

SPATIAL DATA ANALYSIS OF SOLID WASTE MANAGEMENT SYSTEM IN PORT HARCOURT METROPOLIS AFTER 100 YEARS OF ITS EXISTENCE.

Key Words

Spatial data, Solid waste management, Port Harcourt Metropolis, GPS

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This paper will be focusing on.....

Introduction

Historical Development of Waste Management in Port Harcourt, Nigeria

Methods of Refuse Collection, Transfer and Disposal

Methodology

Results and Data Analysis

Conclusion and Recommendation

INTRODUCTION

During the early years of the discovery of Port Harcourt, it was generally addressed as the “Garden city of Nigeria” because of its neatness and the overwhelming presence of vegetation and flowers all over its metropolis. Along history lane, the presence of piles of refuse dotting the entire city brought about its public criticism as “Garbage city of Nigeria”, as indiscriminate dumping of solid waste such as food waste, paper, polythene, textiles, scrap metals, glasses, wood, plastics, etc at street corners, and gutters became very common. These heaps of refuse do not only affect the aesthetical nature of the city, but also block drains, and obstruct free flow of traffic.

This study therefore is targeted at using spatial data to show the nature of solid waste management system in Port Harcourt metropolis after 100 years of its existence. The study involves the collection of primary data from Waste Dumpsites and Collection Points by personal and field observation using Garmin 76 handheld GPS alongside a Digital Camara

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INTRODUCTION Cont.

Waste

Avoidable materials resulting from domestic, industrial or economic activities for which there is no economic demand, and as such must be disposed (Scidrar 1996).

Solid waste

unwanted materials from man’s domestic, Industrial or economic activities and are not free flowing or cannot be discarded through a pipe (Bridgewater and Lidgredm 1982).

Solid waste management

Application of techniques to ensure an orderly generation, Storage, Collection, Transportation and final disposal of solid materials in a manner that is in accordance with the best principle of public health, economics, engineering, conservation, aesthetics, and other conservatives

THE STUDY AREA

- The study covers the entire metropolis of Port Harcourt, the capital of River state and the Head Quarters of the Niger Delta Region of Nigeria. It was established in 1913 as a result of the interplay of three sets of factors namely Geomorphic, political and economical. In accordance with the provision of Nigeria Township ordinance cap 126, Port Harcourt was designated as a second-class township in 1920. Consequent upon national constitutional changes, it becomes the capital of River State in 1976.
- The present Port Harcourt is situated at the southernmost part of Nigeria and between longitude 6°55' and 7° 10' East of the Greenwich meridian and Latitude of 4° 30' and 4° 47' North of the equator.
- The area was named Port Harcourt after the founder of its Port, the then British Secretary of State of the colonial Masters, Viscount Lewis Harcourt.

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HISTORICAL DEVELOPMENT OF SOLID WASTE MANAGEMENT SYSTEM IN PORT HARCOURT

Pre-independence (1912-1960)

- Provision of standard dustbins to each household with collection being disposal by vehicles.
- Adequate sanitary inspectors and labourers
- Low population of people about (5,000 only) within the city (1915).
- City environs characterized and renowned for its cleanliness and beauty and were christened as the Garden city.

Post Independence period (1960-1964) under Eastern Nigeria Govt.

Rise in Population rate, new areas planned and unplanned were built up lacking access road.

Numbers of sanitation workers become minimal and inadequate to cope with increasing population and unplanned development reducing the much labeled set standard.

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The New Rivers State before the Second Republic (1967-1979)

- Rivers State was created on the 27th May, 1967 from the Eastern Nigeria Government, and Port Harcourt became the capital.
- Influx of population as a result Oil boom

During the Second Republic (1979-1983)

- Greater complexity and management imperfection as a result of rapid population increase.
- Five environmental contractors appointed to help manage the heap of municipal waste indiscriminate dumping.
- Provision of plastic dustbins in low density areas and mobile trucks in high density areas at designated locations
- In 1982 Contractors were relieved of responsibility due to poor services and districts councils appointed.

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Between 1984-1999

- The War against Indiscipline (WAI) was launched.
- In 1985 Environmental Sanitation Authority was introduced by the Federal Government of Nigeria
- In 1986, the Rivers State Environmental Sanitation edict was enacted
- In 1989 the Rivers State Refuse Collection and Disposal Law of 1991 as well as the Rivers State Environmental Protection Agency law of 1991 was enacted.
- The 1999 amended Constitution of the Federal Republic of Nigeria gave power to the state to constitute local MSW authorities.

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1999- 2011 (Democratic Era Phase 1)

MSW Management was assigned to Local Contractors. The block waste collection system was adopted and open Vehicles used for haulage.



Plate 1.1: Waste Evacuation along Ada George Road, by Okilton Bus-stop, Port Harcourt.

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2011-Till Date (New Democratic Era)

- Establishment of the Rivers State Waste Management Authority (RIWAMA) to carry out a more organized waste management practice in the state.
- The authority designated waste collection points throughout the city. The landfill method of disposal as shown below was adopted.



Plate 1.2—Doza and Scavengers at work at the Rumuolumeni Dumpsite, Port Harcourt.

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METHODS OF REFUSE COLLECTION

Curbside Collection

- This method requires informing the people to throw their garbages at the curbside (road) on collection day at a specific time to help collection at designated time.

Door to Door Collection

- This might involve providing different waste containers for the inhabitants and ask them to separate their garbage as they throw them in.

Communal Collection

- It involves the storage units where by people go and dump their waste within the stipulated 24 hours of the day.

Block Collection

- Block collection involves the greatest inhabitant participation. The collection vehicles have a designed route which it follows according to schedules individuals are expected to bring out their garbage to the vehicle for discharge.

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WASTE TRANSFER AND HAULAGE

Municipal waste collection may be either hauled directly to the disposal site by the collection equipment or it may be transferred by another size or type of equipment for hauling.

Transferring waste to larger or more efficient hauling vehicles allows the collectors to minimize time on collection routes and it is necessary where disposal site is far from collections service area.

Compactors are mostly used to avoid exposure of the waste to the environment.

METHODS OF WASTE DISPOSAL

Incineration

Disposing waste by a controlled combustion of combustible waste at a very high temperature.

Composting

- Refuse buried with or without light soil to produce soil fertility.

Landfill

- Engineered containment facilities exhausted and with impermeable geo-membrane material to ensure a leak proof integrity, therefore preventing ground water contamination.

Shredding

- Mechanical size reduction method, which waste could be converted to smaller pieces to accommodate more.

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METHODS OF WASTE DISPOSAL Contd

Resource recovery (Waste to wealth)

Converting what has been considered as material to be discarded into use or useable materials as well as wealth.

Sources reduction

Preventing or reducing pollution by controlling the amount of waste generated.

Hog feeding

Recovery act whereby wastes materials are manipulated into feeds for domestic animals and livestock.

Recycling

This is the reuse of materials to make new products. By reducing the need to harvest, mine and process virgin materials, recycling conserves wood, minerals, oil, energy and water.

WASTE DISPOSAL AS PROPOSED BY THE PORT HARCOURT MASTER PLAN (1975)

- Provision of container collection services with a maximum collection time of once weekly.
- Refuse compacting trucks and the location of containers at strategic places were proposed.
- Establishment of one or more treatment plants.
- The use of landfill technique and composition method due to available technologies.

Constrains of the plan.

Lack of Political will

Lack of consideration for future population rise

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METHODOLOGY

Primary data

The primary data were those obtained from field work. They include personal observations and field data obtained from waste collection points and dumpsites using Gamin 76 handheld GPS, a digital camera, alongside some basic surveying instruments.

Secondary data

Test books, journals, conference papers, magazines, internet materials, Newsletters, etc.

Material Requirements

One Gamin 76 handheld GPS: For data acquisition.

One vehicle for transportation.

One digital camera

Pc based Google earth software

A pc based Laptop

Pc based Auto CAD 2000 software.

Geographical calculator (GEOCAL.) programme— for conversions.

Previous literatures related to the study.

RESULTS AND DATA ANALYSIS

Data acquisition

Spatial data of both dumpsites and collection points were acquired using the Garmin 76 handheld GPS. This was achieved under the Clark 1880 Mina Datum in the Nigerian Traverse Mercator (NTM).

Table 1.1 GPS Coordinates of selected Solid Waste collection points in Minna Datum

| S/ S/N | Site Type | DOP | Northing | Easting | location |
|--------|-----------|-----|----------|---------|---|
| 1 | CP | 8.8 | 96406 | 497315 | Mgbuoba/Ozuba road Opp. Living truth church. |
| 2 | CP | 7.4 | 98524 | 495290 | Old dump site, east/west road by uniport. |
| 3 | DS | 9.9 | 96459 | 496482 | Beside Akpor grammar school, Ozuoba |
| 4 | CP | 8.9 | 96666 | 495945 | Opp Ap filling station ozuaba/ choba road ozuoba |
| 5 | CP | 8.4 | 96978 | 495465 | Front of Christ the king apostolic church rumumolagu town choba |
| 6 | DS | 6.9 | 91731 | 502708 | Temporary borrow dumpsite off, orazhi market road, orazhi |
| 7 | CP | 7.6 | 97786 | 493720 | Along choba road |

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Data processing

The Nigerian Traverse Mercator (NTM) Coordinates of the Clark 1880-Mina Datum obtained from the GPS were converted to its Geodetic equivalent and further converted to the Geodetic and Universal Traverse Mercator (UTM) coordinates of the WGS-84 Datum to enhance multiple choices during further procession.

Table 1.2 Converted GPS Coordinates of some selected Solid Waste collection points

| S/ N | Site Type | DOP | DATUM-MINA MIDBELT | | | | DATUM-WGS-84 | | | | Location |
|------|-----------|-----|--------------------|--------|------------------|-------------|--------------|-------------|------------------|-------------|---|
| | | | SYSTEM-NTM | | SYSTEM-GEODETTIC | | SYSTEM-UTM | | SYSTEM GEODETTIC | | |
| | | | N | E | Lat | Long | N | E | Lat | Long | |
| 1 | CP | 9.5 | 99367 | 493957 | 4 53 49. 04 | 6 54 27. 89 | 541706. 92 | 267896. 51 | 4 53 51 35 | 6 54 25. 85 | Along uniport/ choba road by sammies plaza, uniport |
| 2 | CP | 7.9 | 92182 | 504886 | 4 49 55. 95 | 7 0 23.08 | 53451. 16 | 278821. 58 | 4 49 58. 29 | 7 0 20. 45 | under bridge, rumuola air force junction road |
| 3 | CP | 8.1 | 92553 | 506120 | 4 50 8. 12 | 7 13.10 | 534883. 15 | 280167. 24 | 4 50 16. 71 | 7 1 4. 06 | First bank junction road |
| 4 | CP | 9.1 | 92745 | 506231 | 4 50. 14. 38 | 7 1 6. 69 | 535075. 15 | 280167. 24 | 4 50 17. 13 | 7 1 32. 58 | Market junction road |
| 5 | CP | 7.2 | 93458 | 508656 | 4 50 37. 63 | 7 2 25 . 33 | 535782. 42 | 282920 . 87 | 4 50 39. 96 | 7 2 22. 70 | First artillery of road |
| 6 | CP | 8.1 | 93348 | 508884 | 4 50 34. 20 | 7 2 32. 74 | 535676. 38 | 282820. 92 | 4 50 36. 53 | 7 2 30. 11 | Shell gate back of road |

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Data manipulation

The converted rectangular coordinates of both the solid waste dumpsites and collection points were stored in Microsoft Excel 2007 and imported into the AutoCAD 2007. The Geodetic coordinates in WGS 84 was also plotted on the Google earth software.

Data Presentation

Collection points and dumpsites locations were represented by purple place mark on the Google earth and AutoCAD street map of Port Harcourt as shown below.

Data analysis

Open collection points located close to residential buildings, churches, schools, banks, roads, etc, as well as those located along roads inaccessible to haulage are considered inappropriate and dangerous to human health, hence, recommended for removal or subsequent replacement with collection carts,. Temporary dumpsites located within built-up areas are also considered inappropriate and recommended for closure.

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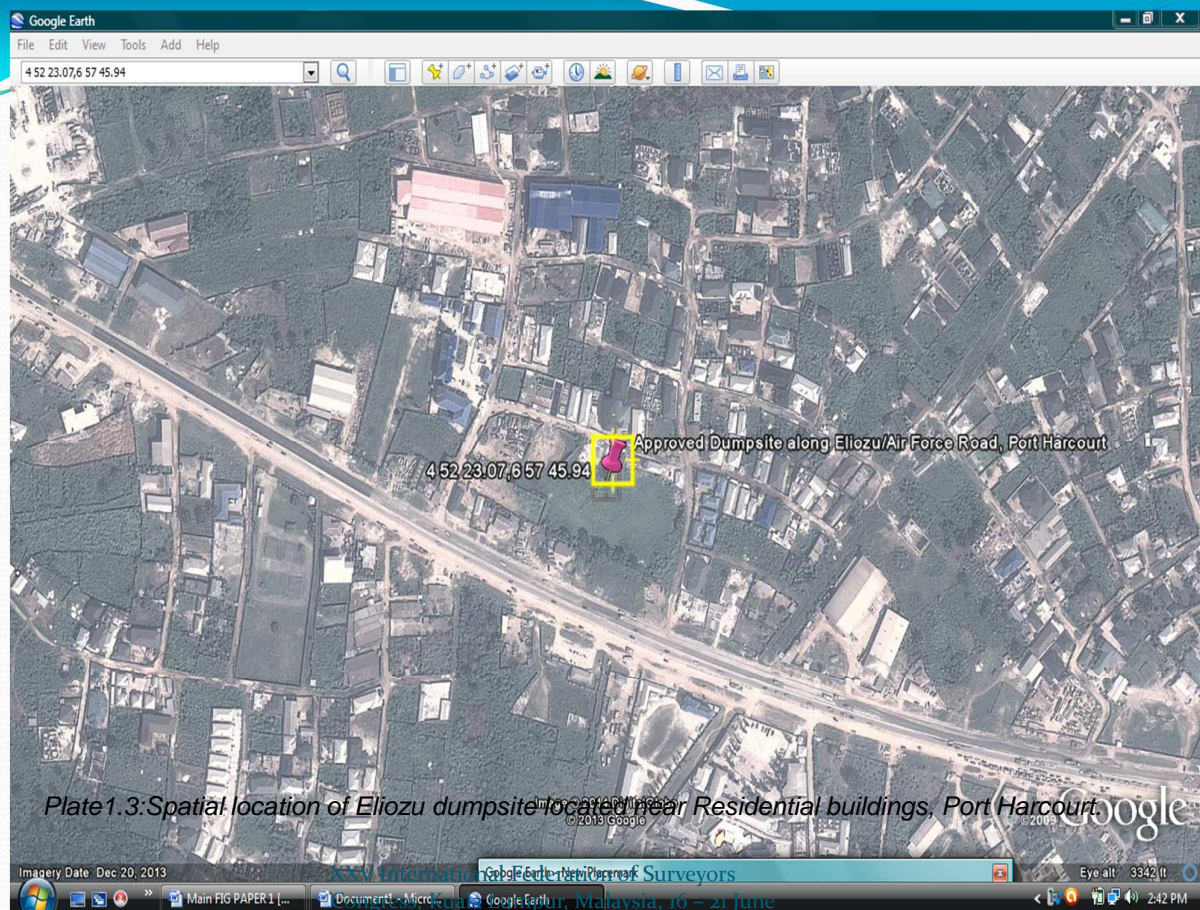


Plate 1.3: Spatial location of Eliozu dumpsite located near Residential buildings, Port Harcourt.

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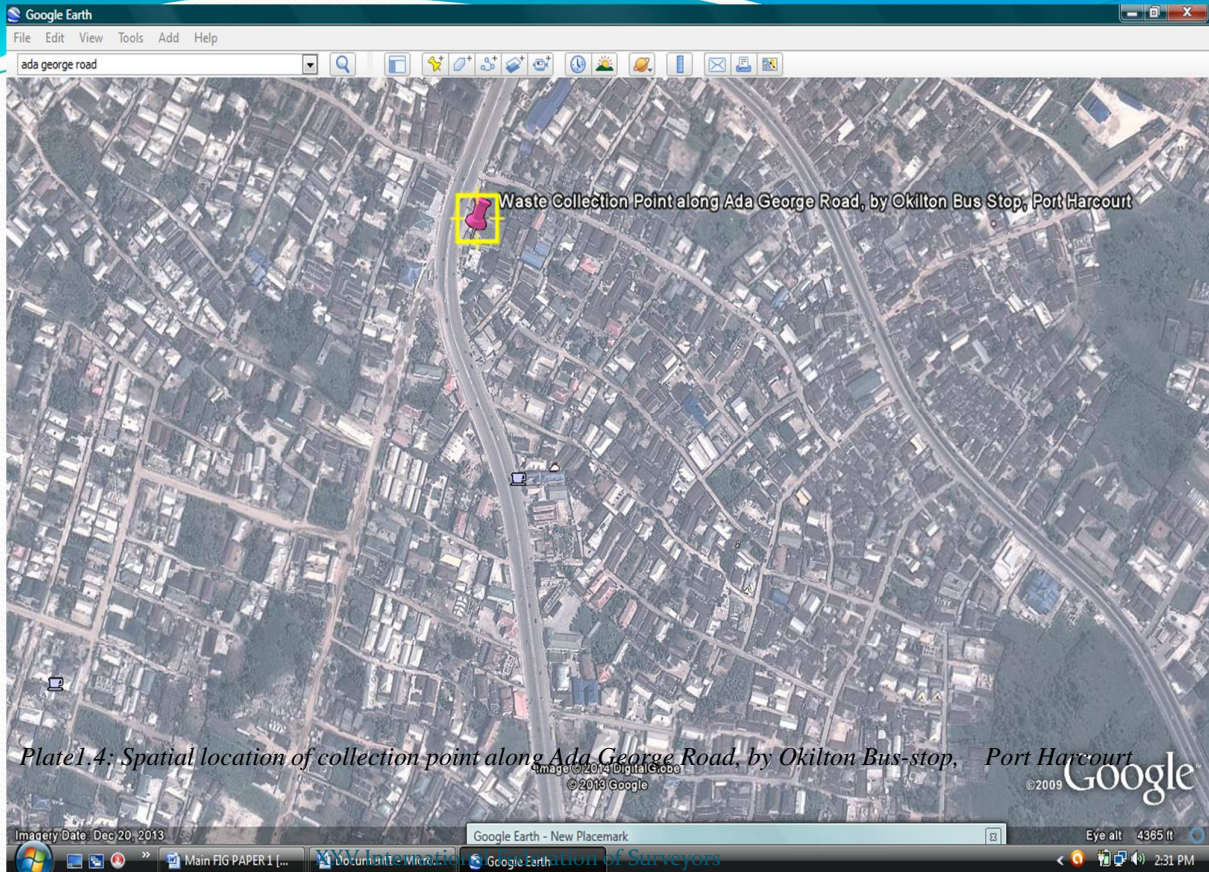


Plate 1.4: Spatial location of collection point along Ada George Road, by Okilton Bus-stop, Port Harcourt

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FINDINGS, CONCLUSION AND RECOMMENDATIONS

Findings

- ➔ The Government of Rivers State do not have a spatial data base of the waste collection centers and dump sites.
- ➔ Waste collection points are scattered in the study area with only two legally approved dumpsites located, at Elioizu and Rumuolumeni
- ➔ Only the landscape method of disposal is practiced
- ➔ Compactors are now been used for waste haulage
- ➔ The delay in clearing the garbage sometimes leads to traffic congestion and flooding.
- ➔ Rivers State Waste Management Authority (RIWAMA) had been recently established by the State Government.

Conclusions

Geo-spatial information is an inevitable tool for a proper waste management practice; surveyors should be involved in the task of building a waste free environment.

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RECOMMENDATION

- Government should provide more dumpsites strategically located at the outskirts of the city.
- Every Waste management company/Contractors should be mandated to employ a Surveyor(s) with the responsibility of identifying spatial locations of waste collection points and dumpsites.
- Government should provides every street a refuse bin for the emptying of waste and to be collected regularly for final disposal by contracting firm.
- Refuse sorting should be encouraged at the source of generation through public enlightenment .
- Re-cycling of waste which turns waste to wealth should be embarked upon
- Sensitization exercises/workshops should be regularly organized to educate the public on how to ensure an adequate waste management system.