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URBAN SEDIMENTATION PROBLEM IN THE HUMID TROPICAL CITY OF UYO, AKWA IBOM STATE, NIGERIA.

**EKANEM, EKANEM M.
DEPARTMENT OF GEOGRAPHY & REGIONAL PLANNING
UNIVERSITY OF UYO
UYO
AKWA IBOM STATE**

ABSTRACT

The urban environmental quality is still not what it should be despite efforts by the Federal and the State Governments in the areas of monthly and bi-monthly environmental sanitation exercises. This is the problem of concern to the urban environmentalist. The urban sedimentation problem has added a new dimension to the problem of urban quality. The study identifies the problems. A survey of the streets in Uyo, a humid Tropical environment identifies the causes as including traffic density, improper management and care of construction site, poor alignment of roads and inadequate and blocked drain among others. In the study area, the points of severe urban sediment pollution were identified and their effects stressed. Possible solutions to the problem of urban sedimentation were also identified to include: legislation, re-organisation of the environmental task forces, proper education of the citizens through public enlightenment campaigns among others.

INTRODUCTION

The need for a good environmental quality is a subject of current concern to environmentalist (Tivy, 1981; Oyegun 1987). Environmental quality is related to the human activities on the landscape and the environment.

The human role in creating landforms and modifying the operation of geomorphological processes such as erosion, weathering and sedimentation¹ are of great importance,

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1. Sedimentation is the process of sediment accumulation. Sediments are loose sand particles, pebbles, pieces of woods, paper etc. that are easily found on the streets. The sand are as a result of intense chemical weathering arising from leaching of the red earth and loose poorly sorted sands.
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though they have not received the attention they deserve, especially in Nigeria. Examining the processes (especially that of sedimentation) and in particular the rate of their operation has served to highlight the role played by man, not only in modifying the landscape, but also in contributing to the various hazardous environmental problems.

For instance Oyegun (1987) noted that Nigerian cities are experiencing rapid spatial expansion which are shown by the construction industry. This has led to considerable sedimentation processes within the urban area as the disturbed soils and loose sands are eventually carried into cities drainage system during the heavy rainfalls.

The result is that the drains can no longer accommodate storm runoffs and the excess spills over roads.

Since urban planning and development has not been taking cognisance of the nature of the local soil and topography, ill conceived construction schemes result in changes in certain phases of the hydrological cycle e.g. peak flow characteristics and total runoff, which affect excessive deposition of sediments. Hence the aim of this study is to analyse the factors and mechanism of sediment production in a rapidly developing town in humid tropical environment; with a view to finding solutions to urban sedimentation hazards.

STUDY AREA

Urban sedimentation is purely an urban affair and therefore the study is strictly limited to Uyo Central Business District (CBD). Uyo is the capital of the newly created Akwa Ibom State. It is located at about 5°N and 8°E (Fig. 1). Uyo can be classed under the Tropical Rainy (Wet) Climates (Af) of Koppen (1918) climatic classification scheme. Temperatures are high throughout the year ranging from 25°C - 30°C with about 5°C annual range. Relative Humidity ranges from 80% to 90% during the rainy season and drops to about 70% to 80% during the dry season. Rainfall is in excess of 2000mm annually with a peak in July-August. Within a period of three years (1987 - 1990) Uyo has doubled both in her spatial expansion and her functions. Up to early 1987, Uyo was a Local Government Area Headquarters, but by late 1987 when Akwa Ibom State was carved out of the former Cross River State, she assumed a new status as the Capital City for the newly created State. In various locations within the city and the suburbs, there are different forms and sizes of construction works ranging from roads, water works, underground cable lying for electricity, telephone, to housing and enhancement of aesthetics.

Uyo lies below 70 meters (230 ft) above sea level. There are variations in relief. The most conspicuous of these relief is the ravine which occupies the northern parts of the town (Fig. 1). The rest of the town are generally flat. However, along the major streets in Uyo namely; Abak, Aka, Oron, Nwaniba, Barracks and Ikot Ekpene Roads there are minor depressions. The main soil type is the coastal plain sands (Orajaka 1975) which are generally uncemented and porous.

METHODOLOGY AND DATA COLLECTION

A reconnaissance survey was carried out in which the measurements were done along the sample streets in Uyo built-up area. The survey was to identify zones of sediment concentration and the amount of accumulation. These were noted to be on the tarred roads where loose soil had spilled over the entire width of the road. These sediments were composed of materials ranging from gravels to silts and pebble. The sampled streets were then classified as 'Sediment Polluted' if there was a stretch of loose soils along the entire length of the road on both sides. On the basis of this, sixteen streets, sampled were sediment polluted (Table 1). To obtain the percentage of pollution, measurements were taken of the width of the streets and the width of area covered with sediment. Measurements in terms of weight of sediments were also taken within specified areas.

Traffic density along the streets was also taken to see if there was any relation between this and the sediments along the streets (see Table 1). The drains on both sides of the road were also measured. The type of construction work taking place along the streets was noted for the purpose of investigating the nature of the relationship between the various forms of construction work and the sediment quantity and type.

OBSERVATION AND DISCUSSION

Sediment pollution has been observed to be an exclusively urban phenomena. This is also true of Uyo, where it is limited to the built-up areas, and can be explained by a number of factors.

Traffic Density

There is a strong positive correlation between traffic density and the quantity of sediment deposits found on the highway. In the study area the major highways with the highest traffic density are the most polluted by sediment (Table 1). These are Ikot Ekpene, Aka, Abak and Oron Roads. Some of these heaps of sediment are thick enough to sustain the growth of weeds.

Construction Sites Work

Road construction is another main source of sediment pollution in Uyo. This is one of the causes of the huge sediments along Ikot Ekpene, Nepa Line, Aka and Barrack Roads. The numerous construction sites serve as sources of sediments which are redistributed along the road.

Also, the 'low ridges' constructed beside the drains (Fig. 2A) prevent sediments from being washed into the drain, resulting in accumulation beside this ridge. Ikot Ekpene and Aka Roads are the most affected as a result of this.

The low angle of inclination of the road (Fig. 2B), results in ineffectiveness of rain water to carry the sediments to the drains. This is the case of Ikot Ekpene, Udo Obio, Udi, Ikpa roads. In some cases these streets hold pools of water because of their surface nature.

Alignment of the Road

The road alignment contributes to the sediments pollution in Uyo. Most of the streets are flat (Table 1) and some slope to just one side (Fig. 2C) This has resulted in the whole length and width of the road being polluted especially after rains. Ikpa road and Udi street are good examples of this. Also where a tarred road joins or crosses an unpaved road, such areas experience serious sediments pollution. Such is the case along Ikot Ekpene road by Oku Street and Udo Ekpo Nkpo by Nwaniba Road junction.

Inadequate and Blocked Drains

Most streets in Uyo capital city lack good drains. The ones that have, are either completely or partially blocked. The drains themselves exhibit a serious degree of inadequacy. During the survey, it was discovered that over 66% of the drains are inadequate (Table 1). By being inadequate, it means that they are either too small for the storm runoff, or they are partially silted up with sediments. This has resulted in over-flowing of storm runoffs and subsequent sedimentation.

The case in point is the 'Ibom Connection'^{2/} where sediments litter the whole highway after every rain. It is also pertinent to note that most of the drains are inadequate in terms of size to cope with the volume of runoff in it. This has resulted in the runoffs overflowing into the road. This is observed along Abak road and parts of Oron road. Sediment is a source of blocking the drains as in the case in Oron Road and these blocked drains in turn constitute a source of sediments to the road especially when it is completely filled up.

Environmental Sanitation Output

After the monthly environmental sanitation exercise, it is common sight to find heaps of sand, refuse and all sorts of litter still on the road after about four days. Within this time, these heaps are scattered and spread by vehicles, animals and pedestrians. This is one of the sources of sediment along street like Umoren, Nwaniba, Iboko, Udobio and Oron Road

2/ Ibom connection is the name given to the main junction that links the major roads that lead out of the capital city of Uyo.

POINTS AND AREAS OF SEDIMENTATION

These points and areas are locations where sedimentation has become a problem. It can be regarded as a hazard zone. They have huge quantities of sediment that in some case, movement of motor traffic are inhibited especially motor cycles.

One of such areas can be identified along Ikot Ekpene Road. The location is a depression between the Akwa Ibom Transport Terminus and the Mobil Gasoline Filling Station. Here every rainfall results in flooding that traffic wades through the waters. Sediment deposits measured here was as much as thirty one (31) kilogram per square meter

Along Oron road there also exist some sediment pron zones. these are notably at Nwaniba road junction and at Uruan Street 'T' Junction. At the later location a little rainfall not only results in flooding but also in sedimentation. there are two hazard zones along Nwaniba Road. One is at the Nwaniba/Brooks Street Junction. This area has no drains and all the runoff from the beginning of the street ends up here with huge sediment deposits. The other is at Nwaniba road by Udo Ekpo Nkpo Street. The problem here is spreading into the adjacent primary school playground. the last area along this road is about two hundred meters from the gate of St. Luke's Specialist Hospital. At this location there is an unpaved road which also contributes sediment in addition to the ones brought by runoff. Traffic wades through this flood waters. This location experienced the worse flooding in the 1990 rainy season. Over forty (40) houses were flooded on both sides of the road

At 'Ibom Connection' by First Bank premises is another point of sediment accumulation. Here flood waters from Uyo main market brings along with it all sorts of litters and huge quantities of sediment. It is note worthy here to mention that the regular cleaning of this particular area (which is what should happen to all other areas and places) has made this unnoticeable except soon after the rain. However the drains are almost completely filled up as a result of this.

EFFECTS OF SEDIMENTATION IN UYO

One major effect of sedimentation in Uyo is the blockage of artificial drainage systems. Along the major streets in the town, parts if not all of the length of the drainage system are blocked. There are others that are partially silted up thereby making the drains inadequate in size to carry the storm runoff. Over 50% of the drains in Uyo are blocked especially those that are not covered. In some streets like Oron road, Nwaniba etc, it does not appear there have been any form of drains.

Flooding is a common annual phenomena in Uyo. Every year it increases in severity and in its spatial spread. In fact the main streets in Uyo have at least one point or serious flooding along its length, and these points coincide with those zones of sediment hazards. Traffic wades through flood water along these major streets.

Sedimentation causes hindrances and delays to road traffic. Ikot Ekpene road, the main outlet from the State capital is one of the most affected. The streets are left with only

one lane, the other being covered by sediment. At some locations, these sediments are so thick that grasses and weed do grow on them. The motor cyclist, which is the most important means of intra-urban transportation in Uyo is the worst affected.

Sedimentation has been noted to constitute a form of health hazard. This is true in Uyo. This is very serious during the dry season when the deposits are sources of atmospheric dust at the passage of traffic.

City highways are damaged seriously by the accumulation of sediments. Most of the zones noted to have serious accumulation of sediments are full of pot holes and hollows. This results in increased cost and frequency of maintenance of roads. Oron, Ikot Ekpene, Nwaniba, Abak, Aka roads are all not left out in this.

Lastly, in Uyo there is a general environmental deterioration especially along the streets. The streets appear dirty and filthy. There is a year by year accumulation of sediment which has solidified and cemented together even on the highway. Along some parts of Oron road these have resulted in the formation of soils, and weeds are now growing on them.

Urban sedimentation could result in traffic accidents (Oyegun 1987). These have not been recorded yet in Uyo, but it appears that if nothing is done about the rapid growth of sedimentation, Uyo may soon begin to record traffic accidents as a result of sedimentation. This will likely be in the hazard zones.

POSSIBLE SOLUTIONS

Several measures should be taken for proper and adequate sediment control in Uyo. These measures include:

1. Construction companies should be made by legislation to properly clear their constructions sites, and also take proper control of sediment brought into the town for construction purposes.
2. Sediment take-in-holes should be created to take the sediments to the drains,
3. Indiscriminate dumping of refuse by people into drains should be legislated against and such legislation must be enforced by competent Local Government Authority (Oyegun 1987).
4. Personnel and equipment of the Task Force on Environmental Sanitation and Protection should be increased to take care of sediment along streets. These sediments could be cleared at least once a month.
5. There should be a well planned clearing of drainage channels by the Task Force on Environmental Sanitation and Protection.
6. Rainfall water from houses should all be channeled to the drains rather than allow it become a source of erosion and sedimentation.
7. Proper use of vegetation on bare soils that serve as a sources of sedimentation should be adopted.
8. Sanitation campaign should be severely undertaken to educate the citizen.

CONCLUSION

Uyo is experiencing a rapid rate of growth of sediments both along the streets and in the drains. This not only has a disastrous effect on the environment but also has resulted in very poor environmental quality not befitting the status of a State Capital.

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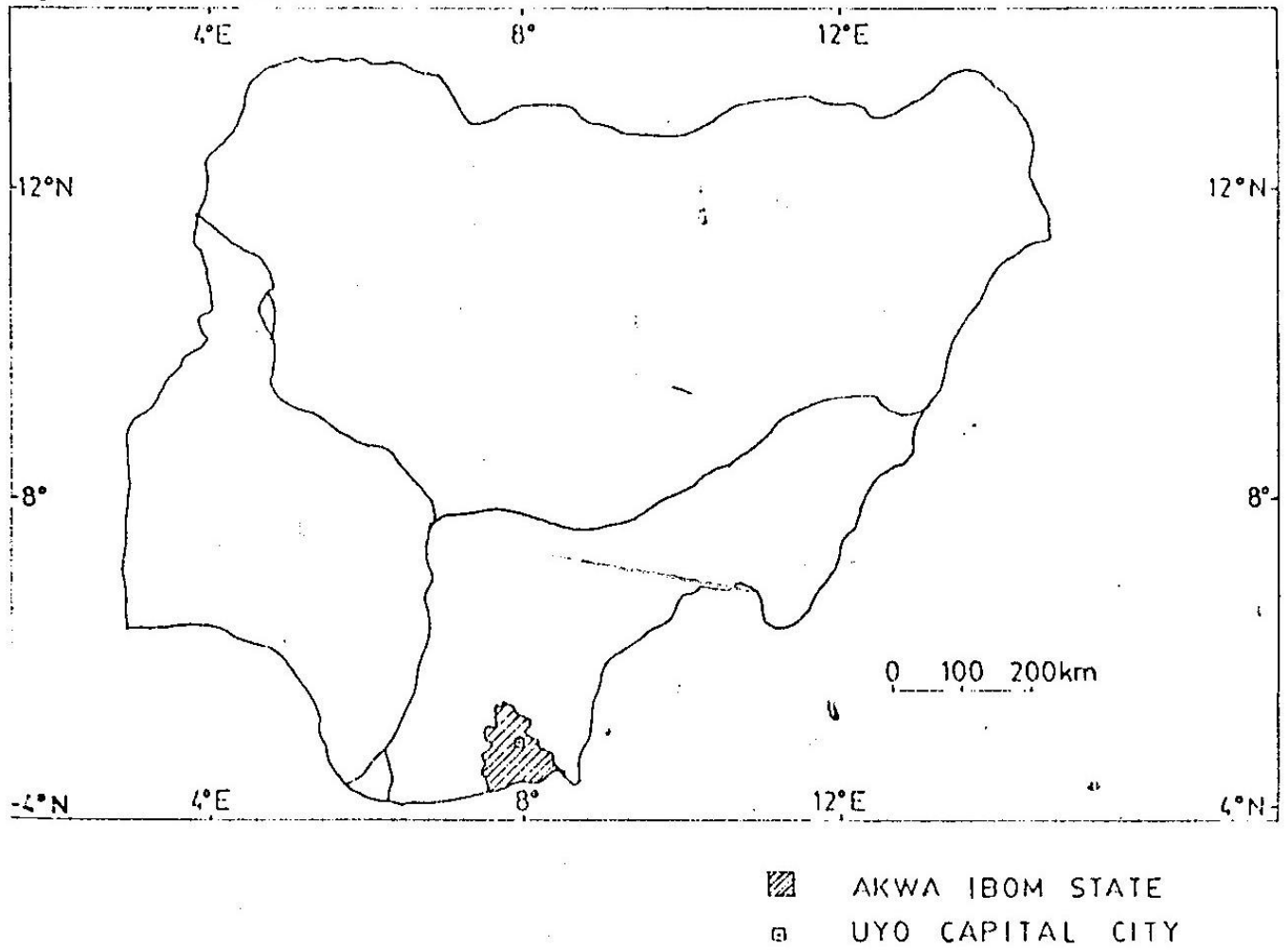
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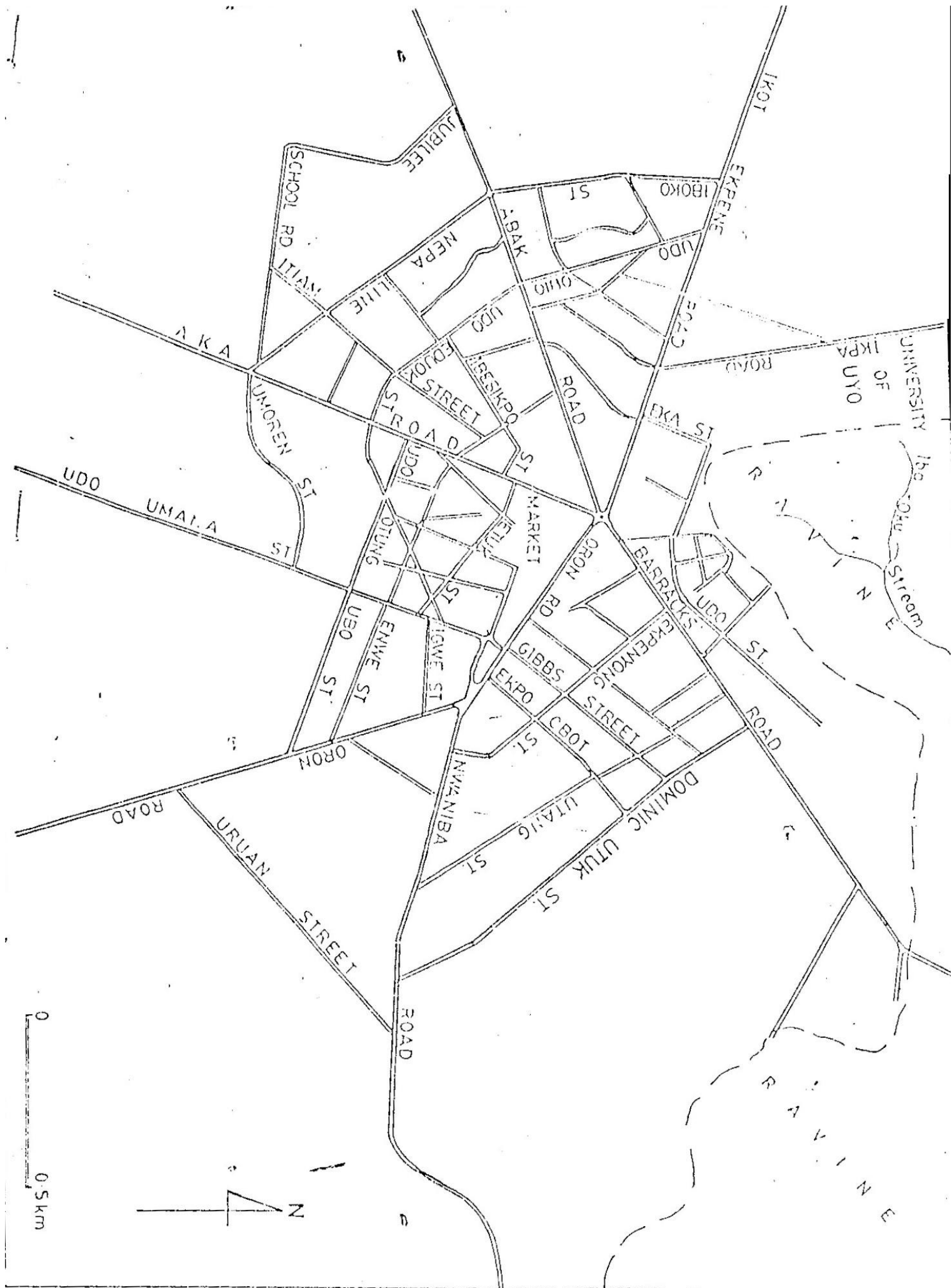
TABLE I
SAMPLED STREETS IN UYO

Street Name	Length (km)	Sample Point	Width of Road	Average Sediment Width m	% area covered by Sea.	Average weight of Sed. per sq. m. (kg)	Traffic density per hr (Vehicle)	Road Alignment	Hazard zone (No.)	Pollution	Construction Activity	Drains Description
Ikot Ekpen	3.2	10	7.2	2.6	36.1	28	3581	Flat	1	Polluted	Road/House	Inadequate
Abak	2.8	9	13.0	6.8	52.3	15	1812	"	1	"	Home	Blocked
Aka	2.6	9	10.0	5.2	52.0	25	1943	"	1	"	Road/House	Inadequate and non existence in some parts
Udi	0.4	3	7.3	3.5	48.0	8	538	Slope to one side	Nil	"	House/Drain	Only on one side partially blocked
Udo Obio	0.6	4	6.5	3.2	49.2	6	655	Flat	Nil	"	Nil	No drains
Nwaniba	2.5	10	10.8	5.6	51.6	15	663	"	Nil	"	"	"
Nepa Line	1.0	3	8.4	2.4	28.6	10	1123	"	"	"	Road/House	Inadequate
Umoren	0.4	2	8.2	2.4	29.3	8	358	"	"	"	Road	"
Udotung Ubo	1.1	3	8.3	2.7	32.5	9	769	"	"	"	Road	"
Udo Umana	1.8	9	8.2	2.3	28.0	6	610	"	"	"	Road/House	Inadequate and non-existence in some parts
Oron	2.0	5	13.1	7.5	57.25	6	1173	"	2	"	Nil	Blocked and non-existence in some parts
Brooks Barracks	1.6	8	8.7	2.2	24.7	2	556	"	1	"	Road	Inadequate
Iboko	1.4	9	10	3.5	35.0	3	675	"	2	"	"	"
Uruan	0.8	3	6.3	3.0	47.6	3	623	"	Nil	"	Nil	No Drains
Gibbs	1.0	5	8.2	2.5	30.5	1.5	523	"	1	"	Road	Inadequate
Gibbs	0.6	5	8.3	3.5	42.2	2.1	486	"	Nil	"	Road	Inadequate

Source: Compiled by the Author From Field Survey

Fig.1(a) STUDY AREA: UYO - LOCATION





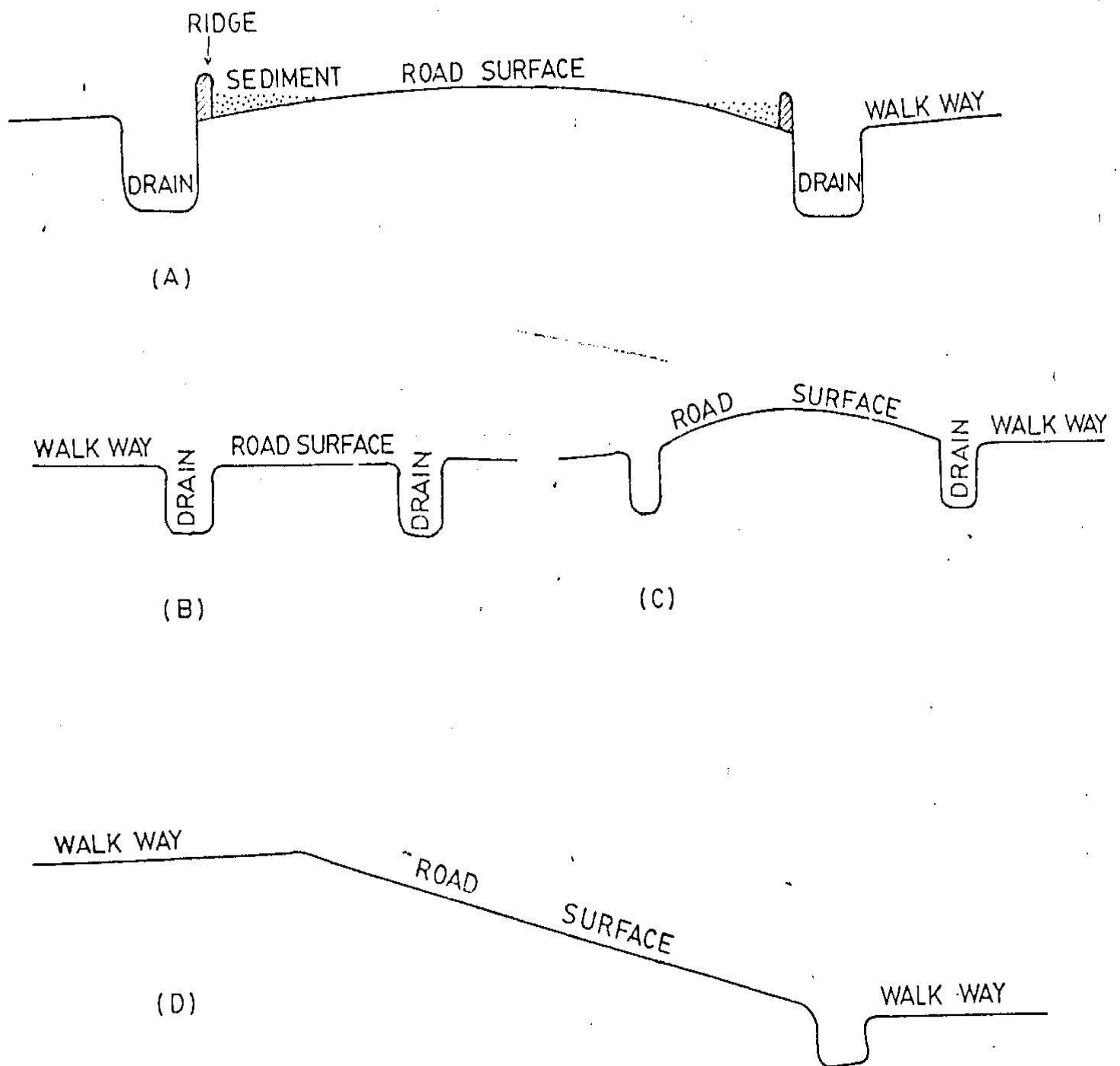


FIG. 2 :, CROSS SECTION OF THE ROADS HAVING VARIOUS ALIGNMENT

- A. SURFACE SHOWING RIDGE
- B. FLAT SURFACE
- C. INCLINED ON BOTH SIDES
- D. INCLINED TO ONE SIDE