fig. 2) indicates the predominance of the 32 years periodicity. However, there does not seem to be any regularity in the cyclical pattern of road traffic accident over the years. Other cycles identified could be attributed to random change.

The reported road traffic accidents in all the Local Government Areas of Lagos State from 1970 to 2001 were compared using the analysis of variance (ANOVA). The results are shown in table 2.

Table 2: Analysis of Variance for Reported Road Traffic Accidents in Lagos State

Factor	Sources of variation	Sum of squares	Degree of freedom	Mean square	F.Cal.	F.Tab
L. G. As	Between L.G.A.	1035323.2	19	54490.90	11.84	1.57
	Within L.G.A.	1859136.0	404	4601.82		
	Total	2894459.2	423			
Years (1970-2001)	Between years	1985622.1	31	64052.33	27.63	1.46
	Within years	908837.13	392	2318.46		
	Total	2894459.2				

The result shows that for the two factors, Local Government Areas and years, the f-calculated of 11.84 and 27.63 respectively were higher than the f-tabular of 1.57 and 1.46 respectively at 0.05 level of significance. It then implies that the means for each of the factors, reported road traffic accidents across all the Local Government Areas in Lagos State and across different years, 1970-2001, were significantly different (see Appendix 1 and 2) for result of the mean comparisons for different Local Government Areas and for different years in Lagos State from 1970 to 2001.

Policy Recommendations

By the serious road traffic accident situation in the area of study, Local Government Areas like Lagos Island, Lagos Mainland, Ajeromi/Ifelodun, Ikeja, Mushin, Oshodi/Isolo, Apapa, Eti-Osa, Kosofe and Ojo Local Government Areas can be described as accident prone areas, because they are all associated with high accident rate, high number of deaths, high number of injuries and so on (See Fig. 11). This trend therefore, suggest that these Local Government Areas of Lagos State are associated with the menace of road traffic accidents and these deserves urgent attention and appropriate policy intervention.
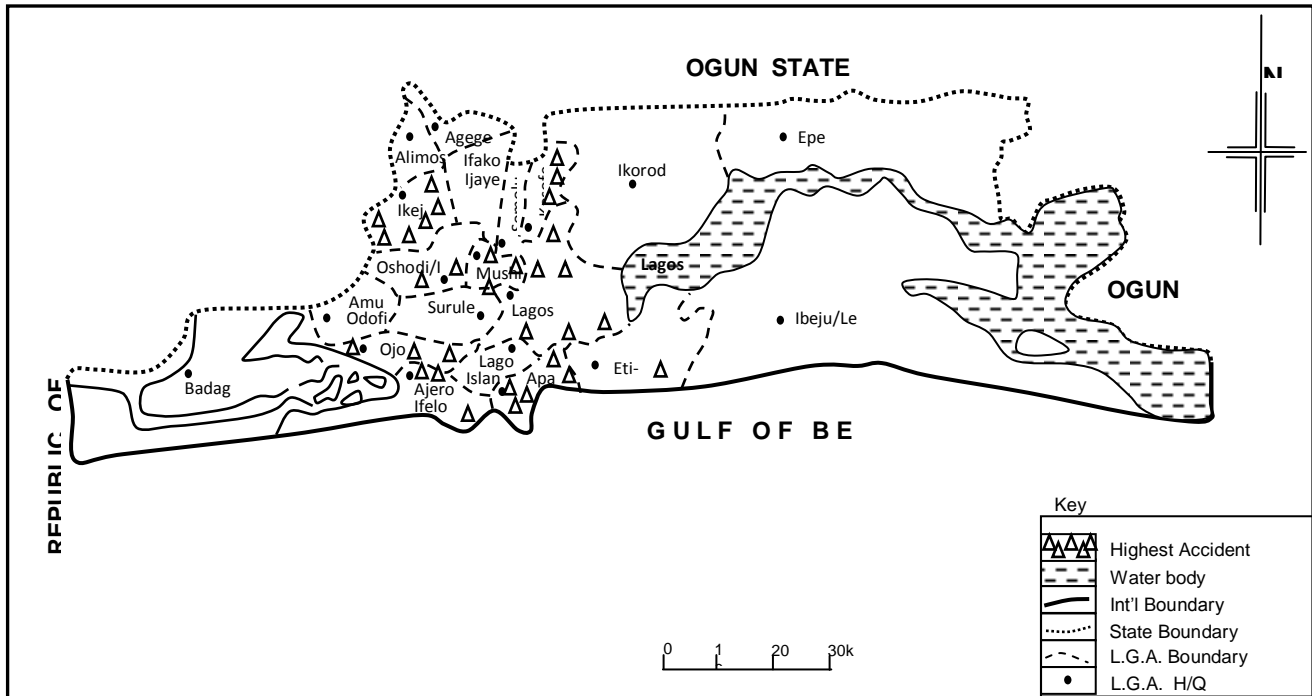

FIG. 11: SPATIAL DISTRIBUTION OF HIGHEST ACCIDENT L.G.As IN LAGOS STATE

Since the driver of a vehicle is the most important determinant of the occurrence of an accident, the quality of drivers on the roads in the study area cannot be over-emphasised. Consequently, training and re-training of drivers should be a basic effort towards reducing the carnage on our roads. The training and retraining of drivers constitute a formidable means of effectively dealing with the issue of road traffic accident reduction. The road traffic system itself is dynamic in nature. Therefore, the training and retraining of operators of vehicles is a sine qua non if the operators are to develop, retain, and display skills that match the demands imposed on them by constantly changing characteristics of the road system. This measure is the only means of ensuring that operators entering or remaining in action in the system are first endowed with the necessary skills.

Also, the system of apprehension and punishment of offenders of traffic rules, to a large extent, constitute a major cause of lawlessness and blatant and general disrespect for the traffic laws on most of Nigerian roads and the consequent increase in accident occurrence. The responsibility of the police and other law enforcement agencies is to create awareness among people of the necessity to behave responsibly while driving on the roads. The police, the Federal Road Safety Corps (FRSC) and traffic wardens are grossly under resourced and under trained for this task. Worst still, is the low salary paid to police officers, which increases corruption among them and makes it impossible for many offenses to be reported.

These measures, if well executed, will contribute positively towards reducing the ugly incidence of road traffic accident in Lagos Safety and Nigeria in general. The current poor road safety record in Nigeria is not inevitable. As other countries like the U.S.A. and Britain have shown, population and vehicular traffic growth does not have to lead to increases in traffic crashes, deaths, and permanent injuries as these undesirable out comes can be minimized through adequate traffic accident control and injury prevention measures (Atubi, 2006 and Atubi and Onokala, 2009).

Conclusion

Traffic accident injuries and fatalities are a serious problem all over the world. In Nigeria, the incidence has become a very disturbing phenomenon as the country is presently ranked among countries with the highest traffic injuries and fatalities in the world (Jacobs et al, 1986; Onakomarya, 1991; Daramola, 2004). Moreover, the country's road safety campaigns are inadequate and often limited to festive seasons. For these campaigns to be effective, they must be year-round and not just limited to festive seasons.

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Appendix I
Reported Road Traffic Accidents
Duncan[a,b]

Local Government Area	Subset for alpha = .05			
	6	7	8	9
Epe				
Badagry				
Ikorodu				
Mushin				
Lagos Mainland				
Ajeromi				
Osodi/Isolo				
Lagos Island	358.3125			
Apapa	364.5625			
Ikeja	367.0000	367.0000		
Amuwo-Odoan	369.7692	369.7692	369.7692	
Surulere	384.3750	384.3750	384.3750	384.3750
Alimosho	400.1538	400.1538	400.1538	400.1538
Eli-Osa	406.5385	406.5385	406.5385	406.5385
Ibeju-Lekki	407.2308	407.2308	407.2308	407.2308
Ojo	409.1538	409.1538	409.1538	409.1538
Ifako-Ijaye		418.6154	418.6154	418.6154
Shomolu			421.0000	421.0000
Kosofe				427.9231
Agege				431.5385
Sig.	0.057	0.051	0.053	0.080

Means for groups in homogenous subsets are displayed.

Reported Road Traffic Accidents
Duncan[a,b]

Local Government Area	Subset for alpha = .05			
	6	7	8	9
Epe				
Badagry				
Ikorodu				
Mushin				
Lagos Mainland				
Ajeromi				
Osodi/Isolo				
Lagos Island	358.3125			
Apapa	364.5625			
Ikeja	367.0000	367.0000		
Amuwo-Odoan	369.7692	369.7692	369.7692	
Surulere	384.3750	384.3750	384.3750	384.3750
Alimosho	400.1538	400.1538	400.1538	400.1538
Eli-Osa	406.5385	406.5385	406.5385	406.5385
Ibeju-Lekki	407.2308	407.2308	407.2308	407.2308
Ojo	409.1538	409.1538	409.1538	409.1538
Ifako-Ijaye		418.6154	418.6154	418.6154
Shomolu			421.0000	421.0000
Kosofe				427.9231
Agege				431.5385
Sig.	0.057	0.051	0.053	0.080

Means for groups in homogenous subsets are displayed

a. Uses harmonic mean sample size = 17.931.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type 1 error levels are not guaranteed.

Reported Road Traffic Accidents
Duncan[a,b]

Years (Category)	N	1	2	3	4	5	6
Subset for alpha = .05
1970	8	143.2500					
1971	8	157.6250					
1972	8	168.2500	168.2500				
1973	8		207.3750	207.3750			
1974	8			234.6250	234.6250		
1975	8			234.8750	234.8750		
1976	8			248.7500	248.7500	248.7500	
1978	8				276.2500	276.2500	276.2500
1977	8					279.8750	279.8750
1979	8					286.3750	286.3750
1980	8						311.3750
1981	8						314.0000
1982	8						
1986	12						
1987	12						
1988	12						
1983	8						
1989	20						
1991	20						
1984	8						
1990	20						
1994	20						
1993	20						
1996	20						
1992	20						
1995	20						
1997	20						
1999	20						
2001	20						
2000	20						
1998	20						
1985	8						
Sig.		0.253	0.056	0.064	0.063	0.094	0.102

Means for groups in homogenous subsets are displayed

Reported Road Traffic Accidents
Duncan[a,b]

Years (Category)	Subset for alpha = .05						
	7	8	9	10	11	12	13
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1978							
1977							
1979							
1980	311.3750						
1981	314.0000						
1982	334.0000	334.0000					
1986	335.3333	335.3333	335.3333				
1987	344.3333	344.3333	344.3333	344.3333			
1988	352.2500	352.2500	352.2500	352.2500	352.2500		
1983		360.7500	360.7500	360.7500	360.7500	360.7500	
1989		369.5500	369.5500	369.5500	369.5500	369.5500	369.5500
1991		373.3500	373.3500	373.3500	373.3500	373.3500	373.3500
1984		377.2500	377.2500	377.2500	377.2500	377.2500	377.2500
1990		377.6000	377.6000	377.6000	377.6000	377.6000	377.6000
1994		381.5500	381.5500	381.5500	381.5500	381.5500	381.5500
1993			382.9500	382.9500	382.9500	382.9500	382.9500
1996			383.0500	383.0500	383.0500	383.0500	383.0500
1992				384.9000	384.9000	384.9000	384.9000
1995				389.5500	389.5500	389.5500	389.5500
1997					393.9000	393.9000	393.9000
1999						401.2000	401.2000
2001						404.1500	404.1500
2000						407.3500	407.3500
1998							410.6500
1985							415.8750
Sig.	0.081	0.051	0.052	0.069	0.096	0.064	0.067

Means for groups in homogenous subsets are displayed

   a.   Uses harmonic mean sample size = 11.034.

   b.   The group sizes are unequal. The harmonic mean of the group sizes is used. Type 1 error levels are not guaranteed.

Appendix 2
Descriptive
Reported Road Traffic Accidents

Years (Category)	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean
					Lower Bound
1970	8	143.2500	21.4459	7.5823	125.3207
1971	8	157.6250	19.9208	7.0431	140.9707
1972	8	168.2500	30.0369	10.6196	143.1385
1973	8	207.3750	52.6659	18.6202	163.3452
1974	8	234.6250	76.2645	26.9636	170.8663
1975	8	234.8750	58.9926	20.8570	185.556
1976	8	248.7500	58.0954	20.5398	200.1811
1977	8	234.8750	57.1300	20.1985	232.1131
1978	8	276.2500	50.1875	17.7440	234.2922
1979	8	286.3750	52.5709	18.5866	242.4247
1980	8	311.3750	64.3693	22.7580	257.5609
1981	8	314.0000	64.8537	22.9292	259.781
1982	8	334.0000	45.8164	16.1985	295.6965
1983	8	360.7500	49.2276	17.4046	319.5947
1984	8	377.2500	53.4248	18.8885	332.5887
1985	8	415.8750	91.2272	32.2537	339.6071
1986	12	335.3333	51.3904	14.8351	302.6815
1987	12	344.3333	42.6025	12.2983	317.265
1988	12	352.2500	36.1892	10.4469	329.2565
1989	20	369.5500	39.8873	8.9191	350.8822
1990	20	377.6000	41.4620	9.2712	358.1952
1991	20	373.3500	44.4443	9.9380	352
1992	20	384.9000	44.7001	9.9952	
1993	20	382.9500	43.5533	9.7388	
1994	20	381.5500	41.7177	9.3284	
1995	20	389.5500	37.7909	8.4503	
1996	20	383.0500	43.9790	9.8340	
1997	20	393.9000	45.8119	10.2438	
1998	20	410.6500	58.9686	13.1858	
1999	20	401.2000	48.0511	10.7445	
2000	20	407.3500	52.4929	11.7378	
2001	20	404.1500	35.0012	7.8265	
Total	424	348.9575	82.7206	4.0173	5653.318