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Research Article

BUILT ENVIRONMENT -THE SBS ISSUES IN ANCIENT BUILDING DESIGNS AND CONSTRUCTION TECHNIQUES

***Ifeanyi Chukwudi OBI**

ObiSoft Innovations UK

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Abstract

History could add some light to the challenges faced today in Health and Safety building design, but would not offer total solution to the search for better approach towards Health and Safety of the end users. This is due to the fact that design changes; climate is ever dynamic and changes over time. This article intends to draw the attention of the reader to the elements of a building as a factor that controls the level of SBS effect on end users. Understanding Health and Safety in design supersedes the field of architecture alone. One of the challenges of Health and Safety planning is that it cuts across all field of endeavour (Hallowell & Gambatese, 2009). An architect alone cannot claim to have answers for "Sick Building Syndrome" issues in a building. Due to these interwoven principles of Health and Safety planning in all fields, various principles and modulus on Health and Safety are developed and published, stating its superiority over other fields. The challenges here is while Builders struggles to gain attention in the field of Health and Safety planning, engineers, architects, landscape designer etc. also creates principles that favours their own field thereby in some instances contradicting each other.However many studies or research has always followed the line of the remedial effect, this work intends to research through preventive effect, how SBS effect on the end users can be minimized using design building elements as a tool. Moisture level in a building determines to a great extent the mold formation and also mold formations also are caused from damp walls, ceilings, Deck or even foundation. The purpose of this work also is to find and recommend ways to eliminate SBS in our buildings through appropriate historical analysis.

Keywords: History of SBS, Sick Building Syndrome, History of Construction, Ancient Buildings.

INTRODUCTION

Briefly as looking through the history of construction undoubtedly, it is one of the oldest industries in existence is the construction industry, running into many years in thousands (Toole, 2002). Archeology has shown structures are built and designed for thousands of years. Constructions has been since far back as the early Neolithic era and the late Mesolithic with evidences in places like the Israel, Cyprus, AIN Mallaha (Fletcher's, 1989). It has been widely acknowledged through the study of Archeology that structures at AIN Mallaha were designed and constructed between 8000-9000 BC (Byrd, & Monahan, 1995). Within the scope of this research, it's important to note, the forms of buildings in AIN Mallaha, had similar built design, this shows that as far back as that Era, Planning's and building design elements where considered in construction of buildings at that time. There are also similarities at Khirokitia dated around 5650 BC, the site shows similar round house design. However, the design shows the evolution of many infrastructures as drainages, paved roads, and in the home designs enhanced living spaces (Fletcher's 1989). This shows at the foundational standard that the building industry is very ancient and has always and gradually evolved their methods. What makes this Era unique, strategic and very important is the way the constructions are patterned, buildings structures are constructed in different design materials, sizes; forms (Berger, 2000; Porteous 2001) were designed and constructed to suit Building requirements and thereby reducing the "Sick Building Syndrome". The Old Testament text originally written as far back as between 14000-400 BC makes references to design safety procedures.

Corresponding Author:** ***Ifeanyi Chukwudi OBI
ObiSoft Innovations UK.

The text indicated that a parapet around the roof is needed when building a new house so that they may not bring guilt of bloodshed when someone fall from the roof (Old Testament, 2007). The prospect of recording an assumed number of deaths would not be accepted today due to fear of litigations. When it comes to reliance on regulatory standards and prescription codes as Kletz (1990) identified, it tends to produce solution to obvious risks and safety issues and less effective in addressing previous unknown dangers.

METHODOLOGY AND HISTORICAL ANALYSIS

This article will evaluate some of the points raised in some literatures. The observations from literatures could help define Health and Safety better and also provide designers with techniques, conceptualization in design, climatic review of design, building and design, and any other established research methods that will aim and lead to a better Health and Safety Building designs. Attempts have been made to create a system of approach for Health and Safety development but none has clearly been defined over the years. Many authors have tried to develop a systematic approach to the Building challenges we are facing today but not many achievements have been made in this field. Sundell in his book stated that the United States Government has awarded a number of mild sufferers and "Sick Building Syndrome" affected people millions of dollars (Sundell, 1996). Guy and Moore in their book "Sustainable Architecture culture and nature in Europe and North America" Stated: "Buildings are responsible for 50% of CO2 emissions and their design has become the focus of intense technical scrutiny. Knowing how to build more safety efficient, or more Healthy buildings, and being able to assemble the social resources to do so, requires different forms of knowledge and

practice. There is wide contention over the optimal pathways to Health and Safety buildings design and great diversity in practices of this efficient architecture" (Guy, & Moore, 2004). From the statement made in this book, there is no mention of which element of the building emits more or less of these Carbon dioxide. Therefore, this becomes a challenge to a building designer or an architect and therefore provokes a need for advanced research in this area to decipher and experiment on different element that make up a building to determine which reacts more positively towards Health and Safety principles guiding the end users health. This is what this article intends to reveal.

In numerous studies(Cooley *et al.,* 1998), (Apter *et al.,* 1994), (Redlich *et al.,* 1997) by scientists towards effective health and Safety choices, in buildings where "Sick Building Syndromes" are experienced in our residential buildings in general, a consented effort has been made to understand what triggers SBS issues in a building. To understand this we also need to understand the culture and the people. Therefore Brower and Leon for example studied how various factors affect an average individual in America. These studies lead them into categorizing the various effects of unhealthy and unsafely activities into four places namely: "air pollution", "water pollution", "habitat alteration", and "global warming" (Brower & Leon 1997). They also stated that the "Life cycle analysis can be very valuable, especially for analysing ways to improve product design, but it is not well-suited to our purpose, which is to paint a comprehensive picture of consumer decisions. It simply takes too much effort to trace the impacts of every product consumers buy in such a painstaking fashion… The approach we took allowed us to analyse the impacts of large numbers of different products in a systematic fashion, through the use of an input-output model and application of a standard tool of Historical analysis. Unlike life cycle analysis, our method considered all inputs to the production process and as a trade-off; we gave up a lot of detail provided by the life cycle analysis" (Brower& Leon, 1990). This system still falls short of reaching to design elements that largely functions as tools that measures, determines and influences the "Sick Building Syndrome" in a building. Also worthy of mention, March and Curwell (1990) stated that the standard of the developed Building in one way or the other cannot be directly linked only on Architectural specification and forms, but also on the nature and quality of the material, effective building maintenance, safety and health measures observed during construction and the standard of the building services."Cradle to Grave" a theory by Curwell and March (1990) expounds clearly that the demolition, construction phase, project design, maintenance must be considered by the Architect designer with focus on the end users and not just the work force. The evolution of Health and Safety design over the past ten years has produced a lot of literatures on Building Health and development ((Norbäck *et al.,* 1990), (Morrow, 1992), (Ryan, 1992).

However, despite this progress in the last ten years it is still a big challenge for designers, architects, landscape designers, etc. and all other professions that are related to the field of Building Construction (Straus, 2010). From this study, observation was made that great percentage of factors that causes "Sick Building Syndrome" in our buildings come from building elements, activities of the End Users and design of men. Designing of our man-made Building should as much as possible realign itself to the natural system of the Climate.

FINDINGS AND EVALUATIONS

The literature review drew my attention to the loop holes in the approaches towards Health and Safety development especially in the area of building designs and no major work on building elements as tools to measure the health and safety level of a building and how they react to the climate; it is this reaction that will determine if a building will eventually have or is having SBS issues and the SBS effect on occupants. When Health and Safety development for end users is defined along these lines in whole, a better picture would begin to emerge as to the best approach towards Healthy Building development management and complete Eradication of SBS effects on end users. Differences in design elements also bring about difference in Health and Safety approach, most times Health and Safety developments in buildings are defined in general, without due consideration to the different building types. For example Health and Safety approach for a residential building type might not be same for a commercial building type. Therefore, Health and Safety development should be defined individually as it affects each building design type. Every building is made up of elements or building parts. These elements are integrated to form a building. Every building element is unique and has its own distinct capability and reacts differently to the same climatic conditions. Throughout the literature review, there are no literatures that dealt on the issue of "Sick Building Syndrome" using different element of the building as research focus and tool to alter SBS effect on end users as this article will do. Solar Heating, lighting, Insulation, thermal floor massing, orientation are elements of design that are often times not considered along this line during SBS building research studies. This negligence in SBS studies guidelines is tantamount to failure in creating design frame work for building Health and Safety housing for End Users. The relationship between design building elements and Sick building Syndromes is undeniable and from the literature reviews and cases, studies have proven them to be strongly related. The purpose of this article is also to prove that with an ideal building design elements, SBS effect on end users is reduced or minimized, creating also a framework for more accurate approach towards Health and Safety planning, design and development so as to eliminate or discourage SBS formations in buildings.

Table 1. Influence of different building Elements

Building elemenent	Ventilation	lighting	Heat	Sbs syndroms
Orientation	✔	✔	✔	Dry or sore throat, heat wave, head ache, drowsiness, running nose
Roofing	---	---	✔	Head ache, Drowsiness, Running Nose
Thermal floor mass	---	✔	✔	Cancer, rapid Loss/gain of Temperature

Conclusion

From the literature review, conclusion was made that "Sick Building Syndrome" subject should be approached from the light of the End Users and design of the Building elements. To remedy SBS is too costly therefore preventive measures are more advisable and this should begin right from the initial design stage and considerations. Due to high cost of "curing" SBS in many buildings in Cyprus, SBS building has remained in that state. The main logic behind these SBS buildingsin historical buildings is that these buildings are very old and were designed on out-dated Health and Safety principle and some of them that are fairly new didn't consider the appropriate use of updated SBS free building designs. Most of the problems encounteredin historical buildings are mainly on the various elements of the building. These elements were designed on previously acceptable Health and Safety design principles. These problems facedin historical buildings continued in detail in the next chapter. These SBS problems led to the various experiments carried out to produce a design solution for SBS issues in Buildings. Below are some of the research findings and they form the basis for my conclusion; they are:

1. **Orientation**: Existing historical residential buildings were not properly oriented. That is to say that many of the living area were situated at the northern façade of the building, instead of the south façade of the building for greater solar access into the living areas.
2. **Roofing**: Complaint of sudden loss of heat energy in the building especially at night by the building occupant that the roofing materials not only that they are old but lack sufficient insulation against rapid heat loss/gain. And also complaint of the high heat level inside the building during peak summer periods. Basically most historical SBS buildings in have no roof structure or adequate insulation.
3. **Thermal floor Mass**: In a typical historical building, the interior of the house are of stone, binding material mix which is not the best material for different climates; moderately cold winter and very hot summer weather.

Also the study of the historical climatic condition brings the problem of heating into consideration. How can the building spaces be heated maximally with the least monetary cost?

Due to the severity of the winter seasonin many places especially in hilly areas, great importance is placed on solarthermal floor heating to help eliminate moisture in enclosed spaces that could lead to fungus formation with regards to the wellbeing of the End Users. The next Chapter will evaluate and answer these factors.

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