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IMPROVING MAINTAINABILITY OF PUBLIC BUILDINGS IN OWERRI NIGERIA

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Public buildings project the character, ideals, and philosophies of the people that own and use them. This suggests that they should be well maintained so as to last long enough to justify the huge expenditures on them, and also kept in good enough condition to sustain expected heavy usage by the public throughout their life cycle. In Owerri, Nigeria, several public buildings are at different stages of deterioration. This has implications for environmental quality, quality of life, and overall well-being of the users. This research studied public buildings in Owerri, to determine levels of defects and the challenges to maintenance. The study was aimed at underscoring the role of design in improving maintainability in public buildings in Owerri. Four categories of public buildings were studied namely educational buildings, banks, administrative offices, and public activity centres. 42 copies of structured questionnaire were administered to targeted respondents. Each building had only one respondent who was either a managerial head of the building studied, or a technical person in charge of maintaining the building. Convenience sampling was used in selecting buildings for the study. Responses were analysed using simple descriptive statistics. Findings of the study showed a high prevalence of defects in all component parts of public buildings studied. The defects were observed regardless of building function, usage, design, or construction method. It also showed lack of any clearly articulated maintenance management strategy in the buildings, which accounted for high occurrences of defects in the buildings. Deductions from the research were that public buildings in Owerri should be designed to eliminate the need for frequent maintenance as a result of failing components and defective parts, especially in the light of current unstructured maintenance management practices. The study concluded by identifying designing for durability, a concept which must commence at the preliminary stages of the design process, as the most effective way of reducing frequency of maintenance, while still keeping the aesthetic and functional appeals of the buildings.

Keywords: building design, building maintainability, building maintenance, defects, public buildings

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INTRODUCTION

Cities depend on public services to function optimally. Public services are provided in public buildings, and good public buildings make it easier to deliver services to the community. Efficient delivery of public services can improve livability of cities, as they keep the cities running smoothly and effectively (Litman, 2015). The types of services provided in public buildings make it imperative that the buildings be fit for purpose, so as to accommodate large volumes of users and also withstand the expected wear and tear as a result of use. Expectedly, huge budgetary allocations are expended in erecting public buildings, and they should therefore remain in good enough condition for a long period of time, to justify the expenditure.

Public building can be defined in a variety of ways, and definitions differ from country to country. One definition of public building, is a building that provides public services and usually occupied by a governmental body (Department of Culture Media and Sport, 2000). In the United States, public buildings are defined as buildings that are accessible to the public and funded from public sources (VanBaren, 2019). Public buildings are also any buildings consisting of, or containing a theatre, public library, hall or other place of public resort, including schools, educational establishments and places of worship (Uk Building Regulations, 2010). In Nigeria, the National Insurance Act of 2003 (Federal Government of Nigeria, 2003), defined public building as any building that is not wholly used by the owner for residential purposes. This definition is further broadened to include tenement houses, hotels, residential buildings occupied by tenants, and any other building to which members of the public enter and exit for purposes of recreation, education, or medical care. These definitions establish a wide range of characteristics that set public buildings apart from other construction.

Public buildings should typically project the character, ideals, and philosophies of the communities they serve. This is critical, as they define the form and landmarks of towns and cities, and are therefore expected to accurately reflect the beliefs, priorities, and aspirations of the people (Serville, 2001). This suggests that the quality of public buildings in a community have a direct bearing on the quality of life of the people, and stand as valid indicators of the level of growth and advancement of the people. This further highlights their importance as not only economic, but social and cultural investments which should function optimally throughout their life span, with minimal downtimes for repairs, rehabilitation, and maintenance.

Public buildings play host to large numbers of persons daily, and are therefore subjected to substantial wear and tear. They should as a result, be designed to withstand high volumes of traffic, and be maintained regularly, to retain them in good condition. Presently, buildings are not constructed to be completely maintenance free. However, ease and frequency of maintenance are important as they determine not only life cycle costs of a building, but also lifespan, fitness for purpose, and overall quality. It is important therefore that buildings are designed to create the right conditions that permit maintenance within reasonable effort and cost.

Over the years, public buildings in Owerri, south-east Nigeria have shown signs of significant dilapidation and disrepair. Many of these buildings have remained in such conditions for several years. Even in their states of disrepair, the buildings remain actively in use, playing host to large numbers of people who work, and access services provided within them daily. As a result, large numbers of the urban population in Owerri are daily constrained to accept poor quality environments as normal. This expectedly has impacted negatively on the people, especially in view of the role quality of public buildings play in predicting neighbourhood satisfaction (McCrea, Stimson & Western, 2005), and their further implications for social interactions and neighbourhood crime (Couch & Dennemann, 2000). This is particularly a cause for concern as poor quality public buildings eventually transform into poor quality urban environments, further creating the possibility of slum development. The United Nation's Sustainable Development Goal (SDG) 11 underscores the critical importance of sustainable cities and communities in the quest to end poverty, protect the climate, and ensure the enjoyment of peace and prosperity by all people. Sustainable cities and communities can only come about by significantly transforming the way urban spaces are built and managed. Public buildings are a significant component of the urban space and must be seen to be properly planned and managed, so as to foster social, cultural and economic growth in the communities where they are.

In Owerri, as with Nigeria generally, there is a tendency towards neglect, indifference or vandalistic attitude regarding public property (Ikpo, 2009). One clear evidence of this is the poor state of maintenance of public buildings. It is possible that lack of an articulated maintenance strategy could be part of the problem. Again, there is the possibility that some of the challenges could be inherent within the fabric of the building, thus making maintenance difficult or costly or both. Whatever the challenges may be, the result is that scores of public buildings in Owerri are dirty and dilapidated, with clear signs of weathering. The effect of these on the quality of the urban environment is negative, and could impact overall well-being of the user population.

Aim and objectives

The aim of this study is to determine appropriate design strategy for improving maintainability of public buildings in Owerri . The objectives of the research are to:

1. Identify the general character of public buildings in Owerri
2. Determine levels of defects that exist in public buildings in Owerri
3. Establish the links between building character (design features) and level of defects in the buildings
4. Identify the possible challenges to effecting maintenance in public buildings in Owerri

LITERATURE REVIEW

Building maintainability

Building maintainability is defined in the British Standard Glossary of terms (BS 3811:1993), as a characteristic of design and installation, expressed when there is a high likelihood that an item will be retained in or restored to a specified condition following prescribed maintenance procedures. According to Feldman (1975), building maintainability is the condition of an item or a surface that permits its repair, adjustment or cleaning, with reasonable effort and cost. This suggests that an item or surface can be such that it may not be easy for maintenance activities to be effectively carried out on it, notwithstanding the desire to do so. The character of a surface or item that may permit ease of maintenance would clearly include location and placement of the item, and properties of the surface material, which are all outcomes of design.

Chew and De Silva (2003) see building maintainability as achieving the optimum performance through the building life span within minimum cost. In this case, maintainability is achieved through use of durable components, materials, and construction methods. Lau and Ho (2014) paint a more holistic picture of maintainability, covering both the character of the building and the maintenance strategy adopted in the building. They see building maintainability as features and/or measures that expedite maintenance, leading to improved maintenance efficiency, augmented building performance and best value outcomes. The design component of maintainability is clearly stated in all the discourses. In summary, maintainability is a concept which addresses the need to improve effectiveness and efficiency of maintenance (Rounds, 2018).

Building Maintenance

Maintenance is the combination of all technical, administrative, and managerial actions during the lifecycle of an item intended to retain it in or restore it to a state in which it can perform the required function (BS EN 13306:2010). Building maintenance is necessary to sustain the utility value of a building (Plavina & Geipele, 2013). Maintenance operations in a building can be broadly categorised as routine, preventive and remedial maintenance. Regular cleaning and beautification of building and premises amount to routine maintenance, and are necessary to keep the structure functional and protected from early decay. Preventive maintenance is all activities undertaken to keep the building structure sound and unsusceptible to early damage. Remedial maintenance on the other hand are measures undertaken to correct, remove or repair a damaged part of a building. The frequency and cost layout of these maintenance activities largely depend on the building itself, and the maintenance strategy adopted.

Maintainability of public buildings

Public buildings by their sheer size and function, are prominent fixtures in any urban environment. These buildings do not exist in isolation. They are a part of the whole town or city, and together with physical infrastructure and spaces, define the design of the urban space. It is known that urban design features can enhance the quality of life in the built environment (CABE, 2002). Urban quality of life according to McCrea et al (2005) includes satisfaction at regional, neighbourhood, and housing levels. While regional satisfaction is concerned with services like health, education, cost of living, and urban growth, neighbourhood satisfaction is best predicted by evaluations of social interactions and quality of public facilities. Quality of public facilities is particularly important because it has been shown to have implications for effective administration of public services, with attendant effects on crime, health, safety, and social behaviour (Deniz, 2016; Rastyapina and Korosteleva, 2016). Urban quality of life does not only refer to the quality of life in urban areas as conventionally known, but also to the quality of its built environment (El Din et al, 2013; Garau and Pavan, 2018). Keeping the built environment in good condition is therefore a key component in ensuring improved quality of urban life.

Public buildings by virtue of their character entertain large numbers of users from varying backgrounds, and thus face peculiar issues relating to operation and maintenance. In Nigeria, maintenance of existing infrastructure is not given the prime of place accorded to new construction (Odediran et al., 2012 in Ofori, Duodu and Bonney, 2015). As a result, the process of decay and dilapidation of public buildings starts quite early in the life of the buildings. The economic and environmental fallouts as a result of this, greatly impinge on the sustainable development of cities and communities. To retain economic value, the buildings must be maintained in a cost effective way. Accordingly, the concept of maintainability in public buildings becomes relevant in terms of minimising the costs and resources required for buildings to function effectively throughout their life span (Government of Singapore, 2016).

Designing for maintainability

Designing for maintainability means deliberately designing the building to accommodate the needs of maintenance. It emphasizes the importance of timely integration of design and construction knowledge into project designs at an early stage (Rounds, 2018). Research evidence points to the fact that improving maintainability in buildings will yield significant impacts on long term use of the buildings (Egan, 2010, Latham, 1994). In developing a checklist for building maintainability, the Government of Singapore working committee on Design for Maintainability (Government of Singapore, 2016) identified four important principles guiding design for maintainability namely; forecasting maintenance, creating access for maintenance, minimising the need for maintenance interventions, and making maintenance operations easy.

In forecasting maintenance, it is important for the designer to understand the impact of his designs on eventual maintenance requirements during the life of the building. This includes creating deliberate access for inspection and maintenance of building components, fittings and fixtures at the design stage. Additionally, careful construction detailing and materials specification can effectively minimise maintenance interventions in a building. Incidents like unwanted water penetration and premature breakdown or deterioration of finishes and components can be reduced through design. Again, when maintenance work on a part of the building becomes inevitable, it is important that the design of the building consciously integrates some levels of standardization that facilitate easy inspection and productive maintenance. Designing buildings in line with maintenance considerations is important because it bequeaths the building the qualities of intrinsic maintainability. Intrinsic maintainability is maintainability of an item, determined by its original design (EN 13306: 2010). This quality in a building, protects it from avoidable maintenance demands that can lead to higher upkeep costs and manpower needs, effectively reducing life-cycle costs of the building.

RESEARCH METHODOLOGY

This research studied the challenges to maintenance of public buildings in Owerri Nigeria, so as to determine how maintainability can be improved in the buildings. Descriptive research design was used. This is effective in studies that seek to establish the current status of existing phenomena without interference. Data collection was through survey.

The survey was conducted using a structured questionnaire administered to any of two categories of users, who were considered qualified to answer the questions. The first category was managerial heads of the buildings studied, who were in a position to know the state of the buildings, report same for maintenance and monitor the maintenance process. These were classified as direct users. The second category was the technical personnel in charge of maintaining the buildings, who could in some cases, be users of the buildings also. These categories of users were considered qualified to answer the questions, as they are directly involved in maintenance of the buildings. Qualitative data were collected through personal observations. This was undertaken, to determine the nature and extent of deterioration common in public buildings in Owerri.

The study area covered the core administrative zone of Owerri capital territory, which comprises sections of Owerri municipal, Owerri west, and Owerri north local government areas. Owerri is the capital city of Imo state in southeast Nigeria. It is also a growing center of entertainment, attracting visitors from neighbouring states to its hotels, bars, restaurants, and night clubs. Good public infrastructure would substantially enhance the status of the city, and support its continued growth. Four broad building types were selected for the survey. They are administrative, educational, banking, and public activity center buildings. These make up the majority of public building typology in Owerri. Fifty copies of questionnaire were administered in fifty separate buildings falling into these four categories. The buildings studied were chosen through purposive sampling. Fifteen (15) buildings each were chosen from education and banking because they are the predominant public building types in the study area. Ten (10) buildings each were selected from administrative and public activity center buildings. Public activity center buildings include libraries, theatres, event centers etc.

Forty two (42) copies of questionnaire were returned, making a return rate of 84%. Simple descriptive statistics were used to analyze the results.

RESULTS AND DISCUSSION

General character of public buildings in Owerri – the buildings studied showed a preponderance of low rise buildings on two floors only; ground and first floors. 59.5% of the buildings surveyed were under 20 years old and could be said to be relatively new, and not yet subject to obsolescence. The predominant material for walls is sandcrete block. Aluminium frames with glass in-fill panels are the preferred choice for windows. These were seen in the form of sliding, projected and casement windows. Doors were mostly made of wood, and a combination of glass and aluminium. Roofs with concrete gutters and parapet walls made up 35.7% of the sample, while pitched roofs with exposed eaves were 50% of all buildings surveyed. It was however observed that majority of the pitched roofs were low-pitched, with its attendant low water run-off characteristics. 83.3% of the walls were rendered with cement-sand screed, and painted. 14.3% of the buildings were finished in aluminium composite cladding with the screeded wall behind it. Electrical as well as plumbing pipe-works were concealed in the wall cavity in most of the buildings studied . Air conditioning units were seen dotting all facades of the buildings and appeared not to be part of any co-ordinated services planning. Central air conditioning was seen in 14.3% of the buildings surveyed. Summary of the general characteristics of public buildings in Owerri is summarised in Table 1 below.

Table 1 – General character of Public buildings in Owerri

		Frequency	Valid Percent	Cumulative Percent
Building type (height)	One floor	8	19.1	19.1
	Two floors	24	57.1	76.2
	Three floors	9	21.4	97.6
	Four floors and above	1	2.4	100
Age of building	0 – 5 years	3	7.1	7.1
	6 – 20 years	22	52.4	59.5
	Above 20 years	17	40.5	100
Wall material	Masonry(sandcrete blocks)	33	78.6	78.6
	Brick (burnt bricks/facing)	7	16.7	95.3
	Other	2	4.7	100
Window type	Aluminum and glass	36	85.7	85.7
	Wood and glass	5	11.9	97.6
	Other	1	2.4	100
Door	Wood	19	45.2	45.2
	Aluminum and glass	13	31.0	76.2
	Steel	3	7.1	83.3
	Light metal (Composite) doo	6	14.3	97.6
	Other	1	2.4	100
Roof	Flat concrete roof	3	7.1	7.1
	Low pitched roof with parap	15	35.7	42.8
	Pitched roof with exposed eave	21	50.0	92.8
	Other	3	7.1	100
Wall finish	Plaster and paint	35	83.3	83.3
	Glass curtain wall	1	2.4	85.7
	Aluminum composite claddir	6	14.3	100
Electrical installation	Surface wiring	5	11.9	11.9
	Concealed conduit wiring	34	80.9	92.8
	Exposed conduit wiring	2	4.8	97.6
	Other	1	2.4	100
Plumbing	Surface piping	14	33.3	33.3
	Surface but hidden in a duct covered with grill	3	7.1	40.4
	Concealed in wall	25	59.6	100
Air conditioning	Single unit	13	31.0	31.0
	Split unit (single space)	16	42.8	73.8
	Central unit	6	14.3	88.1
	None	5	11.9	100

Levels of deterioration in public buildings in Owerri – Questions were asked to determine the component parts of the buildings where respondents observed defects, and their assessment of the extent of the defects.

Table 2 – Defects in building components in public buildings in Owerri

Description	VM Defects %	MDefects%	Not sure %	MNDefects%	No defects %	
Roofing sheets	4.8	28.6	4.8	52.4	9.5	100
Windows	2.4	15.5	0	59.5	22.6	100
Plumbing	2.4	16.7	7.1	57.1	16.7	100
Handrails, cabinets €	2.4	14.3	7.1	66.7	9.5	100
Doors	3.6	17.9	3.6	59.4	15.5	100
Electrical fittings	3.6	21.4	5.9	53.6	15.5	100
Wall finish	7.1	26.2	3.6	44.0	19.1	100
Ceiling	0	28.6	0	47.6	23.8	100
Wall structure	1.0	16.8	4.8	56.0	21.4	100
Floor finish	2.4	40.4	4.8	31.0	21.4	100
Air conditioning	7.1	26.2	4.8	38.1	23.8	100
Floor structure	0	28.6	4.8	28.6	38.0	100
Roof structure	4.8	7.1	23.8	40.5	23.8	100

A total of 19 items comprising internal and external components and services in a building were rated to determine extent of defects. The rating was done using a five point Likert scale of Very major, Major, Not sure, Minor, and None. Forty two (42) respondents filled out the questionnaire, making a total of 798 possible responses.The items were collapsed into 13, following the merging of components that had external and internal aspects. Frequencies and percentages were calculated for each of the response types. The classification of defects was explained to the respondents as follows:

Very major defect (VMDefects) – defects within the building that result in total failure of a part or whole of a structural component of the building, such that it can no longer perform its designed function eg. blown off roof covering, collapsed roof, collapsed ceiling, eroded foundation etc.

Major defect (MDefects) – defects that affect a major component of the building in such a way that it no longer functions optimally even though it has not failed completely. It also applies to a series of consecutive minor defects in a part of the building occurring at the same time thereby creating a heavier impact eg. cracks in the wall, broken ceiling sheets, leaking roofs, broken fittings and fixtures

Minor defect (MNDefects) – defects that mostly affect aesthetics, cleanliness, and optimal functioning of the building without the need for improvisation eg. broken latches, flaking, chalking, and peeling of paint, dirty surfaces, chipped tiles, burnt out light bulbs etc.

Table 3 – Prevailing category of defect in public buildings in Owerri

	Frequency	Percent	Cumulative Percent
Very major	30	3.8	3.8
Major	162	20.3	24.1
Not sure	35	4.4	28.4
Minor	394	49.4	77.8
None	177	22.2	100.0
Total	798	100.0	

Results were analysed using simple percentages. From the results, all buildings surveyed had varying levels of defects in almost all their component parts.

Data collected showed that the predominant extent of defects in public buildings in Owerri are minor defects, with minimal cases of very major defects.

The links between building character and defects in buildings – building character in this case is determined by the design and features of the different components that make up the building. External walls in a building should have some protection from both incident and driving rain. This protection can be in the form of an overhanging roof, or wall finishes that inhibit the penetration of rain or both. The predominant external wall finish in the study area is paint on screened masonry wall. In this case, the roof feature would be an important component in protecting the walls from adverse effects of rain. The predominant roof types seen were low pitched roofs with concrete parapet which either flushed with the external walls , or projected up to 600mm beyond the external walls, and pitched roofs with completely exposed eaves directly discharging rain to the ground. Tables 4 and 5 show links between these two roof types, and recorded levels of defects in the walls of corresponding buildings.

Table 4 – Level of defect in wall structure under different roof types

	Very major defect	Major defect	Not su	Minor defect	No defec	Cumulative Percent
Low pitched roof with concrete parapet	0	16.12	0	64.52	19.36	100
Pitched roof with exposed eave	2.56	15.38	0	58.98	23.08	100

Table 5 – Level of defect in wall finishes under different roof types

	Very major defect	Major defect	Not sur	Minor defect	No defec	Cumulative Percent
Low pitched roof with parapet	13.8	37.93	0	34.48	13.79	100
Pitched roof with exposed eave	2.50	22.5	0	57.5	17.5	100

In table 4, low-pitched roofs with concrete parapet recorded marginally higher percentage values than pitched roofs with exposed eaves, in both minor and major defects to the wall structure. Defects in the wall structure were not only as a result of water action. In table 5, observed levels of defects rose considerably in low-pitched roofs with concrete eaves. Major defects to wall finishes in buildings with this roof type rose to 37.93%, making it the predominant type of defects in this roof category, ahead of minor defects which recorded 34.48%. For pitched roofs with exposed eaves, the predominant type of defects were minor defects, and remained relatively stable as it was in the wall structure at 57.5%. These results show that the severity of defects on wall finishes increased in roofs with concrete parapet walls and did not increase in pitched roofs with free hanging eaves. This suggests a link between roof character and level of defects in wall finishes in the buildings studied.

Level of defects in plumbing services were also assessed, to ascertain any possible links between plumbing pipe work installation methods and defects in the building. Three methods of plumbing pipe work installation were seen in the buildings. They are surface and exposed pipe-work, pipe-work concealed in the walls of buildings, and non-concealed pipe-work hidden behind grills and in ducts. Of these, concealed pipe-work was the predominant method of plumbing pipe-work installation at 59.6% occurrence, followed by exposed pipe-work at 33.3%, cumulatively accounting for 92.9% of plumbing pipe work installation methods in the buildings studied. Table 6 shows analysis of defects in plumbing services, measured against these two frequently occurring installation methods.

Table 6 - Level of defects in plumbing fittings and fixtures

Type of plumbing pipework	Very major defect	Major defec	Not su	Minor defec	No defect	Cumulative Percent
Surface and exposed	7.14	25.58	7.14	57.14	0	100
Concealed in wall cavity	4.0	44.0	8.0	32.0	12.0	100

The results in Table 6 show the two observed pipe installation methods recorded very high occurrences of defects in the plumbing services. In the case of surface and exposed pipe work, minor defects were seen in 57.14% of the times, while major and very major defects accounted cumulatively for 32.72%. For the concealed pipe work, minor defects were observed in 32% of the cases, while major and very major defects cumulatively were seen in 48%. Total defects in all categories for both surface and concealed methods were 89.6% and 80% respectively. These are very high figures for both methods. However, majority of the defects seen in concealed pipe work were major defects unlike in the surface pipe work.

Challenges to effecting maintenance – Questions were asked about the challenges to maintenance in the buildings studied. Maintenance challenges include access for maintenance, properties of materials and finishes to be maintained, design and detailing, and methods and quality of construction. Aspects of these factors were included in the questions asked, and responses were rated based on a five-point Likert scale of strongly disagree (SDA), disagree (DA), neither agree nor disagree (Not sure), agree (A), and strongly agree (SA).

Table 7 – Challenges to effecting maintenance

Description of item	SDA (%	DA (%)	Not sure %	A (%)	SA(%)	Cumm %
Sometimes components to be maintained are beyond the reach of workmen	2.4	28.6	7.1	54.8	7.1	100
The technology (know-how and equipmen required to effect some levels of maintenance is not available	14.3	35.7	4.8	33.3	11.9	100
Some of the maintenance problems in the building are as a result of the design of th building	0	14.3	14.3	45.2	26.2	100
The quality of construction is a major caus of maintenance problems in the building	2.4	11.9	14.3	40.5	31.0	100
The finishing materials used are such that they require constant maintenance	0	16.7	7.1	57.1	3.79	100

Questions were asked on possible challenges to the technical aspect of maintenance, which is effecting repairs, rehabilitation, or cleaning of parts or components of the buildings studied. The questions were asked in relation to design, quality of construction, and location and quality of materials used for the parts or components. Data collected showed that improper design, poor quality construction and non durable materials all play a part in the inability of the buildings to be maintained with ease, in a cost effective way.

CONCLUSION

Designing for maintainability simply means designing to make for easier and more cost effective maintenance of the designed feature. This study identified the character, and challenges to maintenance of public buildings in Owerri, Nigeria. 59.5% of the buildings studied were twenty years old and below. The study established that public buildings in Owerri have high incidence of defects in almost all their component parts, notwithstanding the fact that most of them are not old enough to exhibit signs of depreciation and obsolescence. This is particularly unfavourable to the corporate image of the city, especially in the light of the role of public buildings as critical indicators of the quality of life of the people who use and own them.

Linkages were established in the study, between certain building features and defects in other component parts of the building. However the linkages were not such as to conclusively attribute to them, the prevalence of the said defects. The general observation from the study was that defects were prevalent in every type of building component, irrespective of design or construction method. This observation does not however contradict the findings of this study which accept design, construction method, and quality of materials as important determinants of occurrences of defects in buildings. This suggests that currently, the aspects of design in public buildings, which would significantly improve their maintainability have not been fully explored, as poorly maintained public buildings span across the different building types, irrespective of usage and function.

Conclusions of this study point to the fact that emphasis in design of public buildings should be placed on durability. Durability is that quality of materials and components to be strong, last for long periods, and resist stress and force, while still retaining aesthetic and functional value. Space planning, construction detailing, materials specification, and production of maintenance manual must be done with the aim of achieving durability. Designing for durability will keep the appeal of public buildings for prolonged periods of time even in the absence of preventive maintenance. This would also effectively minimize the cost and resources required for the buildings to function effectively. Minimising the need for maintenance operations is a key attribute of building maintainability (Government of Singapore, 2016). At the early stage of the design process, durability of components and materials can be achieved by integrating design and construction knowledge into all the preliminary decisions. This will involve considering the following:

- possible weather action on building components,
- ease of operation of building components and services during the operational phase of the building,
- ease of access for construction, cleaning and maintenance,
- specifying materials with inherent properties of durability, and
- construction detailing which safeguards the integrity of the materials and components.

Durability is essential if public buildings are to be kept in use and in good enough condition for prolonged periods of time, especially while the overall poor maintenance management strategy and attendant poor maintenance culture in public buildings in Owerri subsists. Of course this will not negate the need to eventually strive to improve maintenance management protocols in public buildings in Owerri.

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