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Effects of Congestion and Travel Time Variability along Abuja - Keffi Corridor in Nigeria

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Abstract - Uncontrolled motorization is one of the major causes of traffic congestion along the outer ring corridor of Abuja due to the absence of adequate mitigation measures. The purpose of this paper is to identify the traffic influencing events causing congestion, determine the travel time variability along Abuja – Keffi corridor and to make suggestions for effective traffic-related measures in reducing congestion along this route. The process of traffic impact mitigation was examined in this study and it was found that a measure related to bus stops provision is most effective in reducing congestion along this corridor. It is recommended that the Federal Capital Territory Administration (FCTA) should develop more explicit policy tools for mitigating the traffic impact along this outer ring corridors of Abuja.

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I. Introduction

An effective transport system is indispensable to the economic progress of any nation. This is because of the fact that without adequate facilities for moving goods and people from place to place, economic and social activities could be paralyzed. Nigeria's increasing population over the years coupled with diminishing resources has worsened its transport system especially in the sub-urban and urban centers especially in the Federal Capital cities like Abuja and Lagos. (Ibi, 2004)

The demand for transport outstrip the supply, while the poor interchange system, high cost of transport and lack of passenger information system are some of the problems facing the average commuters (Ibi, 2004). It was found out in this study that good transport with major bus stops would make significant contribution to travel time and patterns and can provide movement of large number of people while occupying a relatively small portion of road space. A good transport with well-located bus-stops helps to eliminate congestion which is the major problem along the study route and also reduce the number of road accidents and overall safety and efficiency of the road network. Congestion has, in fact become one of the dominant factors that determine how a city grows and its effect has caused significant increase in undesired long delays, adverse pollutions, increased operating costs and adverse sociological effects along the study road corridor.

Traffic congestion is one of the most significant problems faced in modern cities like Abuja. Statistics indicate that road transport is the dominant mode of transportation in Africa (Kerekezi, 2002), about 95% in Nigeria; resulting in road traffic congestion. The effects of congestion cause increase in undesired long delays, adverse pollutions, potential increase in accidents, increased operating costs and adverse sociological effects (Philpott, 1997).

Congestion causes increase in travel time which may eventually become increasingly variable and unpredictable as congestion increases. Congestion levels are never the same from day-to-day on the same highway because the varieties of traffic-influencing events that influence congestion are never the same. Commuters could be late for work or after-work appointments, business travelers could be late for meetings, and truckers could incur extra charges by not delivering their goods on time (http://wwwcf.fhwa.dot.gov cited on 14th December 2009).

II. Description Of Study Area

Abuja is a city in the central part of Nigeria and the Federal Capital of Nigeria. Abuja is about 1250m (about 4100 ft) above sea level, occupying 713km^2 of land area. The city average monthly temperature is in the range 21^0- 25^0 C (69^0 - 77^0 F).

The city center of Abuja is crowded with a mix business wholesale and retail outlets which attracts customers from all parts of the country. Also, the three outer ring corridors of Abuja generate high traffic levels due to high rate of daily drift from sub-urban area into Abuja especially along Abuja – Keffi corridor. This concentration of activities as well as the high traffic levels explains the recurring traffic congestion at peak periods and the need for traffic management operations to maintain acceptable levels of traffic performance.

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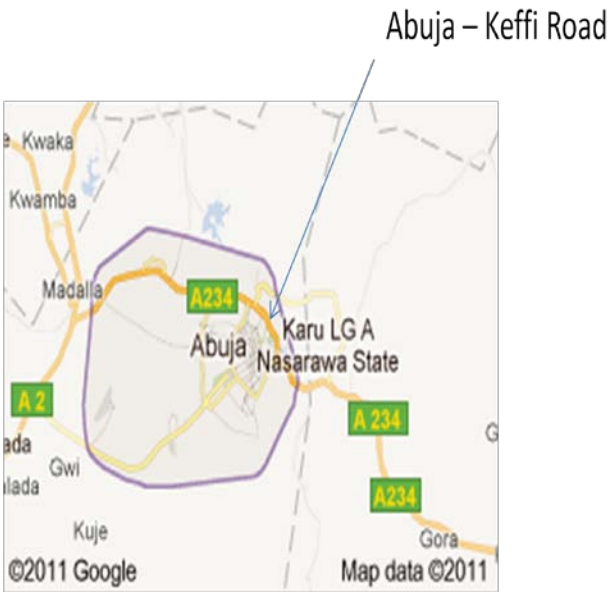

Fig 1 : Map of Abuja showing the study road

Statistics has shown that the city population is growing in relation to vehicle ownership and is likely to continue to grow in future. The growth pattern of the population and vehicle registration of Abuja between the years of 2000 and 2010 is shown in Fig. 2.. The implication of all these is an unexpected growth in the traffic levels which may lead to overloading of some major sub-urban corridor such as Abuja – Keffi road. It can be established that there is a corresponding increase in the number of vehicles being registered to the rise in the population.

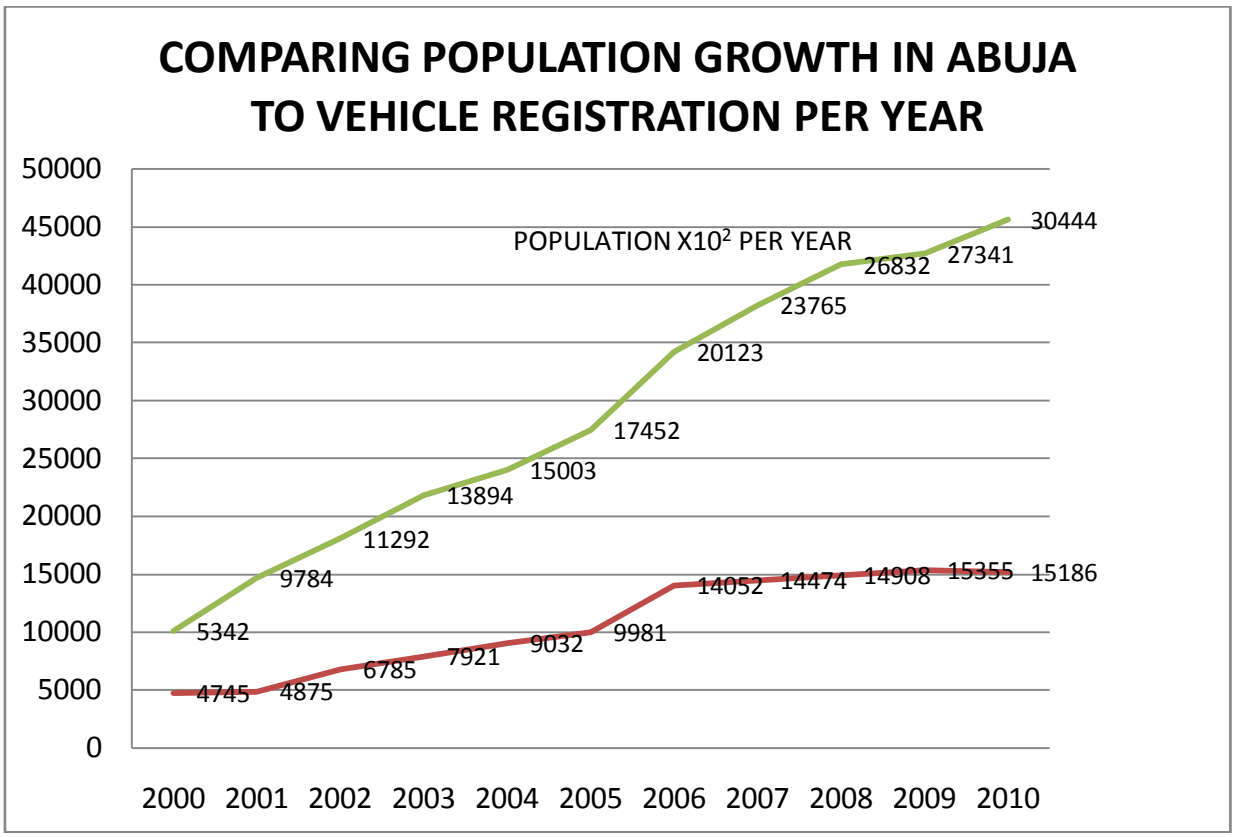

Fig 2 : Growth Pattern of Abuja population and Vehicle Registration

Fig.2 shows the statistics relating population to vehicle registration in the city. It can be established that there is a corresponding increase in the number of vehicles being registered to the rise in the population.

III. Travel Time Variability

Travel time variability can be defined in terms of how travel times vary over time (e.g., hour-to-hour, day-to-day). The traffic-influencing "events" such as traffic incidents, weather, and work zones; contribute to total

congestion which produces unreliable travel times. This event-driven variability in travel conditions is referred to as non-recurring congestion since it happens differently every day.

a) Methodology

Two hours video coverage each was recorded for both peak and non-peak periods (weekday and weekend) at the three critical congested locations along the road. The traffic volume at the each location; Sani Abacha, Karu and Nyanyan Flyovers were recorded for all existing modes of transport. The travel time of vehicles during peak and non-peak period at each location was analyzed using random selection method while playing back the video at 15 minutes interval. The events that impede traffic flow and cause travel to be unreliable often occur in combination. An analysis of how the combination of these events affect the travel time reliability was carried out along Abuja – Keffi road for the weekday and weekend during peak and non-peak period respectively. The possible trips and travel time are plotted to illustrate the travel time variation. Few roadside interviews were also conducted to test the view of travelers on daily trip. It was revealed that it becomes hard for travelers to predict how long time to commute to work. It appears even more difficult for travelers to plan their work trip as most offices resume work by 8.00am and the road section is always filled up beyond capacity between the hours of 7am and 9am. This uncertainty in travel time could introduce extra travel time and cost into the daily trip in order to account for time variability thereby resulting in travel time reliability. Four scenarios; namely (i) widening of the road (ii) construction of by-pass (iii) replacing of car usage with improved public transport and (iv) provision of bus stops at critical locations were examined in determining the most appropriate mitigation measure for this corridor..

b) Results and Discussions

Tables 1 to 6 present the summary of the classified traffic count at each counting location.

Table 1 : Peak Hour Traffic Counts

Sani Abacha Flyover

Time (min)	Car	Bus	Truck/Van	Motorcycle
0 – 15	1,243	206	97	6
15 – 30	1,579	178	68	5
30 – 45	1,467	301	72	11
45 – 60	1,622	98	101	5
Peak Hr. Traffic	5,911	783	338	27

Karu flyover

Time(min)	Car	Bus	Truck/Van	Motorcycle
0 – 15	983	183	78	23
15 – 30	1,039	214	94	19
30 – 45	501	312	111	37
45 – 60	1,426	381	176	15
Peak Hour Traffic	3,949	1,090	459	94

Nyanya Flyover

Time(min)	Car	Bus	Truck/Van	Motorcycle
0 – 15	783	225	49	17
15 – 30	895	81	58	54
30 – 45	987	102	34	16
45 – 60	920	89	102	12
Peak Hour Flow	3,585	497	243	99

The traffic volume distribution in Tables 1 indicates that the flow of car traffic reduces as one moves away from Abuja central district while the motorcycle traffic increases At Karu flyover which serve as collecting and distributing arterial between Abuja district and suburbs presents more buses and truck traffic compared to other locations. It is not surprising having number of cars entering Abuja district to be high as a result of distributed traffic from other sub-urban districts being linked by Karu flyover.

The number of motorcycles entering Abuja central district is very low due to a ban on use of commercial motorcycles within the district. However, congestion resulting from this high number of cars interacting with some other events on the road can be complex and varies greatly from day-to-day. The problem is that with the exception of the physical bottlenecks, the sources of congestion occur with maddening irregularity.

The variation in travel time as collected in the study area from Karu Junction to Nyanyan junction is shown in Figures 3 - 6.

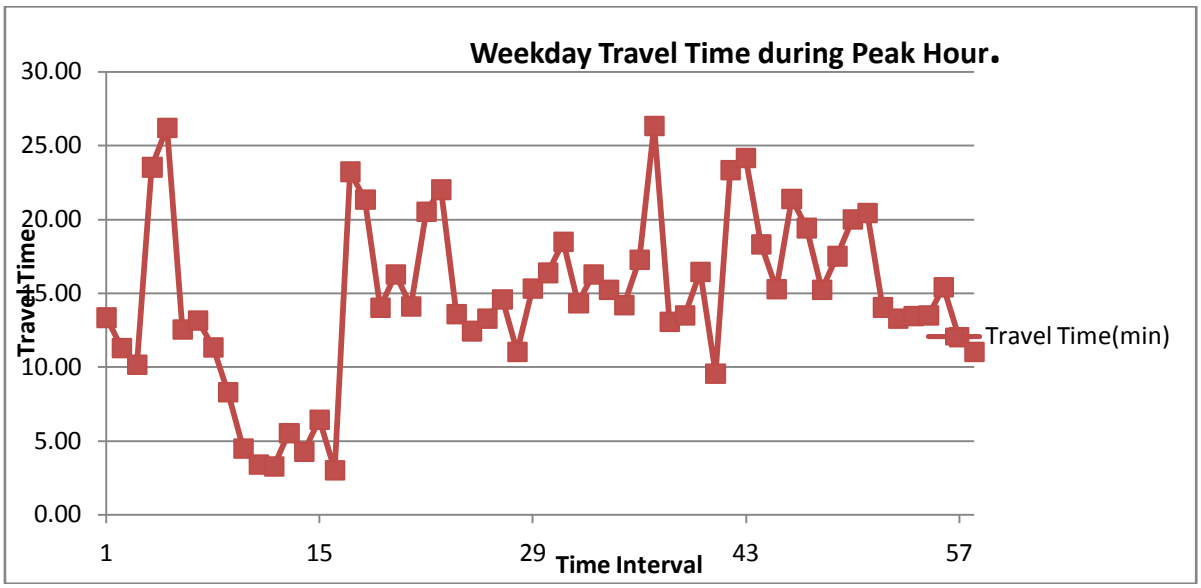

Figure 3 : Travel Time Variability at Weekday Peak Hour (7.00am – 8.00am) at Karu

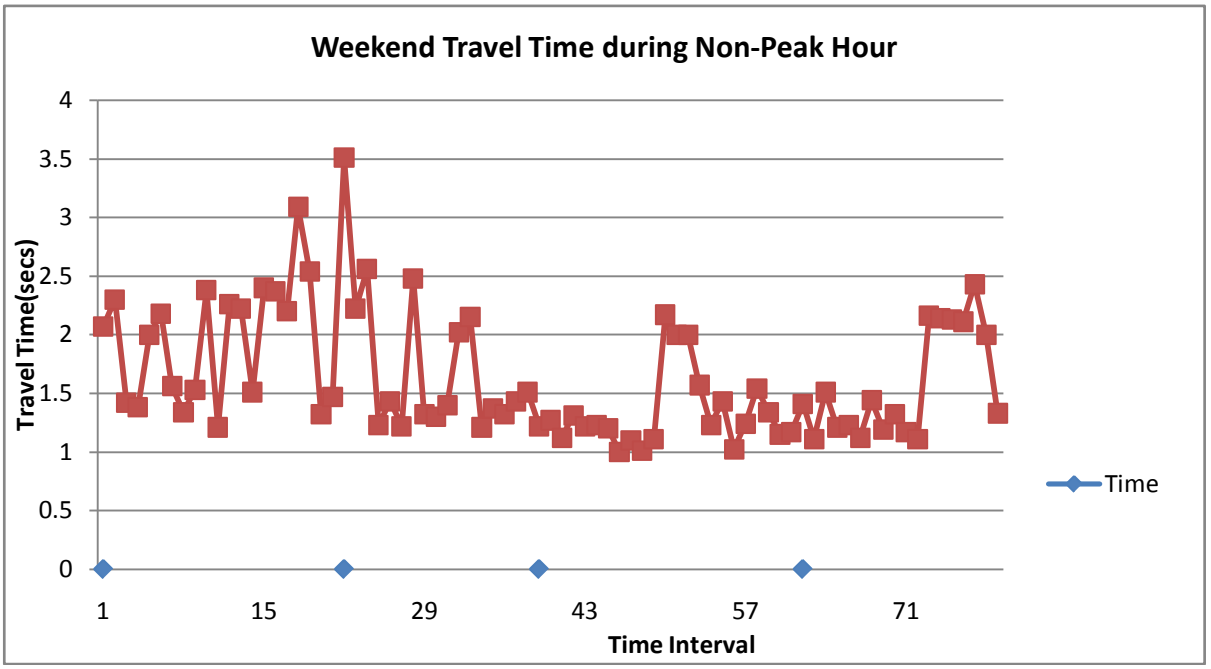

Figure 4 : Travel Time Variability at Weekend Non-Peak Hour (7.00am – 8.00am) at Karu

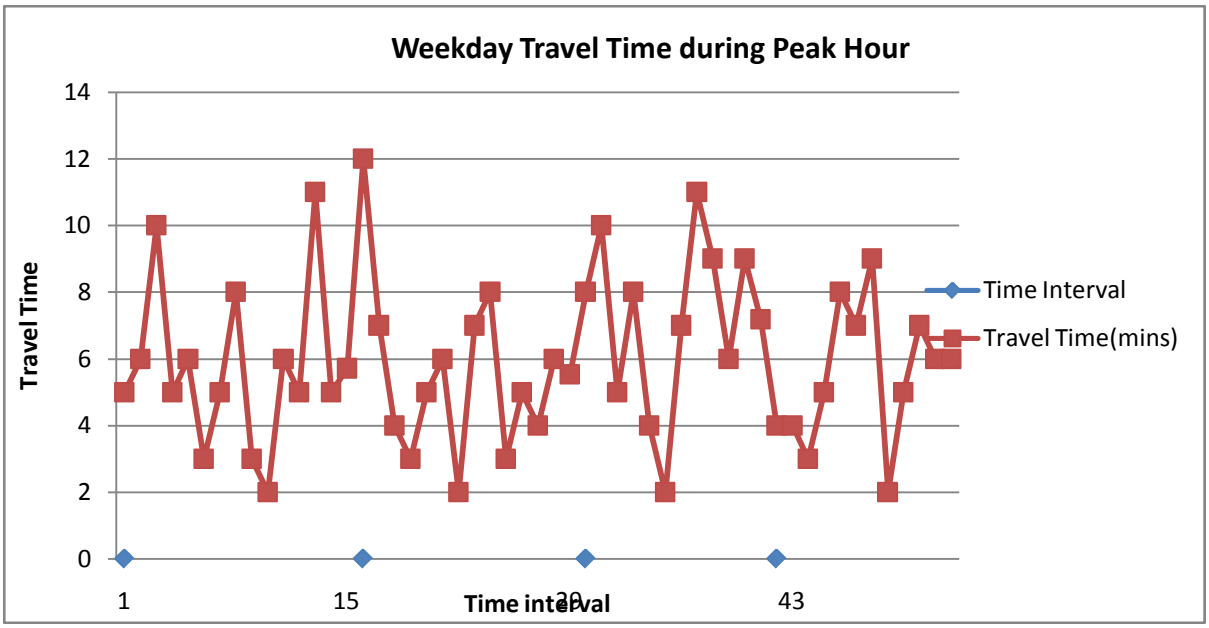

Figure 5 : Travel Time Variability at Weekday Peak Hour (7.00am – 8.00am) at Nyanyan

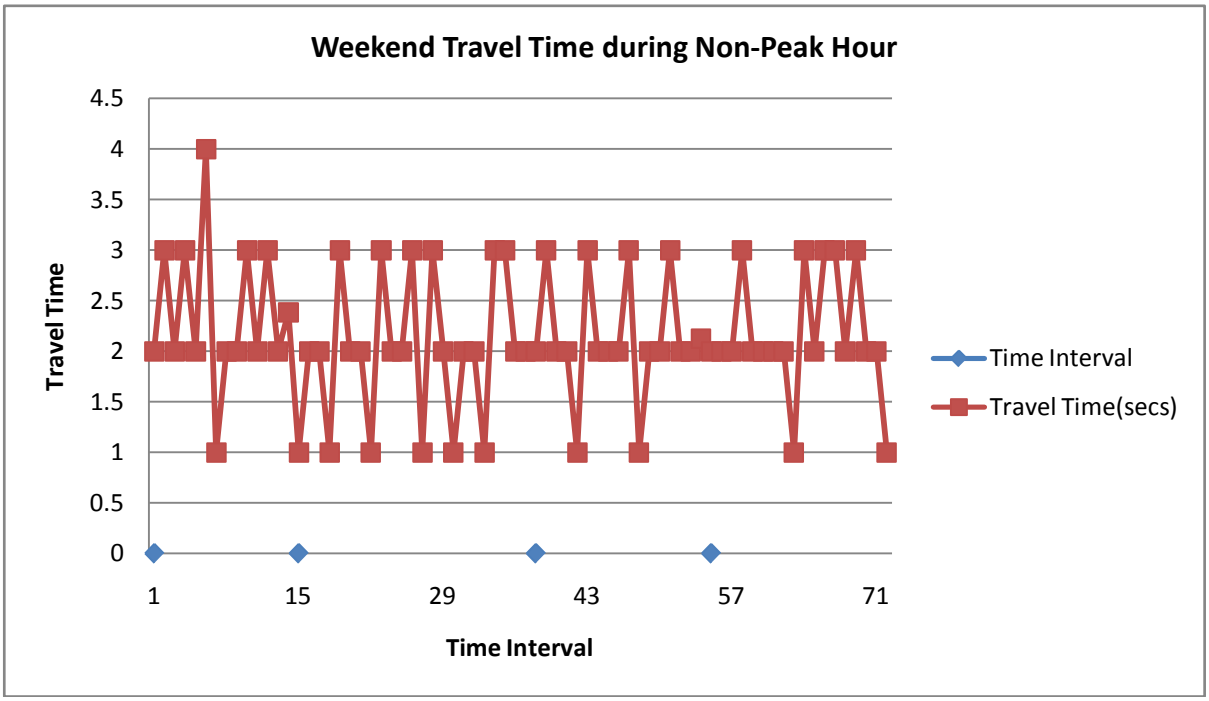

Figure 6 : Travel Time Variability at Weekend Non-Peak Hour (7.00am – 8.00am) at Nyanyan

Fig 7 : Traffic Situation at Karu Junction showing Effect of Merging Traffic

Fig 8 : Traffic Situation at Nyanyan showing Effect of Breakdown Vehicles

As shown in Figures 3 through 6 above, the minimum travel time during peak hour (7.00am – 8.00am) is about 27 minutes while at non-peak on weekend a commuter can travel the same stretch of road for about 3.5 minutes. This implies that a commuter's travel time is 87 percent more during the weekday compared to weekend. Thus, the travel time becomes unreliable during the weekday as unusual circumstances can dramatically change the performance of the road, thereby affecting both travel speed and throughput volume. The road then becomes susceptible to traffic delay and may result in jam density. Figures 7 and 8 above show the traffic situations during peak period at Karu junction and Nyanyan respectively. This traffic incidence occurring in erratic patterns in form of unpredictable blocking of lanes contributes significantly to making travel unreliable for commuters

Variability is determined by how travel times vary over time, and developing of trip frequency distributions reflects how much variability exists. This implies that every traveler needs a buffer or extra time to ensure a high rate of on-time arrival and thereby helps in the development of variety of variability measures. This paper therefore recommends introduction of bus stops as the immediate mitigating measures for reducing congestion along the study road because the shoulder of the road corridor is wide enough to accommodate bus stops and bays without interfering with the traffic flow. Bus-Stops if located along this road will prevent indiscriminate parking or waiting of buses during the peak hour while picking or dropping passengers. It will also reduce the risk of commuters being knocked down while alerting or boarding transport system. Since the cost implication is low and it can be implement immediately.

IV. Conclusion

The study has been able to identify congestion and its causes, estimate the travel time and determine the variability of average travel time. It observed that increasing traffic leads to increasing severity, spatial extension and duration of congestion. The two immediate consequences of congestion; travel times that increase on average and that travel times become increasingly variable and unpredictable are becoming a major concern for transportation agencies. However, at present, there is no well-established practice of accounting for changes in average travel time and changes in the variability of travel times. The interaction between travel demand, traffic flow, congestion, travel time variability, and individual scheduling choices should be understood by the commuters as well as government agencies that are responsible for planning road networks in Nigeria. Therefore, like many developed countries, Nigeria should try to improve the performance of the existing transport systems in order to enhance mobility and safety, reduce demand for car use, and improve traffic fluidity.

References Références Referencias

1. Ibi T.M.(2004) MSc Thesis on 'Improvement of Traffic Performance through Road Space Supply Management – A case Study of City Centre Jos, Nigeria. UNESCO-IHE, The Netherlands.
2. Karekezi S. (2002) ''Urban Transport and Climatic Change Mitigation: An African Perspective''. http:/www.urbancity.org/ cited December 2009.
3. Philpott J. (1997) ''Transport: Let's move Toward a Cleaner Path''. Cited December, 2011 http://www.cerf.org/iiec/news/121997/a5.htm
4. Transportation Research Board, September 2003 *Providing a Highway System with Reliable Travel Times, Future Strategic Highway Research Plan Area 3*, Number 2, cited December 2009, http://wwwcf.fhwa.dot.gov/exit.cfm?link=http://www.bts.go

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