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***TOPIC***

***THE IMPACT OF BUILDING CONSTRUCTION ON URBAN FLOODING IN ENUGU NORTH LOCAL GOVT. AREA ENUGU STATE NIGERIA***

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***Abstract***

*Flooding incidences due to various factors have led to several effects especially in the developing world. This paper examines the effect of flooding due to building construction in Enugu North LGA, Enugu State with a view to recommending measures that will help ameliorate the situation. Direct observations and structured interview methods were used to acquire the needed primary data from residents of identified flood areas in addition to secondary data obtained from official records of the Enugu State Ministry of Environment. The methodology adopted in the research was the application of linear regression, frequency tables and simple percentages, graphs and charts. Findings from the research revealed that there is gross inadequacy in the provision of drainage channels, coupled with poor designs, poor building construction and blocked drainage channels. In addition, houses are built indiscriminately, while solid waste disposal are not properly managed. In view of the above discoveries, some of the recommendations which were postulated include the need to reform building construction inspection agencies in Enugu state and to develop and implement proactive and holistic urban flooding control and management measures.*

***KEY WORDS:*** *Urban Flooding, Building Construction, Enugu North.*

**THE IMPACT OF BUILDING CONSTRUCTION ON URBAN FLOODING IN ENUGU NORTH LOCAL GOVT. AREA ENUGU STATE NIGERIA**

**1.0 INTRODUCTION**

Flooding is one of the fundamental environmental challenges that results from interaction between man and his environment. This often emphasizes the extent to which man can go to control nature. Such heavy rains periodically cause rivers or streams to overflow their banks spilling onto the surrounding floodplains (Giwa, 2005; Abaje and Giwa, 2007).

In an urbanizing environment like Enugu north, the infiltration capacity is reduced by the replacement of ground cover with impervious urban surfaces which gives rise to overland flow as a means of disposing excess rain water. This is otherwise known as urban flood. In other words, urban flood is conceived as overland flow of urban streets sufficient enough to cause significant property damage, traffic obstructions, nuisance, and health hazards (Odemerho, 1988; Onokerhoraye, 1995; Mba, 1996) and (Rashid, 2000).

Flood in Enugu North is generally caused by rain water. Other factors that cause flood include; the size of the land area from where rainfall is collected, the shape of this area, its average gradient along the main channel through which the rain water is led to the site, the rate of urbanization, soil type, moisture content of soil, land use and similar factors, all contribute to the relative magnitude of floods in the Enugu metropolis as a whole. The major suspected causative factor of flooding in the study area is building construction, being that building development programmes and policies have reduced the infiltration capacity of soils, deflected water from natural drainage basins and significantly altered the ecology in the study area.

According to Aladelokun (2004), other causative factors that sponsors flooding include land use pattern of the area and bad planning as well as natural factors like dam braking and volcanic activities. However, the nature of floods and their impacts depend on the natural and man-made conditions on the floodplains, economic development and the installation of flood protection measures which has political, economic and social dimension as well as engineering aspects.

Based on the foregoing, this study is aimed at carrying out an empirical analysis of theeffect of building construction on Urban flooding, with an empirical focus on Enugu North Local Government Area (L.G.A) of Enugu state Nigeria.

**1.2 Statement of the Problem**

Flooding is a phenomenon that sometimes has devastating effects on human livelihoods. Impact of floods is more pronounced in low-lying areas due to rapid growth in population, poor governance, decaying infrastructure and lack of proper environmental planning and management. Flooding is also exacerbated by climate change, inadequate preparedness and the most especially method and style of building construction in an area. However, flooding in Enugu North is an environmental challenge that has continued to defy solution as more people are rendered vulnerable to the hazards involved. The implications of recent flooding in some areas in Enugu including Enugu North include among others; loss of life and properties, spread of diseases, deformed livelihoods, assets and infrastructure. The primary causative factor that continues to exacerbate flooding events in major areas in Enugu metropolis including Enugu North is building construction, development and operational usage. The prevailing effects of building construction in Enugu North, particularly flooding affecting almost everything in the study area demands urgent attention in form of environmental and infrastructure planning, effective policy, improved and effective management of ecological fund.

**1.3 Objectives of the Study**

This study focuses on identifying the various urban flood occurrences and the impact or contribution of building construction on urban flooding in Enugu North L.G.A of Enugu state Nigeria.

**1.4 Scope of the Study**

This study is anchored on carrying an empirical analysis of the impact of building construction on urban flooding. The geographical scope of this study is on Enugu North L.G.A of Enugu state Nigeria. Using the case of Fidelity Estate Ebe-ano tunnel as an example, where in 2015, 2016, 2017, flood took over half of the roads creating various discomforts like road blockage which led to a lot of traffic discomfort, bad stench emanating from stagnated water, health hazards, mosquitoes and other social hazards.

**2.0 REVIEW OF RELATED LITERATURE**

**2.1.1 The Concept of Flood/Urbanization**

Urbanization particularly in developing countries is an inevitable issue of discourse in most cities because of the rapid and uncontrolled rate at which the process is affecting the fabrics of cities most especially in developing countries. For instance, the persistent migration of people from deprived areas coupled with poor urban governance has put unprecedented pressure on cities’ resources and infrastructure. It goes beyond doubt that, failure to manage the impacts of rapid urbanization in most cities is threatening human health, environmental quality and urban productivity. This is coupled with the general global climate change that is responsible for an unpredictable weather condition resulting to an increase occurrence of natural disasters, such as floods, storms and forest fires. Within the cities, human activities such as rapid industrialization and urbanization, population growth, exploitation of natural resources and location of infrastructures exacerbate the occurrence of floods. Although flood is a natural occurrence, it often leads to disasters as a result of human-created vulnerability, which is a consequence of human-environment interactions.

Flood is the overflow of water into an environment that is normally dry thereby causing inundation and harm to plants and animals, including man. Its harm can be extended to man’s buildings and infrastructures (Udosen, 2011). Most flood definitions include damage they cause and depend on their sources or types and magnitude. In the case of flood resulting from rivers, Ating (2003) defines it as a relatively high flow which overtakes the natural channels provided for run–off as well as a high stream which overtops its natural or artificial banks.

Wolf (1965) also describes flood as high rate of discharge in water sources and the inundation of normally dry lands. West (1991) further states that flood is a body of water which rises to overflow its banks or low- lying areas. All over the world, flood is known to cause great damage to people’s lives, belongings and properties. Flood causes one third of deaths, one third of all injuries and one third of all damage from natural disasters. This damage is normally felt by various “receptors” being people, buildings, infrastructure, agriculture, and open recreational spaces.

**2.2 Empirical Studies**

Aladelokun and Ajayi (2014) carried out an appraisal of the socio-economic impacts of urban flood in ado-ekiti metropolis in Ekiti state. Based on the primary objective which is to know the economic and social implications of these floods, formed the basis for this research. Both primary and secondary data were sourced to enhance the documentation of the socio-economic implications of the urban flood in the metropolis. Simple statistics were employed in the analysis. Results reveal that apart from houses that submerged and collapse by the floods, market places, roads and farmlands are submerged for days and sometimes are washed away. Some animals, even human beings lost their lives to the floods and many electric poles were destroyed.

Odufuwa, Adedeji, Oladesu and Bongwa (2012) provided an overview of how Nigerian cities have been affected by flood incidences. The paper contends that prevailing effects of climate change, particularly flooding affecting almost everything in cities demands urgent attention in form of environmental and infrastructure planning, effective policy, improved and effective management of ecological fund including the need for enhanced environmental disaster insurance, public enlightment programmes, integration of environmental planning and education to curriculum of schools at all level and capacity building towards adaptation and mitigation of climate change impacts. It was discovered from the research that flood is mostly prevalent in semi-urban areas.

Akinluyi and Adeleye (2013) examined the essential link between the building industry, technology, materials and labour in relations to housing programme. The goal of the study was to critically examine the roles of building industry in the housing programme since housing has immensely contributed to the development of building construction industry in Nigeria. The paper shows some of the functions of building industry in housing programme, the materials used, technology employed and the labour used in the construction process and highlights the need for government to encourage both the private and public building industry to provide quality and affordable housing for human consumption as this will be part of the housing programme organized to alleviate the problem of inadequate housing in most developing countries.

**3.0 METHODOLOGY**

**3.1 Research Design**

This research adopted the survey and documentary method. The survey method involved the field collection of information, which entails the direct observation and structured interview methods to acquire the needed primary data from residents of identified flood prone areas to supplement secondary data obtained from official records of the Enugu State Ministry of Environment.

**3.2 Population and Sample Size of the Study**

According to Onodugo (2010), population is the totality of subjects which meet a given set of criterion. The target population of this study consists of the mature residents of Enugu North. An exploration of the staff database/statistics through the record of National Population Commission (NPC) Enugu reveals that as at March 2016, the total population of matured residents of the chosen area is one hundred and eighty seven (187). This implies that the total population of the study is 187 subjects.To determine the sample size, the Taro Yamane statistic was adopted and it yielded one hundred and twenty seven (127). Appendix I.

**3.3 Method of Data Analysis**

Data collected from the research were statistically analyzed using a combination of linear regression, frequency tables, simple percentages and the t-test. In terms of model specification of the linear regression statistic, two variables are the main areas of focus. These variables are building construction which is the independent variable and urban flooding which is the dependent variable. The model to represent this relationship is specified thus:

…………. (1)

Where:

URBf = Urban flooding

BUILDC = Building construction

Bo= The Constant term

B1= The coefficient of building construction

U = The stochastic error term

**Test of Significance**

To test for the statistical significance of individual regression co-efficient, t-statistic is used. A two-tailed test was conducted at 5% level of significance.

**Decision Rule (T-Test)**

If t0.025 < t\* Ho will be rejected and the H1 accepted. Otherwise, the alternative hypothesis H1 will be rejected and the null hypothesis Ho be accepted.

**4.0 PRESENTATION AND ANALYSIS OF RESULTS**

The collected information/data were analyzed with various statistical tools. It comprised of the following sections; response rate analysis, tables, and frequencies/percentages, regression analysis and test of hypothesis.

**4.1 Response Rate Analysis**

In a survey research, questionnaire is distributed to various respondents and in the process the rate of return is calculated to measure if the responses are sufficient enough for analysis. In this study, 127 copies of the questionnaire were distributed to the respondents, 123 were returned and it was discovered that 3 of the questionnaire were not properly filled. Thus in all, 120 questionnaire was used for the analysis. To calculate the rate of return, we have:



Since the return rate is 94.4%, then the response rate is high and acceptable. Presenting the above analysis in a tabular form, we have:

|  |  |  |
| --- | --- | --- |
| **QUESTIONNAIRE DISTRIBUTED**  | **QUESTIONNAIRE RETURNED** | **RESPONSE RATE (%)** |
| 127 | 120 | 94.4% |

**4.2 Tables, [Demographic Information] Frequencies and Percentages**

**GENDER**

|  |  |  |
| --- | --- | --- |
| **Gender** | **Frequency** | **Percentage (%)** |
| Male | 80 | 67 |
| Female | 40 | 33 |
| **Total** | **120** | **100%** |

**Source: Field Survey, 2017**

The table above shows the sex distribution of the respondents. It clearly shows that 80 respondents constituting 67 percent of the respondents were male while 40 respondents which were made up of 33 percent of the total respondents are female. In essence, the majority of the respondents are male.

**AGE**

|  |  |  |
| --- | --- | --- |
| **Age** | **Frequency** | **Percentage (%)** |
| 18 – 30 years | 21 | 18 |
| 31 – 40 years | 77 | 64 |
| 41 – 50 years | 15 | 13 |
| 51 years and above | 7 | 6 |
| **Total** | **120** | **100%** |

**Source: Field Survey, 2017**

The above table shows that 21 of the respondents which is 18 percent of the total respondents fall into the age category of 18 – 30 years, 77 respondents fall into the age category of 31 – 40 years, 15 of the respondents making up 13 percent of the total respondents fall into the age category of 41 – 50 years and 7 of the respondents are into the age category of 51 years and above. Therefore, the majority of the respondents were suitable and matured enough to provide the needed answers.

**MARITAL STATUS**

|  |  |  |
| --- | --- | --- |
| **Marital Status** | **Frequency** | **Percentage (%)** |
| Single | 30 | 25 |
| Married | 90 | 75 |
| Divorced | - | - |
| **Total** | **120** | **100** |

**Source: Field Survey, 2017.**

The above table shows that out of a total number of 120 respondents, 30 of them were single as at the time of this study while 90 which constitute about 75 percent of the respondents are married. Hence; we have more of married respondents than single.

**SECTION B**

**Table 1**

**Please indicate your local government area of residence**

|  |  |  |
| --- | --- | --- |
| **ITEM** | **FREQUENCY** | **PERCENTAGE** |
| Enugu North | 120 | - |
| Enugu West | - | - |
| Enugu South | - | - |
| Other | - | - |
| **Total** | **120** | **100%** |

Source: Field Survey, 2017.

Table 1 reveals that the totality of the respondents are residents of Enugu North which is the location scope of the study.

**Table 2: Do you experience flooding when there is a heavy down pour?**

|  |  |  |
| --- | --- | --- |
| **ITEM** | **FREQUENCY** | **PERCENTAGE** |
| Yes | 90 | 75 |
| No | 20 | 17 |
| Uncertain | 10 | 8 |
| **Total** | **120** | **100%** |

Source: Field Survey, 2017.

Table 2 clearly shows that 90(75%) of the respondents asserted that they experience flood when there is a heavy down pour, 20(17%) asserted they don’t while 10(8%) are just uncertain. It shows that on the average, majority of the respondents experience flooding in Enugu North.

**Table 3: Have you been a victim of flooding menace?**

|  |  |  |
| --- | --- | --- |
| **ITEM** | **FREQUENCY** | **PERCENTAGE** |
| Yes | 30 | 25 |
| No | 90 | 75 |
| Uncertain | - | - |
| **Total** | **120** | **100%** |

Source: Field Survey, 2017.

Table 3 clearly shows that out of the 120 respondents, 30(25%) asserted they have been victims of flooding menace in Enugu North 90(75%) asserted they have not been victims of flooding menace in Enugu North.

**Table 4:** **Do you think flooding increases as more buildings are erected around your neighborhood?**

|  |  |  |
| --- | --- | --- |
| **ITEM** | **FREQUENCY** | **PERCENTAGE** |
| Yes | 101 | 84 |
| No | 15 | 13 |
| Uncertain | 4 | 3 |
| **Total** | **120** | **100%** |

Source: Field Survey, 2017.

The respondents were asked if they think that flooding increases as more buildings are erected, from the answers given, it can be clearly seen that from table 4, 101(84%) said yes, 15(13%) said no while 4(3%) are uncertain. This entails that majority of the respondents assert that the more the buildings, the higher the flood occurrence.

**Regression Analysis Results**

Based on the responses from the respondents, the regression analysis was carried out through the encoding of the responses. This will also lead naturally to testing the hypothesis of the research.

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The regression table shows that the un-standardized coefficient of Building construction yielded a positive value at the magnitude of 4.402. This positive magnitude simply entails that there exists a direct relationship between building construction and urban flooding in Enugu North. It means that the higher the building erected, the higher the level of flooding in the area.

The t-statistic which yielded 7.799 which is above the absolute value of 2 compels the rejection of the null hypothesis (Ho) and the acceptance of the alternative (H1). Hence; Building construction contributes to urban flooding in Enugu North L.G.A Enugu state Nigeria.

**5.0 CONCLUSION AND RECOMMENDATIONS**

This study has been able to carry out an empirical analysis of the effect of building construction on urban flooding with an empirical focus in Enugu North L.G.A of Enugu state; Nigeria. Data for the analysis was adopted from the distribution of constructed questionnaire. Findings from the research revealed that building construction, development and operational usage have exacerbates flooding events in Enugu North. This can be empirically attributed to the fact that building there is gross inadequacy in the provision of drainage channels, reduction in the infiltration capacity of soils and diversion of water from natural drainage basins, coupled with poor designs, poor building construction and blocked drainage channels in the study area.

In the light of the findings of the study, the following recommendations were considered appropriate:

* Strategic drainage channels should be constructed in Enugu North as this will succor the inadequate state of drainage channels caused by building construction and development.
* Housing agents should strictly ensure that subsequent building construction abide by the plan as provided by urban and regional planners.
* In Enugu North, infrastructure should be put in place for the harvesting of excess or flood water for human development, through the construction of water reservoirs and treatment plants, dams for irrigation, power generation and potable water supply for sustainable developments.
* Road construction should be done according to the Engineers specification and road maintenance adopted periodically where and when necessary.

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**Appendix I**

To derive the optimal sample size, Taro-Yammane (1967) formula was used. The formula is specified as:



Where:

n = Sample Size [Unknown]

N = Population Size (187)

1 = Fixed Numerical factor

e = margin of error usually 5%

To derive the optimal sample size, we have:



 = 127

**Appendix II**

**Questionnaire**

**TOPIC:** THE EFFECT OF BUILDING CONSTRUCTION ON URBAN FLOODING IN ENUGU NORTH

**Please Tick the option you consider the most appropriate.**

**Section A: Personal Data**

1. **SEX:**

 Male

 Female

2. **AGE**

 18 – 30

 31 – 40 years

 41 - 50

 51 years and above

3**. Marital Status**

 Single

 Married

 Divorced

 Widowed

4. **Academic Qualification**

 WAEC/SSCE

 OND/NCE

 HND/B.sc

 MBA/M.Sc

 Ph.D

5. **Number of Years you have lived in your present place of residence**

 1 – 10

 11 – 20

 31 – 40

 41 and above

**SECTION B**

**Instruction**

Please tick the option that best corresponds to your appropriate answer.

6. **Please indicate your local government area of residence**

 Enugu North

 Enugu West

 Enugu South

 Other

7. **Please describe your apartment**

 A room apartment

 2 room apartment

 A 3 bedroom flat

 Others

8. **Do you experience flooding when there is a heavy down pour?**

 Yes

 No

 Uncertain

9. **Have you been a victim of flooding menace?**

 Yes

 No

 Uncertain

10. **Do you think flooding increases as more buildings are erected around your neighborhood?**

 Yes

 No

 Uncertain

11. **Indicate your status**

 House owner

 Tenant

12. **Approximately how many buildings have been erected since you lived here?**

 1 – 5 buildings

 2 – 6 buildings

 3 – 9 buildings

 10 buildings and above

**Interview Questions**

1. Do you think flood increases as more buildings are erected?
2. Do farmers complain so much about flooding menace?
3. Are there flood control measures actively in your area?
4. Do you think more buildings are increasing the flood tendencies?