# CONTENTS

Gender: Roles and Travel Pattern in Badan, Nigeria  
S. O. Fasade & K. O. Olayiwola  

An Assessment of the Quality of Valuation Reports Prepared by Nigerian Estate Surveyors and Valuers  
G. K. Babawale & A. S. Afolayan  

An Evaluation of Market Location and Traffic Flow Improvement in Lagos, Nigeria: A Case Study of Oshodi  
Samuel Iyiola Ooi, Emmanuel Eje & Charles Asemere  

Trip Length Characteristics in Lagos Metropolis  
Wale Alade  

Rural Housing Needs and Responses: Challenges and Prospects in Nigeria  
M. B. Gazu, S. O. Fasade & K. O. Olayiwola  

Security of Tenure and Housing Condition in Informal Settlements of Ijora-Oloke, Lagos  
Oluwafemi Olajide  

Application of Geographic Information System (GIS) in Local Government Administration: A Pilot Study of Arochuku LGA, Abia State  
O. O. Ayeni & Immaculata I. C. Nwokoro  

Community-Driven Sustainable Development in the Niger Delta: The Case of Bonny Kingdom  
Victor C. Obinna, Opeolu B. Owe, Victor A. Akujiaru & Alfred A. Allison  

Assessment of Maintenance Management Practices in Lagos and Ogun State Prisons of Nigeria  
O. O. Farinloye, A. O. Adenuga & R. A. O. Iyagba  

Eleko Rural Beach Initiative: Maximizing Economic Benefit of Domestic Tourism Destination in Littoral Lagos Community  
O. T. Adejumo  

Remote Sensing for Wetland Resource Delineation and Assessment: A Perspective on Basic Techniques and Readily Available Imagery  
Jerry N. Obienu & Deomola S. Onojie  

Land Values and Housing Densities in Nigerian Cities: The Case of Onitsha  
Victor Ujiije  

Assessment of Factors Generating Sick Building Syndrome in Ikorodu  
Adenubi Adegbesan, Samuel Dekoto & A. O. Adenuga  

The Challenges of Population Growth and Poverty in Low Income Communities of Metropolitan Lagos  
Immaculata I. C. Nwokoro & Nnabia D. Olugbala  

Urban Safety Management (USM) Approach to Crime Reduction in Lagos Metropolis  
Taske I. Salau & Taihut O. Lawanson  

The Contemporary African City: Environmental, Social and Economic Challenges and Opportunities in Lagos, Ciao and Johannesburg  
S. O. Aigbe & I. R. Alia  

Gender and Space: Between Homes and Stalls on Road Setbacks in Lagos Metropolis  
Wale Alade & Olubukola Oluwaleye
Determining Socio-Economic Structure of Passengers in Travel Delay on the Adjoining Roads of the University of Lagos
O. O. Agunloye & D. A. Taiwo

Exploring Tourism Potentials for Local Economic Development: The Case of Obafemi Awolowo University, Ile-Ife
E. O. Omisore, E. I. Okeke & O. P. Daramola

Emerging Global Cities: The African Perspectives
Waleed A. Kadiri

Land Use Conversion in Surulere Local Government Area, Lagos, Nigeria
Farimmade, Ademola

Influence of Financing Techniques on Performance of Telecommunication Projects in Nigeria
Olubode E.Ogunsannni

162
169
179
187
193
Assessment of Factors Generating Sick Building Syndrome in Ikorodu

Adekunbi Adesanya
Department of Building Technology,
Lagos State Polytechnic, Ikorodu-Lagos

Samuel Dekolo
Department of Urban and Regional Planning,
Lagos State Polytechnic, Ikorodu -Lagos
sam.dekolo@gmail.com

A. O. Adenuga
Department of Building, Faculty of Environmental Science,
University of Lagos, Akoka, Yaba, Lagos State.

Abstract
Planning has been very proactive in outdoor environmental issues with lesser emphasis on the indoor environments. However, large parts of our daily lives are spent indoors and the quality of life in any community is largely dependent on the internal and external condition of every building. Even though some natural factors such as climate and pollutants migrating from the outdoor environment are responsible for the discomfort and health problems within buildings, there are also man-made factors relating life-style, materials and product used for buildings, which should be of concern to the urban planners and the public. This study aims at examining the prevalence of Sick Building Syndrome generating factors within residential buildings in Ikorodu Local Government with an emphasis on building conditions and materials. In achieving this objective, the study adopted research survey technique with questionnaires administered to the occupants within the study area based on stratified random sampling technique. Data collected were analyzed using descriptive and inferential statistics. The findings of the study revealed that the level of factors generating SBS examined is very high within the study area. Suggestions are made for legislation to strengthen existing development control efforts in the area of building regulations and product specifications for new buildings, maintenance of existing housing stock in the study area and in the larger society.

Introduction
The term “sick building syndrome” (SBS) is used to describe situations in which building occupants experience acute health problems and discomforts that appear to be linked to time spent in a building, but no specific causes can be identified (Jirot & Bayard, 1996). It has also been used to describe the situation in which building occupants express their dissatisfaction with the quality of the overall indoor environment in a building (Stovijk, 1991).

The etiological factors have been investigated extensively and some factors seem to be consistently related to the development of SBS related symptoms. It is experienced more often in air conditioned building than naturally ventilated (Andersson, 1998). Depending on the study, many factors may be investigated, such as socioeconomic, ethnic, and sex mix of the population.

Psychological factors are relevant in determining the threshold at which people will respond adversely to their environment. However, improving physical factors in the environment has been shown to improve reported symptom as shown by blinded intervention studies and more recently studies of moving entire population to new working environments. Most studies to date have concentrated on the etiological factors within potentially poor quality building environments. The current study was designed to investigate which etiological factors were prevalent in residential buildings in the study area.

Statement of Problem
There seems to be a missing gap or de-emphasis in planning knowledge about the relationship between the built environment and health. Etiological studies reveal a strong
relationship between the quality of indoor environment and several health problems (WHO, 1997). However, planners as well as other built environment professionals cannot be absolved from the blame for urban health problems such as Sick Building Syndrome. According to a report published by Building (2005), the British Monarch, Prince Charles was quoted blaming ‘Sick Building Syndrome’ and health problems in British cities on poor urban planning. According to him, “health difficulties including obesity, allergies and asthma could be linked to the ‘cavalier attitude’ shown by planners and the building industry”.

In the Lagos Megacity as also seen in cities of developing economies, there are problems of housing shortages that accentuate overcrowding, poor housing standards, urban sprawls, informal settlements and lack of infrastructure. According to the 2006 NPH Census, 52.3% of the total housing stock in Ikorodu Local Government Area was compound houses characterized by blight and these form the core residential area (See Fig. 2). These favour uncomfortable living conditions, high level indoor exposures to health risks related to kerosene-based cooking, poor ventilation, gasoline power generation and poor sanitation.

Moreover, there is also a general laissez-faire attitude towards building maintenance both in the private and public housing sectors. It is an unfortunate, but glaring fact that buildings are in very poor and deplorable conditions of structural and decorative disrepair. There is need for urgent action in tackling the problem raised above to severe health disaster like the ‘Bubonic Plague’ that rocked the Oko-Awo in Lagos Island early this century. This plague led to the development of planned housing estates like ‘New Lagos’ in Surulere and others. There is also a policy imperative, in the area of development control and urban renewal strategies since studies have shown that there is a strong relationship between lack of control of the residential environment and poor health conditions.

Aim and Objectives of the Study

Building sickness syndrome remains poorly understood. Biological factors range from temperature, humidity, air movement to internal pollutants, dust, lighting, and noise factors. The study aims at assessing the prevalence of factors generating sick building syndrome within the study area and to determine the level of awareness of maintenance practices. In other to achieve this aim, the condition of residential buildings were assessed to determine the level of sick building syndrome; Factors generating sick building syndrome within the study area were identified and appropriate solution and strategies were also suggested. The major significance of the study is to create awareness to individuals and local authorities on the importance of maintenance and the need for regulation and control in housing design and construction. This will ensure a well planned and healthy environment.

Conceptual Framework and Literature Review

The Concept of Sick Building Syndrome (SBS)

Conceptually Sick Building Syndrome can be traced to the late 1970s, even though the term was first coined by World Health Organization in 1982; the concept has remained poorly defined and vaguely understood (See WHO, 1983; Jaakkola, 1997). This is because defining the term from medical point of view is quite different to the interdisciplinary approach adopted by non-medical researchers. While the former defines SBS as a set of symptoms and signs diagnosed from user(s) of a building, the latter adopts a figurative expression of a particular condition of the observed building. In other words, it is “used to describe the situation in which building occupants express their dissatisfaction with the quality of the overall indoor environment in a building” (Stovijk, 1991). Another approach, which is ecological, uses SBS to describe “a building in which complaints of ill health are more common than might reasonably be expected” (Finnegan, Pickering, & Burge, 1984).

Causes of Sick Building Syndrome

Sick building syndrome is a combination of ailments or symptoms associated with an individual’s place of work or residence related to poor indoor air quality. It becomes evident when occupants of a home or building experiences health problems which have an unknown a cause after a long stay. In most cases these problems are manifested when a building is poorly designed and operated or maintained
in a manner that is inconsistent with its design (Iyagba, 2005).

Even though there is limitation on investigating possible health outcomes as a result of indoor exposures to health hazard since this is inherent in the fields of environmental epidemiology and public health research areas; there is a growing interest and a body of evidences that indoor health problems have triggered the evolution of environmental friendly architectures and new building technologies like ‘green buildings’ and ‘energy-saving buildings’ (See WHO, 1997; O’Sullivan, 1997).

Indoor air quality may be determined by internally generated factors and environmental determinants. Internal generated factors include indoor air pollution from upholstery, copy machines which generate ozone, insect and rodent control agent, wood products like shelves or desk, carpeting which can give off formaldehyde, cleaning chemical and adhesives may emit volatile organic compounds (VOCs), which can cause chronic and acute health effects at high concentration, an example is carcinogens from cigarette smoke. While low or moderate levels of VOCs can cause reaction in some people which can lead to adverse health effect overtime. Even fragrances, air fresheners, fireplaces and space heaters can also contaminate the air we breathe (Eisner, Smith, & Blanc, 1998; Mizoue, Ueda, & Hiro, 1999).

Apart from indoor air pollution, external environmental determinants like infiltration of polluted outdoor air are major factor in SBS. Studies have shown that carbon monoxide and lead from vehicles exhaust and fixed generators can constitute severe health problems even leading to death. Some of the indoor air pollutants are further explained below.

**Indoor Air Pollutants**

Pollutants are major contributors to SBS. According to Kawakami et al (1999), they include Carbon-monoxide (CO), which is an asphyxiate; nitrogen dioxide (NO2) and Sulphur Dioxide (SO2), which are irritants. These three are the common products of combustion pollutant in the home. Methacryl chloride, which is in some household product such as paint strippers, can also be metabolized to form carbon-monoxide (CO).

Other types of are biological pollutants found in homes like, dander, mold, dust mites and others carried by animals and people into and throughout homes and buildings. High relative humidity, flooding, inadequate exhaust of bathrooms or kitchens, humidifiers, air conditioners, dip pans under cooling coils and components of Heating, Ventilation and Air Conditioning (HVAC) system are all sources of biological air pollutants. Three types of human disease which involve specific activity of the immune system, and toxinosis in which biologically produced chemical toxin cause direct effect. In many cases SBS may be related to microbial contamination in building such as environmental and industrial fungal infestation with mounds and fungi etc. (Kawakami, Araki, & Takatsuka, 1999).

**Volatile Organic Compounds (VOC)**

Volatile Organic Compounds (VOCs) are regarded as principal chemical pollutants in indoor environments; they are emitted from finishing materials in buildings. These include volatile compounds as aromatic hydrocarbons (benzene, toluene and xylene), pesticides and formaldehyde. The main sources of formaldehyde are tobacco smoking, furniture, tapestry, thinners, floors made of wood-derived materials and cleaning agents. Other potential sources of VOCs are perfumes and hair sprays, paints, adhesives, some copiers and printers (Wigulski and Lubkowski, 1997).

**Heavy Metals and Man Made Fibres**

Over the past decades, the potential for exposure to pollutants from heavy metals and man-made fibres (such as asbestos) in building has been significantly reduced except for older buildings and those being rehabilitated or reconstructed. In most developed countries, asbestos are rarely used as materials for homes because can penetrate into the lung causing irritations and lung cancer (DOE, 1996). The scenario is quite different in Nigeria.

In the 2006 Population and Housing Census, asbestos recorded 10.2% usage at the national level with Lagos State having the lion share of 34.3%. Within Lagos State, it is the highest with 45% of the total housing unit using asbestos as roofing materials, while it recorded 51.7%, which is also the highest usage in Ikorodu Local Government Area (FGN, 2009). These figures reveal that there could be likely exposure to asbestos dust.
Overcrowding and Housing Shortage

Having examined sources of air pollution, it is worthy to note that housing conditions that contribute to negative indoor environments includes limitation in indoor spaces and overcrowding; reduction in fresh air movement; air pollution and conditions that favour the growth of pathogenic microflora and microfauna. According to Maziarza (1997), the housing situation that is considered free from health risk is one every family has independent home and every person has individual living space with at least 7m² of floor area; this is because there is scientific evidence that when two or more persons occupy a room, adverse health consequences are to be expected.

Furthermore, for adequate ventilation and air exchange, a minimum accepted demand of indoor air per capita and per hour is 20 m³, with one air exchange per hour in living rooms. However, in practice, the figures are two-fold smaller, with an extreme situation found ‘face-to-face’ apartments which constitute 52.3% of the study area (FGN, 2009).

Fig. 1: Housing Types in Ikorodu
Source: Adapted from Table HC2, 2006 NPHC Vol. II (FGN, 2009)

Fig. 2: Overcrowded Housing in Central Ikorodu
Source: Extracted from Quick bird Satellite Imagery, 2006
Illnesses Associated with Sick Building Syndrome

A cautious look at the health outcomes related to Sick Building Syndrome reveals that is no singular illness but complaints by occupants of symptoms as affecting the main anatomical parts as the eyes, respiratory tracts (including nose, airways and paranasal), skin and central nervous system. This may result in mechanical irritation and inflammation; immunological and allergic reactions; toxicity; infections and environmental psychological stress. SBS can be diagnosed in individuals based on designated signs and symptoms, which may appear unconnected. This has made evidence inconclusive on the existence of a clinical disease giving rise to the designated symptoms (Godish, 2001; Jukkola, 1997).

In summary, illnesses associated with Sick Building Syndrome may subjective or determined by individual susceptibility rather than a clinical syndrome. It is therefore suggested that further research is required to relate individual symptoms, with specific residential houses, with specific factors. However, this research will be limited to examining SBS from two perspectives as suggested by Iyagba (2005). The first is the user perspective: which examine occurrences of discomfort, unease or illness felt by the user(s) of buildings. The second perspective is observation of defects in the building structure and the internal environment. This is the basis for the adopted methodology.

METHODOLOGY

For the purpose of carrying out a survey for the assessment of sick building syndrome and its significant awareness, a questionnaire focused on the performance, usage and maintenance culture of residence within the study area was designed to obtain the data required. The purposive sampling method was adopted. Sixty (60) well structured and completed questionnaires were retrieved and thus formed source of information required. The primary data included the response to the questionnaire and findings from personal interviews, while secondary data comprised research finding through internet, journals and books.

Data obtained from the respondents were tabulated, indicating frequencies of responses and their percentage. Descriptive and inferential statistics were used for the data analysis.

Data Analysis And Discussion Of Results

Table 1: Building Types

<table>
<thead>
<tr>
<th>Types</th>
<th>Freq.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bungalow</td>
<td>22</td>
<td>36.7</td>
</tr>
<tr>
<td>One Storey</td>
<td>26</td>
<td>43.3</td>
</tr>
<tr>
<td>Two Storey</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 1 above shows the type of building respondents reside, majority of the respondents reside in one storey building.

Table 2: Use of Building

<table>
<thead>
<tr>
<th>Use</th>
<th>Freq.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial building</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>Residential building</td>
<td>35</td>
<td>58.3</td>
</tr>
<tr>
<td>Mixed Use (Residential/Commercial building)</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: field survey (2009)

Table 2 above shows the use of the building. About 58.3% of buildings were residential buildings, while mixed use of commercial and residential accounted for 30% of the buildings. Commercial use accounted for 11.7% only.

Table 3: Duration of Stay Building

<table>
<thead>
<tr>
<th>Duration</th>
<th>Freq.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 2 years</td>
<td>11</td>
<td>18.3</td>
</tr>
<tr>
<td>2-5 years</td>
<td>21</td>
<td>35.0</td>
</tr>
<tr>
<td>5-10 years</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>10-15 years</td>
<td>20</td>
<td>33.3</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: field survey (2009)

Age is relative to the level of wear and tear of a building, which is a potential for generating factors generating SBS. Information on the number of years spent by respondents in buildings was to derive approximate ages since some respondents were not owners of sampled buildings. The result of the survey shows that 53.3% of the respondents have lived in their accommodation for five years or less, while 43.3% have stayed for more than five years and 33.3% over ten years.
Table 4: Building Defects Reported By Occupants In The Last One Year

<table>
<thead>
<tr>
<th>Assessment of defect reported by the building occupants</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor ventilation/discomfort from heat</td>
<td>4.93</td>
<td>1</td>
</tr>
<tr>
<td>Pollution in the air</td>
<td>3.83</td>
<td>2</td>
</tr>
<tr>
<td>Damages taps/stop valves</td>
<td>3.59</td>
<td>3</td>
</tr>
<tr>
<td>Wall cracks</td>
<td>3.59</td>
<td>4</td>
</tr>
<tr>
<td>Moisture sports and stains around pipes</td>
<td>3.45</td>
<td>5</td>
</tr>
<tr>
<td>Lack of fire protection</td>
<td>3.24</td>
<td>6</td>
</tr>
<tr>
<td>Damaged internal doors</td>
<td>3.14</td>
<td>7</td>
</tr>
<tr>
<td>Damaged roofing sheets</td>
<td>2.93</td>
<td>8</td>
</tr>
<tr>
<td>Electrical fault</td>
<td>2.93</td>
<td>9</td>
</tr>
<tr>
<td>Blocked Drains</td>
<td>2.90</td>
<td>10</td>
</tr>
<tr>
<td>Broken louvers/panes</td>
<td>2.86</td>
<td>11</td>
</tr>
<tr>
<td>Burst pipes</td>
<td>2.86</td>
<td>12</td>
</tr>
<tr>
<td>Poor waste disposal</td>
<td>2.75</td>
<td>13</td>
</tr>
<tr>
<td>Poor sanitation of the environment</td>
<td>2.68</td>
<td>14</td>
</tr>
<tr>
<td>Damaged external doors</td>
<td>2.48</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: Field Survey (2009)

From Table 4, fifteen (15) types of defects were reported by respondents; when ranked according to the level of significance, it was obvious that factors that have a significance level of over 3 points in the 5 points scale were more likely to generate sick building sickness than the others. These includes: poor ventilation/discomfort from heat, air pollution, damaged taps/stop valves, wall cracks, moisture spots and stains around pipes, lack of fire protection and damaged internal doors. Moreover, poor ventilation and air pollution has the highest reported cases, which provides a favourable condition for sick building sickness.

In summary, all the factors ranked had a mean of 3.21; this implies that, these factors put together have a ‘significance level’ above average and are likely factors for sick building syndrome to be generated within the study area.

CONCLUSION AND RECOMMENDATION

This article assessed the factors that could generate Sick Building Syndrome within Ikorodu, a fast growing town in the Lagos Metropolis. In its findings, such factors includes poor ventilation and discomfort from heat due to poor building design and lack of adequate setback, air pollution from dusty external environment, cooking and petrol generators; damaged taps, wall cracks, moisture spots and stains around pipes to mention a few. Since the quality of life and health of individuals in the study area depends on condition of their dwelling places, it is therefore essential that certain policy measures are taken to prevent sick building syndrome (SBS). These policies may be aimed at strengthening and improving existing building permit regulations and building codes, which is the responsibility of urban planners, construction professionals and policy makers.

The occupants of buildings should be adequately educated on SBS related lifestyle like Tobacco smoking indoors, appropriate indoor cooking and the use of generators. They should be educated on building maintenance culture and the need for prompt reporting of defects to the appropriate authorities where owners or landlords fail to respond. Moreover, building health inspectors from local government authorities should carry out regular inspection of buildings, including their surrounding as well as the comfort of the occupants to detect signs of current disrepair and potential ones.

In concluding this paper, a direction for future research on the assessment of factors generating SBS is hereby suggested. Using spatial analysis, observations, measurements and frequency of health symptoms, comfort of occupants, associated SBS factors can be mapped with a GIS. The results for each building are mapped and statistically correlated to determine recognizable patterns and location factors; this will further help policy makers and stakeholders to proffer comprehensive solutions to sick building syndrome.

REFERENCES


