Civil and Environmental Research
ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online)
Vol.3, No.11, 2013

Maintenance Strategy in Building Design: An Imperative for Comfortable and Hospitable Housing.

OLAMIDE, ENIOLA VICTOR
Department of Urban & Regional Planning, The Federal Polytechnic, Ado Ekiti.
E-mail: victorolamide@yahoo.com;

ADEDARA, TAIWO MARCUS
Department of Tourism and Event Management, Afe Babalola University, Ado Ekiti
E-mail:mactaiwo@gmail.com,

ENGR, AKEJU, EMMANUEL. ABIODUN.
Department of Mechanical Engineering. The Federal Polytechnic, Ado Ekiti.
E-mail: bioakeju@gmail.com.

ABSTRACT

Housing unit, in however architecturally well designed, beautifully structurally positioned, should always had the intrinsic nature to satisfy the desire of the intended end users at all time. If the above submission is anything to go by, then it become imperative for maintenance strategy to be inculcated from the inception building design for protection, preservation of building aesthetic nature and ensuring Comfortability and hospitability desired by the people. The life span of a building commences as the function of the structure is ascertained by the end user and the developer. The process of maintenance in building construction entails putting a good numbers of factors into consideration. These factors among others are; the site and situation of the building, the prevailing environmental condition, which will dictate the quality of building materials in order to harness the best opportunity of the climatic conditions of the environment. This will in turn lower the effect of expenses incurred on maintaining the edifice. The foregoing is the thrust of this study. Relevant data were garnered from personal observation as primary source and other publications as secondary source. Information on facility management and building maintenance strategies were gathered from relevant texts, learned journals, publication excerpts, to substantiate the imperative of the thrust of the research study. Observations of some building structures that are negatively affected for non compliance with the tenet of facility management and maintenance and those otherwise were put forward to ascertain the veracity of the research submission.

Keywords: Maintenance Standards, Building lifespan, Comfortability, Hospitability.

Introduction

A cue from the maintenance behavior of the mammal called Bat, rightly comes to mind for proper introduction of this study. “Bats are meticulous in their grooming, spending a fair part of the day and night combing and grooming their fur and cleansing their wing membranes. Generally, they comb with the claws of one foot while hanging by the other; they remove the combings and moisten their claws with their lips and tongue. On the wing membranes in particular, they use the mouth meticulously, perhaps oiling the skin with the secretions of dermal (skin) glands while cleansing it”. (Encyclopedia Britannica, 2012). If animal could be so meticulous at body maintenance like this, how much more human being should be so concerned about the house that sheltered him.

Maintenance can be referred to as, the combination of all technical and associated administrative actions intended to retain an item in, or bring it to a state which it can perform its required function. As such, it can take many forms and may have varying outcomes. Lack maintenance can take many years to have any obvious effects on structures e.g. leaking roof gutters, whereas a badly maintained car will tend to show up problems far more quickly.

Building maintenance also tends to be relatively expensive and can often caused disruption to the occupants of the building. Maintenance can be planned, responsive or ad-hoc. The maintenance of a building is seen as an undesirable but unavoidable expense in return for intangible returns. All building owners want more than one return on investment: tenants should pay as at when due. Expenses incurred in maintaining the building is not desired by the owner. This has brought about the undesirable sights of unkempt, dilapidated looking, aesthetically unpleasing buildings in our environment. Even some institutions of learning, be it primary,

secondary or tertiary are not left out. All this are precipitated by the non-availability of building codes, non involvement of maintenance specialists at the brief and design stages, non-availability of maintenance standards.

LITERATURE REVIEW

Maintenance in its generic term has to do with general cleanliness, preservation of fittings and fixtures through regular repairs band replacements. It should be noted that one of the important functions of maintenance is to ensure that the use to which a building is put is the most suitable having regard to its physical character, legal status economic returns and general environmental factors. Maintenance to this effect is seen as work undertaken to keep or restore every facility to an acceptable standard at an acceptable costs.

Property owners all too frequently endeavor to keep maintenance expenditure to a minimum, ignoring or misunderstanding the adverse long-term effects of such a policy. Neglect of maintenance has accumulative results with rapidly increasing deterioration of the fabric accompanied by harmful effects on the occupants. Buildings are too valuable assets to be neglected in this way:

Maintenance is a wide, concept and according to Leach (1961, 387-399) “It includes all such works that are necessary to keep building in a condition in which it may be used in a normal way without risk to injury. Whether to itself or its surroundings or to the life, limb or health of persons……” This definition includes improvement as an aspect of maintenance hence Miles, C.W.N (1972, 119) posited that, “It is difficult to decide where maintenance ends and improvement begins”.

It can also be argued further that maintenance work described those works carried out on an existing structure in order to keep, restore or improve every part of the building to an acceptable standard to sustain its utility and value.

In the traditional past, buildings were constructed of purely local materials such as leaves, mats, mud, clay, bamboos, and sticks among others. One major thing was that, the buildings were always in a good state of maintenance. Our forefathers regarded maintenance as a part of everyday activity. They had to plan before hand when to thatch the roof, scrub the wall and when to keep the surroundings tidy. In the past, there was no formal education in maintenance standard, yet the practice of maintenance permeated into all the facet of life. One could therefore say that maintenance consciousness was acquired by instincts; it did not require a reformer to propagate it. It is humanly inherent, naturally instinctual. Just as the bird will naturally prune its feathers when it’s ruffled and nestling its nest when the need arises.

Building maintenance is often regarded as a nuisance, looking at it from the pressure of market forces operating through the development process which brings about the birth of a building, nevertheless, it is the level of maintenance that governs its health through life and safeguards it from an untimely death. An instance of lack of maintenance of our existing building has resulted in structural defects and many at times total building failures such as the Iponri Building Disaster, inLagos in May 18, 1985 in which 13 people lost their lives (Celestine, Jan. 1989).

The repairs and maintenance problems arising in any building can be traced to a number of factors which may have their origin in any stages of the building development process from design through construction to final completion.

Olorunoje (1995) noted that, the efficiency, convenience life span and economic viability and appearance of building can be affected by the type of materials used, quality of workmanship, and utility of thebuildingstructurewhich start to deteriorate from the moment they are completed and from that time begins to show various types of defects. To this effect there is tendency for movement and consolidation, depending on the magnitude of this defect.

TYPE OF MAINTENANCE

Bs 3811 categorizes building maintenance by means of the following terms and definitions.

1. Planned maintenance: The maintenance organized and carried out within foresight, control and the use of records to a predetermined plan.

2. Unplanned maintenance: "The maintenance carried out to no predetermined plan."
3. Preventive maintenance: The maintenance carried out at predetermined intervals or corresponding to prescribe criteria and intended to reduce the probability of failure or the Performance degradation of an item.
4. Corrective maintenance: The maintenance carried out after a failure has occurred and intended to restore an items to a state in which it can perform it's require function.
5. Emergency maintenance: The maintenance which is necessary to put in hand immediately to avoid serious consequence. This is sometimes referred to as day-to-day maintenance, resulting from such incident as gas leaks and gage damage.
6. Condition-Based maintenance: The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.
7. Schedule Maintenance: The preventive maintenance carried out to a predetermined interval of time, number of operations, mileage e.t.c.

Another approach to maintenance classification has been adopted by Speight (1980)_who subdivided maintenance into three broad categories:

1. Major Repair of Restoration: Such as re-roofing or rebuilding defective walls and often incorporating an element of improvement.
2. Periodic Maintenance: A typical example being annual contracts for decorations and the like.
3. Routine of day-to-day maintenance: This is largely of the preventive type, such as checking rainwater gutters and servicing mechanical and electrical installations

KunleWahab (1987) also classified maintenance as follows:

1. Normalized Maintenance: This refers to works which may be regarded as normal in relation to the constructional materials specified as well as consequences of condition of use. For example a designer can consciously adopt abort-lived materials within in-built high maintenance cost particularly when the designed life has been exceeded. Such repairs would be the consequences of the initial design decision.
2. Design faults and their Remedies: this refers to work resulting from design faults in relation to either technical errors or layout errors.
(a). Technical errors arising from in-appropriate constructional details or choice of materials. It is possible that due to pressure of advertising, components may be adopted with disastrous results. In addition dissimilar and over reactive materials may be inadvertently combined.
(b.) Errors of Layout in relation to size arrangement and juxtaposition of working spaces.
1. Desirable Improved Standard: This refers to work made necessary by a demand for higher standards or a change in the pattern of use which could not have been foreseen at the time of the initial design. Example of this abounds in kitchen cupboards/accessories; an integrated space cooking system;
2. Poor Workmanship: This refers to work arising from poor workmanship by contractors due to either total incompetence, lack of supervision or absence of professional expertise such as those possessed by professional builders.

The major reasons for maintaining a building is to enable it effectively fulfill the function for which it was constructed. Maintenance is also aimed at enabling the building retain the value of investment and a good appearance, throughout its lifetime.

The need to maintain a building arises soon after its construction is completed. This is as a result of deterioration of the elements on the building which starts soon after these elements are installed. The rate of deterioration being independent on the design, specification method of construction of the building, its usage, maintenance management and the environmental condition.

Unfortunately, in this country, building maintenance is one of the most neglected areas of our economy and there is not even an existing National Policy on building maintenance. In fact, the general tendency in this country is to regard maintenance as unproductive. Hence institutional and public buildings hardly budget for the maintenance and where such budgets are made, they are hardly used for maintenance. This attitude has resulted in a general decay of our institutional and public buildings and infrastructure and their environment. One only needs to work into our Universities, Secondary schools, Primary Schools, Secretariats, House of Assembly, Hotels, Hospitals and other such buildings to realize the extent of their decay. This type of neglect is extremely costly to the nation because neglect of maintenance has a cumulative result of rapid increase in the deterioration of the fabric and finishes of a building. This is often accompanied by harmful effects which includes reduce morale that leads to lower quality of work and which turns encourages antisocial behavior in school, offices and

workplaces. Maintenance is a resource consuming activities and besides maintenance, building owners, tenants occupiers leasehold occupies e.t.c. have other activities of functions requiring the use of their limited resources. It is therefore obvious that hundred percent maintenance cannot be achieved if other activities must not suffer. It is therefore necessary that right from the inception of the building, decisions have to be made as to the level and nature of maintenance expenditure, since relationship of initial and user cost is often in inverse proportion (Sealey, I.H. 1987).

STRATEGIES OF BUILDING MAINTENANCE

Civil engineering functions; The functions of the civil engineer can be divided into three categories: those performed before construction (feasibility studies, site investigations, and design), those performed during construction (dealing with clients, consulting engineers, and contractors), and those performed after construction (maintenance and research). Feasibility studies

Feasibility studies; No major project today is started without an extensive study of the objective and without preliminary studies of possible plans leading to a recommended scheme, perhaps with alternatives. Feasibility studies may cover alternative methods—e.g., bridge versus tunnel, in the case of a water crossing—or, once the method is decided, the choice of route. Both economic and engineering problems must be considered**.**

Site investigations; A preliminary site investigation is part of the feasibility study, but once a plan has been adopted a more extensive investigation is usually imperative. Money spent in a rigorous study of ground and substructure may save large sums later in remedial works or in changes made necessary in constructional methods.

Since the load-bearing qualities and stability of the ground are such important factors in any large-scale construction, then a serious study of soil mechanics become highly imperative

Design; The design of engineering works may require the application of design theory from many fields—e.g., hydraulics, thermodynamics, or nuclear physics. Research in structural analysis and the technology of materials has opened the way for more rational designs, new design concepts, and greater economy of materials.

Replacement and maintenance

Replacement problems involve items that degenerate with use or with the passage of time and those that fail after a certain amount of use or time. Items that deteriorate are likely to be large and costly (e.g., machine tools, trucks, ships, and home appliances). Non-deteriorating items tend to be small and relatively inexpensive (e.g., light bulbs, vacuum tubes, ink cartridges). The longer a deteriorating item is operated the more maintenance it requires to maintain efficiency. Furthermore, the longer such an item is kept the less is its resale value and the more likely it is to be made obsolete by new equipment. If the item is replaced frequently, however, investment costs increase. Thus the problem is to determine when to replace such items and how much maintenance (particularly preventive) to perform so that the sum of the operating, maintenance, and investment costs is minimized. In the case of non-deteriorating items the problem involves determining whether to replace them as a group or to replace individuals as they fail. Though group replacement is wasteful, labour cost of replacements is greater when done singly; for example, the light bulbs in a large subway system may be replaced in groups to save labour. Replacement problems that involve minimizing the costs of items, failures, and the replacement labour are solvable either by numerical analysis or simulation. (Holstein, 2012).

In another dimension, building maintenance may be divided into two categories namely: Conservation and Redevelopment. In order to conserve a building such preventive maintenance measures as daily check-up, minor repairs, major repairs, etc are undertaken as at when required.

Every maintenance job includes inspection, cleaning, painting, elimination of defects in engineering services and equipment, taking care of the environment etc. Repairs at initial maintenance stage are done to eliminate the defects of design specification and construction due to the use of unsuitable materials or structures, etc. The proper time to undertake major repairs and their extent depends on the type of building, the wear intensity, and the type of building structure.

Building Refurbishment is aimed at eliminating the effects of wear and obsolesces. Since the standards of comfort are steadily growing, the quality of a building should also be continuously improved throughout its life.

Principles of Determining Building Lifespan

The paper look at the following factors as the bench mark to be considered in determining efficient building lifetime namely: functional considerations and cost- benefit ratio optimization.

The assessment of the functions which will be performed in the building is a factor to be considered so as to guide the design, construction and its eventual maintenance strategy. The expenditures associated with these functions are usually determined taking into account the benefits of a function and the cost of its realization.

The problem of determining the correct relations between building brief, design, construction and maintenance expenses and benefits obtained has always been very acute. Efforts are often made to get maximum benefit at minimum expense i.e. to optimize the cost-benefit ratio. To cut overall expenditure during the lifetime of a building, it is necessary to search for various ways of saving costs at the stages of its brief, design, construction and maintenance. All the stakeholders should join hands in trying to increase the benefits obtained from a building during its lifetimes through their concepts of a beneficial project often differ. These parties, as well as their separate members are trying to achieve a number of objectives, usually embracing economic, social, legislative, moral and other aspects simultaneously. Some of the objectives are more easily achievable than others as well as being differing in importance for the project. The lower the cost-benefits are provided for the owner, the users, society and other interested parties.

The problem of cost benefit ratio may be successfully solved only when the achievements of various, such as management, economics, architecture, law, engineering, technology, ethics, aesthetics, psychology, etc are used. The results from the fact that the benefits obtained from the fact that the benefits obtained from a building during its lifetime may be evaluated only if the data obtained from all these science is properly collated and analyzed.

DISCUSSION

The determination of the functions of a building during its lifetime, its design, construction, as well as the resulting building products and maintenance are the integral parts of a single process. Therefore any improvement (or impairment) of certain solutions will affect other solutions and the project capability to satisfy the requirements of various interested parties. There is the need for maintenance specialists to be actively involved in the design stage of any building stage of any building project since the lifetime of building begins with determining its purpose when a client and designers define the demand for a building with the specifications and limitations that is, the application of concurrent Engineering.

Design stage including technical and architectural design and detailing, specifications, etc. At this state, maintenance strategies and objectives as well as the means to be used to achieve them should be determined. The extent and efficiency of maintenance depends on the volumetric-planning and design solutions, as well as on the quality of materials, structures and engineering services, the capacity to satisfy the requirements of a user and other factors. A maintenance specialist should be involved at the design stage of projects, to ensure that maintenance problems are taken into consideration at the very beginning of design work.

The consideration phase usually reveals all potential defects. Therefore, to improve and make maintenance cheaper, the builders should strictly follow the plan specifications and use good quality materials and refer gray areas to the designer for further clarification. Adequate maintenance should be provided throughout the entire lifetime of a building ensuring that a building and its facilities meet the requirements raised by the users and specifications. Old buildings should be investigated as to the degree of wear and obsolesce, as well as specifying their current value, then an informed decision can be made whether to refurbish or demolish.

Maintenance and refurbishment of buildings have very distinctive features when compared with traditional construction methods. Building maintenance is usually a minor, short-term, discontinuous process, which is mostly performed manually. Consequently, building and refurbishment are the first among the branches of industry noted for the use of manual labour. For this reason, building maintenance and refurbishment are considered to be more cumbersome and requires workers that are less exposed than new construction workers. Therefore, more qualified workers are not attracted by it.

Maintenance can take many forms, and may have varying outcomes. A lack of maintenance can take many years to have any obvious effects e.g. leaking roof gutters, whereas a badly maintained car will tend to show up problems far more quickly.

Building maintenance also tends to be relatively expensive and can often cause disruption to the occupants of the building. Maintenance can be planned, responsive or ad-hoc. The maintenance of building is seen as an undesirable but unavoidable expense in return on invest; tenants should pay as at when due. Expenses incurred in maintaining the building is not desired by the owner. This has brought about the undesirable sights of unkempt, dilapidated looking, aesthetically unpleasing building in our environment. Even some institutions of learning, be it primary, secondary or tertiary are not left out. All these are precipitated by the non-availability of building codes, non involvement of maintenance specialists at the brief and design stages, non-availability of maintenance standards.

Standards are essential for the effective solution formulation and execution of any maintenance policy. The standards set the quality of quality maintenance required. The standards relate to the finance available and the level of performance required of the system. The standards have to be set by the agency that has authority to decide to an acceptable level of maintenance. In relation to other objectives and performance, standards, are particularly difficult to quantify. It is much more difficult to isolate.

Acknowledgements

We appreciate the support of our Colleagues in our various places of work that made the gathering together of materials a possibility. The effort of the typist who out of tight schedule was able to do the typesetting of the manuscript would not go uncommented. Similarly, my thanks go to a host of others who had in one way or the other rendered assistance for the completion of the study. I Olamide should not forget the incessant advice and moral support of my Head of Department, in person of Mr. K. Alao on the importance of publications and ample chances he gave us to go about the intellectual activities.

REFERENCES

Ambrasas G. Zavadskas E and Kakluskas A. (1996) Demonstration system development of efficient project" Statyba Vilnius ''Technika'' M Noe. Pg 84-100

Avadskas, E. and Kaklauskas, A. (1995) "project quality Increase by application of quality expert system" Proceeding of 4th International Conference ModernBuilding Materials, Structures and Technique, held on 10-13 May, BilniusLithuavia pp.39-66.

Bat**.** (2012). Encyclopædia Britannica. Encyclopædia Britannica Ultimate Reference Suite. Chicago: Encyclopædia Britannica.

Celestine (1989) Building Maintenance: A catalyst to Economic Developments the Estate Surveyor and Valuer Vol. 13 No.1 (pg 26-30) in Taiwo, D.O. unpublished B.Tech Thesis. "Maintenance of Private Residential Buildings: A case study of Isikan Quarter, Akure. Civil engineering. (2012). Encyclopædia Britannica. Encyclopædia Britannica Ultimate Reference Suite. Chicago: Encyclopædia Britannica.

Kunle, A.W (1987) An Approach of Building Maintenance Management: The Estate Surveyor and Valuer Vol. 9 No.2 (pg 42-50) in Taiwo, D.O. unpublished B.Tech Thesis.

Leach, W.A. (1961) Urban Estate management, The Estate Gazette Ltd. Vol.11 (pg45) in Taiwo, D.O. unpublished B.Tech Thesis.

Miles D. (1972) A manual on Building Maintenance: International Technology Publications Ltd Vol. 11976 (pg. 18-19) in Taiwo, D.O. unpublished B.Tech Thesis.

Olorunoje, G.S. (1995) EffectiveBuilding Maintenance and its Significance in Nigeria; Builder Magazine: A journal of Building Science and Managers vol. 10 No. 2 (pg 14- 16).

Operations research. (2012). Encyclopædia Britannica. Encyclopædia Britannica Ultimate Reference Suite. Chicago: Encyclopædia Britannica.

Sealey, I. H (1987) Building Maintenance: (2nd Edition) Macmillan Education Limited, London (pg 1-5, 17-20)

Speight (1980) in Taiwo, D.O. unpublished B.Tech Thesis. "Maintenance of Private Residential Buildings: A case study of Isikan Quarter, Akure.

Townsend, T. "Asset Management – the maintenance perspective", Maintenance and asset Management, vol.12, No1, 3-10, 1988.

Zavadskas, E.Kaklauskas, A. Bejer, E. (1992) multiple criteria Analysis of projects, University of Aalborg. Denmark 93pp.