Maintenance Planning of Building Facades: A Case Study of Bells University International Conference Centre

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Abstract- ***The upkeep of a building's facades ought to be on going in accordance to the designed maintenance planning Schedule, this will mark the prevention of facade component failure, keep the system functional for the duration of the service life and well Influence the aesthetic value of such building facade. The purpose of this study is to investigate the maintenance planning of Bells University International Conference Centre facade with a view to proffer a required façade maintenance measure. Observation method was used in examining the physical state of the facade, structured interview of the maintenance units in charge of the building facade to examine the Existing maintenance practices on the façade. It was discovered that the facade is in averagely clean state while some structural components such as columns and beams shows to have been painted for a while. The paint substances smear in patches at different part on the clay brick around the beans and column. This shows that the painting process was not carefully done or necessary process is not adopted. Findings also revealed that the external AC unit hung to the exterior walls also lead to dampness of the facade. This study recommends a systematic schedule maintenance in strict accordance to building maintenance regulation at every six months by the maintenance units under a technical process of operation.***

Indexed Terms- ***facades, maintenance, deterioration, weather, clay facade***

I. INTRODUCTION

A façade has both a literal and symbolic meaning. It is an external face or side of a building, usually located at the front and containing the principal entrance. This literal meaning gives rise to the symbolic meaning of a false front; an image held out to the world that masks what lies behind it. (Kyle, Lacasse, Cornick, & Abdulghani, 2008)

As it sets the tone for the rest of the building, a building's façade is frequently its most significant architectural design feature. The façade is crucial from an engineering standpoint because it affects energy efficiency. Using a facade maintenance program, which is a strategic approach, building managers can document the specifics of the facade system based on the materials used, condition assessment, repair requirements, budgetary expectations, and other factors. Dealing with facade problems in advance of more expensive projects is a preventative measure. A common factor for most facades is avoiding water penetration or other types of water damage. Even though most facades are designed to keep water out, it can be challenging to accomplish this task., mainly because of the materials frequently used on building facades. Usually, over time, joints and finishes deteriorate. (Seethur, 2019)

II. LITERATURE REVIEW

The exterior of all the faces of a building is described by the word "façade," which is derived from the Italian word "facciata." Since it is one of the most iconic and recognizable components that have become ingrained in popular culture, it serves as the calling card of an architectural project. The overall structure's façade sets the tone and expectations. It is crucial in energy efficiency, acoustics performance, and light transmission. The façade not only serves as a partition between the inside and the outside but also has a unique identity and fits in a particular setting. (www.designingbuildings.co.uk, 2022)

2.1 Façade Cleaning

Pollutants, grime, stains, and other undesirable stains should be routinely removed from building facades. A neat facade can improve the overall perception, help attract or retain tenants, and positively impact the neighborhood. Regular facade cleaning may highlight areas of the building that have experienced other issues or are particularly vulnerable. For instance, taking proactive measures to stop invasive root growth that could harm the facade, like removing a seedling while cleaning, can help (or even contribute to some structural failure). Cleaning up dirt and stains might also highlight other structural flaws. Early detection of these issues could assist building owners in preventing more significant problems in the future. (Kyle, Lacasse, Cornick, & Abdulghani, 2008)

2.2 Types of Facades and Facades Cleaning

Methods for cleaning facades typically use water. Pressure washing, soaking, and steam heat washing are all part of this conservative strategy for getting rid of typical dirt and grime. However, in some circumstances, techniques might involve scaffolding, protective sheeting, sandblasting, other techniques, and chemical treatments. Building facades can be made of stainless steel, glass, aluminum, stone, and wood. The cleaning procedure will be determined by the material type and the location of the building (which influences weather-related facade degradation). The purpose of the building could also play a role. (CUPAPIZARRAS, 2019)

- Stone

While stone may seem unaffected in its natural state when used to create a building façade, biological and chemical pollutants can seriously damage the stone's appearance. Given that improper techniques can result in irreparable damage, cleaning stone facades may call for specialized knowledge. Stone facades should ideally be cleaned up before any dirt accumulates. This means that damp areas of the stone should receive special attention. Warm water, dish soap, and vinegar are some basic cleaning supplies. A sponge, soft brush, or rotary tool attached to a buffing machine are examples of tools.

- Timber

Removing accumulated natural growth from timber facades (such as moss or algae) is necessary. Then, clean it with a warm water solution and some dish soap. A sponge and soft brush can be used to apply the solution, which is then washed off with clean water.

Appropriate Time of Façade Services

Facade cleaning ought to be a part of a more extensive maintenance schedule. It should be covered in the preliminary investigation process before any facade repairs are made. A clean, transparent facade devoid of debris will make it easier to see issues and create a better surface for restoration work.

When It's time to clean the façade, facilities and maintenance personnel may occasionally carry out small-scale facade cleaning. When working at a height, in particular, this will call for the appropriate training and tools. For larger facade cleaning projects, hiring a professional with the expertise and tools (like pressure washers and scaffolding) might be necessary to complete the work safely and efficiently. (Seethur, 2019)

2.3 Façade Maintenance System

Systems for maintaining facades must adhere to all pertinent laws and regulations. Therefore, it is crucial to consider necessary and responsible façade maintenance carefully. It has a lot of experience designing machinery for maintaining façades. Each design considers the following: Norms & guidelines, Commercial viability, user security at installations, environmental preservation, long-term expenses Risk management for the building's owner. In general, facades need regular maintenance. Building managers can document the specifics of the facade system based on the materials used, condition assessment, repair requirements, budgetary expectations, etc., by using a facade maintenance program, which is a strategic approach. It is a preventative measure to deal with facade issues before they turn into costly projects. (www.designingbuildings.co.uk, 2022)

The Benefits of Façade Maintenance

- Stop the deterioration and decay process.
- Keep the building safe and stable.
- Prevent unneeded harm from the elements or everyday use.
- Enhance efficiency.

- Contribute to developing plans for building construction, renovation, or retrofit.
- Identify the root causes of defects to help stop their recurrence or repetition.
- Monitor ongoing adherence to legal requirements.

III. STUDY AREA

This study focuses on Bells University of Technology in Ota, Ogun State. Ogun State is located in southwestern Nigeria, according to its geographical profile. It is bordered on the south by Lagos State and the Atlantic Ocean, on the north by Oyo and Osun States, on the east by Ondo State, and on the west by the Republic of Benin. Abeokuta is the capital, while Abeokuta, Ewekoro, and Ikenne are the major cities.

Plate 1: Bells University of Technology, Conference Center
Source: Researchers' Fieldwork, 2022

IV. ADVANTAGES OF CLAY FAÇADE OR RED BRICKS FAÇADE

- Durability - Terracotta tiles are the ideal material for exterior walls of homes, offices, and even public buildings because they have passed tests for high strength and safety. They are highly durable and last for many years, thanks to their weather resistance power.
- Long-Lasting Appeal - They are resistant to the outside environment because they are the product of cutting-edge technology and firing techniques. Since clay facades are made of terracotta, they do not have any calcium leakages or efflorescence effects and can maintain their color for long periods.
- Sustainable - These are the best materials to use when constructing sustainable buildings because they are made from natural resources like clay.
- Provide Insulation-Clay naturally acts as a thermal insulator, and the combined benefit of a ventilated façade further increases insulation. Clay facades contribute to the preservation of a pleasant indoor environment by preventing heat from entering the building.
- Minimal Maintenance: These require very little maintenance after installation. They can quickly stop the panels from rattling, and their native rainwater drainage system aids in preventing soiling, which results in minimal maintenance.
- Simple Fixing - This fix is straightforward since no sealants or routing are required. Additionally, it aids in avoiding wall cracks that appear and uneven surfaces.
- Fireproof – One of the significant advantages of using clay facades is their fire resistance because they are fired at extremely high temperatures
- Aesthetic Appeal - Clay facades give buildings a modern appearance and can be painted in various colors to match the building's overall design theme.

V. FACTORS THAT DETERMINE THE SCHEDULE FOR BUILDING FAÇADE MAINTENANCE

Buildings and other assets are kept in excellent condition and operate at peak performance thanks to maintenance. Inadequate maintenance can lead to decay, degradation, and reduced performance, impacting health and putting users, occupants, and nearby people's safety in danger. (www.Designingbuildings.co.uk, 2022).

Buildings age at different rates and require different amounts of maintenance depending on their design, the caliber of their materials and artistry, function, and location. Although no construction will ever require no maintenance, the quality of the design and artistry can reduce the amount required.

5.1 Types of Façade Maintenance in Building

Maintenance can be classified as;

- Planned maintenance: Regular upkeep, such as boiler servicing
- Preventive maintenance: Work done to prolong a product's life or keep it in good working order, such as replacing cracked roofing tiles before bad weather.
- Corrective maintenance: This entails fixing broken items, such as gutters or windows.
- Front-line maintenance refers to caring for something still in use, like painting and decorating an already occupied building.
- Proactive maintenance: Maintenance tasks are carried out to prevent failures or spot flaws that could cause damage.
- Reliability-centered maintenance: Using a variety of maintenance techniques, it is made sure that a physical asset keeps working as it should.
- Scheduled maintenance: Preventive maintenance performed at regular intervals, based on the number of operations, the number of hours run, and other factors.

5.2 Consequences of Façade Maintenance Neglect on Building

Significant issues may arise from improper facade maintenance. For instance, simply covering cracks with render won't fix the underlying problem; the cracks could spread and cause significant damage. Instead of treating the symptoms, problems must be treated for their root causes. Speaking with a remediation and repair expert for facades might be necessary. Cleaning may occasionally be required as part of the preliminary investigation process before repairs are made. An uncluttered facade free of debris, stains, and other unwanted materials will make it easier to identify issues and provide a better surface for restoration work. On the other hand, water-based facade cleaning might not be done until after sealing if there is a leak problem. (Madureira, Flores-Colen, Brito, & Pereira, 2010)

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5.3 Way of Planning for Facade Maintenance

Plans for facade maintenance should consider the lifespan of facade components and proactively schedule cleaning and maintenance to reduce costs and inconvenience for building occupants. Regular work reviews throughout the year should be planned along with annual facade inspections. Did scheduling follow it? Are contractors trustworthy? This information may be used to plan and set budgets if larger facade maintenance projects are required. Since building systems are frequently connected, facade maintenance should ideally be a part of a larger exterior maintenance plan. For instance, a leak from the roof might only affect the facade. (Chaturvedi, 2020)

5.4 Building Scheduled Maintenance for Façade

Cleaning, regional repairs, regional replacements, and preventive maintenance are all included in scheduled maintenance. They lessen unplanned activities, causing less disruption to everyday building use, and they make it possible to estimate overall costs. Beginning with the design phase, they ought to project each component's performance over time using scientific and organized data about degradation models, the kind of end-user, and the state of the climate service.
(www.designingbuildings.co.uk, 2022)

VI. CLIMATE CONDITION IN BELLS UNIVERSITY OF TECHNOLOGY

Climate is the long-term accumulation of the atmospheric components (and their variations) that, in the short term, make up weather. Climate conditions at a specific location over an extended period. These include the following: wind, precipitation (type, frequency, and amount), temperature, humidity, and solar radiation (speed and direction)

Ogun, one of Nigeria's coldest states, has a daily high-temperature average of just 31 degrees Celsius. The sometimes-pleasant but often-tropically humid weather is caused by high humidity and temperatures. It is inviting to take a bath at an average water temperature of 27 degrees all year long because it is warm to hot. The best time to travel is from November to March because there is less rain. Precipitation decreases significantly from May to October. (Arnfield, 2019)

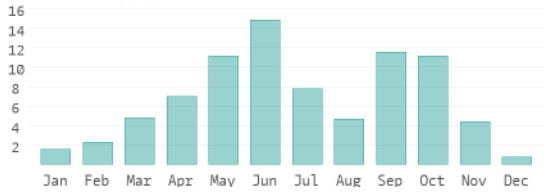
- Climate Conditions in Ogun State

Hours Of Sunshine Per Day

Source: (United Nations Statistics Division, 2021)

The time when the sun is visible is the number of hours of sunshine. That is, without mountains, clouds, or fog obstructing the view. The state of Ogun experiences the most sunshine in November, with 8 hours per day. The sun shines for the fewest hours in July.

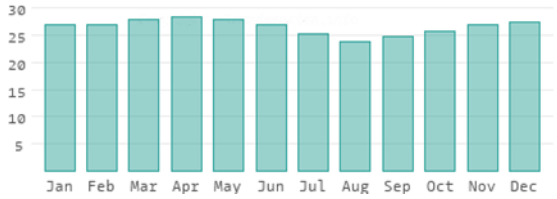
Rainy Days Per Month



Source: (United Nations Statistics Division, 2021)

A day is considered rainy if there is at least 0.1 mm (or 0.1 liters) of precipitation on the ground. Rain, snow, hail, or even dew can qualify as this. Therefore, it does not have to rain all day. With 15 rainy days, June has the most and December has the least amount of rainy days.

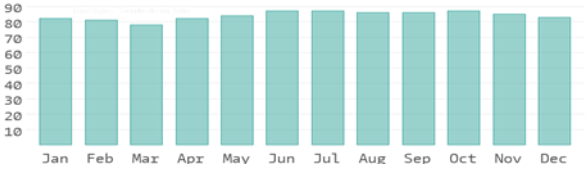
Water Temperature



Source: (United Nations Statistics Division, 2021)

Water currents, as well as local solar radiation, play a role in determining water temperature. For instance, depending on the season, warm or cold-water masses are transported from other places. Ogun experiences its warmest weather in April when the water is 29 °C.

Relative Humidity In %



Source: (United Nations Statistics Division, 2021)

More moisture can be absorbed by warm air than by cold air. The relative humidity tells us how much water is present in the atmosphere. The person feels uneasy and considers high humidity to be oppressive. Relative humidity of 40 to 60 percent is generally considered to be pleasant. July is the most uncomfortable month, with an 87 percent humidity average. On the other hand, it is less difficult to endure in March. (United Nations Statistics Division, 2021)

Table 1: Annual weather Analysis of Ogun State, 2021

WEATHER PER MONTH IN OGUN STATE	RESEARCH CONCLUSION
Weather in Sango Ota in January	33°C is the average temperature, and at night it feels like 26°C. Sango Ota experienced about two rainy days and 33.15mm of rain in January. It's close to 69 percent humidity.
Weather in Sango Ota in February	Around 32°C is the average temperature, and at night it feels like 27°C. Sango Ota experiences about five rainy days and 55.71mm of rain in February. The relative humidity is close to 74%.
Weather in Sango Ota in March	Around 32°C is the average temperature, and at night it feels like 27°C. Sango Ota receives 54.04mm of rain in March, with about six rainy days throughout the month. The humidity level is almost 75%.

Weather in Sango Ota in April	Around 32°C is the average temperature, and at night it feels like 27°C. Sango Ota receives 53.25mm of rain and roughly seven rainy days in April. The relative humidity is close to 74%.
Weather in Sango Ota in May	Around 32°C is the average temperature, and at night it feels like 27°C. Sango Ota receives 103.28mm of rain and roughly eight rainy days in May. It's close to 76 percent humidity.
Weather in Sango Ota in June	Around 30°C is the average temperature, and at night it feels like 26°C. Sango Ota experienced 13 rainy days and 289.93mm of rain in June. The humidity level is almost 79 percent.
Weather in Sango Ota in July	28°C is the average temperature, and at night it feels like 24°C. Sango Ota experienced 14 rainy days and 289.10mm of rain in July. There is nearly 82 percent humidity.
Weather in Sango Ota in August	28°C is the average temperature, and at night it feels like 24°C. Sango Ota receives 181.86mm of rain and roughly nine rainy days in August. It's close to 83 percent humidity.
Weather in Sango Ota in September	28°C is the average temperature, and at night it feels like 24°C. Sango Ota receives 181.86mm of rain and roughly nine rainy days in August. It's close to 83 percent humidity.
Weather in Sango Ota in October	Around 30°C is the average temperature, and at night it feels like 26°C. Sango Ota receives 145.61mm of rain and roughly eight rainy days in October. The humidity level is almost 80%.
Weather in Sango Ota in November	Around 32°C is the average temperature, and at night it feels like 26°C. Sango Ota receives 103.50mm of rain in November, with roughly six rainy days throughout the month. It's close to 77 percent humidity.
Weather in Sango Ota in December	33°C is the average temperature, and at night it feels like 26°C. Sango Ota receives 38.36mm of rain and about two rainy days in December. The humidity level is almost 70%.

(United Nations Statistics Division, 2021)

Observation Report of Bells University Conference Centre

- The façade is not adequately maintained as the paints are wearing off.
- The structural elements such as columns, and beam are adequately painted but evidence of melted paint smear on various brick walls located near the beam & columns. This shows that the painting process was not carefully done or necessary treatments were not adopted in the painting process.
- The Ac (external unit) hanging on the exterior wall (facade) also causes dampness on the wall, due to the discharge of water from the AC.

RECOMMENDATION

This study recommends that a scheduled maintenance method should be adopted due to the use of clay façades in Bells University conference center. The clay façade should be cleaned using a water-based

method which is the Nebulous spray method for every six months by the building maintenance staff.

CONCLUSION

In conclusion, this research shows that Bells University conference center is not adequately maintained due to the lack of proper maintenance planning. It was further discovered that no façade maintenance schedule in place to adequately cater for the wall finish.

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