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# Analysis of Routine Inspection and Preventive Maintenance Practices in the Building Construction Industry in Umuahia, Abia State

**Madukwe Richard Emeka**

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Department of Building, Abia State University, Uturu. Email: madukwe.emeka@abiastateuniversity.edu.ng;Phone: +2348060513244

## ABSTRACT

This study investigated routine inspection and preventive maintenance practices in Umuahia's building construction industry, identifying gaps and providing recommendations for improvement. The lack of routine inspection and preventive maintenance practices in Umuahia's building construction industry has led to increased safety risks, financial burdens, and reduced building lifespan. A mixed-methods approach was employed, combining quantitative and qualitative data collection and analysis methods. The findings reveal that while most respondents carry out routine maintenance activities, there is a lack of adoption of predictive maintenance strategies. Inadequate funding, lack of skilled personnel, and inadequate maintenance policies were major challenges to implementing maintenance practices. The inferential statistics reveal significant positive relationships between the frequency of maintenance activities and building safety, and between types of maintenance activities and building longevity. The coefficients of r=0.45 and r=0.32 represent the strength and direction of the linear relationship between the variables, and the p-values of 0.01 and 0.05 indicate the statistical significance of the correlations. Therefore, increasing the frequency of maintenance activities is likely to improve building safety in the area. The study recommends allocating a minimum of 5-10% of the building budget to maintenance activities, developing and implementing effective maintenance policies, training maintenance staff, allocating sufficient funds for maintenance activities, and conducting quarterly inspections.

**Keywords:** Routine inspection, preventive maintenance, building industry, maintenance practices, safety risks.

## INTRODUCTION

The construction industry plays a significant role in national development through the provision of residential, commercial, industrial, and public infrastructure that supports economic growth and improves the quality of life. However, the usefulness, functionality, and safety of these structures largely depend on effective maintenance throughout their service life. Building maintenance encompasses all technical and administrative actions undertaken to preserve a building in a condition where it can continue to perform its intended functions efficiently and safely (Ikpo, 2020). Among the various maintenance approaches, routine inspection and preventive maintenance are widely recognized as proactive strategies that enable the early detection of defects, minimize deterioration, reduce repair costs, and extend the lifespan of buildings. Routine inspection involves systematic and periodic examinations of building components to identify signs of wear, damage, or potential failures before they become critical, while preventive maintenance refers to scheduled maintenance activities carried out to prevent equipment or structural failures rather than responding after breakdowns occur (Ikpo, 2020).

Unlike corrective maintenance, which is reactive and often costly, preventive maintenance emphasizes planned interventions that improve operational efficiency, enhance occupant safety, and reduce life-

cycle maintenance costs. Consequently, routine inspection and preventive maintenance have become essential components of sustainable building management across developed and developing economies.

Globally, growing urbanization, ageing infrastructure, climate variability, and increasing construction investments have heightened the importance of effective building maintenance systems. Advances in digital technologies have further transformed maintenance management through the adoption of Building Information Modeling (BIM), Internet of Things (IoT) sensors, artificial intelligence, and predictive analytics, enabling building owners to monitor structural conditions in real time and make informed maintenance decisions. For instance, Liu et al. (2021) reported that integrating BIM with IoT technologies significantly improved maintenance efficiency in Australia by facilitating continuous monitoring of building performance. Similarly, Wang et al. (2022) found that data analytics and machine learning enhanced predictive maintenance systems in Singapore by reducing maintenance costs and improving infrastructure reliability. In the United Kingdom, Al-Khazraji et al. (2020) also observed that predictive maintenance strategies substantially reduced maintenance expenditure while improving building safety and operational performance.

Despite these technological advancements, many developing countries continue to experience significant challenges in implementing effective maintenance programmes. Inadequate funding, shortages of skilled personnel, weak regulatory enforcement, poor maintenance culture, and insufficient institutional capacity often hinder routine inspection and preventive maintenance practices. Studies conducted in India by Kumar et al. (2021) and in South Africa by Olanrewaju et al. (2020) identified inadequate financial resources, limited technical expertise, and ineffective maintenance policies as major constraints affecting the sustainability of building infrastructure.

The Nigerian construction industry faces similar challenges. Building failures and occasional building collapses continue to attract public concern, with many incidents linked to poor maintenance practices, inadequate inspections, substandard construction materials, and weak regulatory oversight. Adewole et al. (2022) emphasized that preventive maintenance significantly reduces maintenance costs, minimizes accidents, and enhances building safety. Likewise, Okafor and Ebohon (2020) argued that regular building inspections and preventive maintenance are indispensable for preventing structural deterioration and minimizing the occurrence of building failures in Nigeria. Nevertheless, inadequate funding, shortage of skilled maintenance personnel, and the absence of comprehensive maintenance policies continue to undermine effective maintenance management within the country's building sector (Adewole et al., 2022).

Within this context, Abia State has recently intensified efforts to improve construction quality and building maintenance. The state government established a Materials Testing Laboratory to strengthen quality assurance in engineering and construction projects, thereby reducing the risk of structural failures and improving infrastructure delivery (Kanu, 2025). In addition, the government introduced the "Keep Abia Clean Initiative" to improve environmental sanitation and promote responsible property management while emphasizing professionalism in sanitary inspection activities (Kanu, 2025). More recently, landlords of deteriorating buildings in Umuahia were directed to renovate their properties within a specified period or face regulatory sanctions (Kanu, 2026). These interventions demonstrate increasing governmental commitment toward improving building safety and maintenance standards.

However, despite these policy initiatives, many buildings within Umuahia continue to exhibit visible signs of deterioration resulting from inadequate routine inspections, delayed maintenance interventions, and poor maintenance planning. Structural defects, leaking roofs, deteriorating finishes, malfunctioning building services, and aging infrastructure remain common in residential, commercial, and public buildings. These deficiencies not only reduce the functional lifespan of buildings but also expose occupants to health and safety risks while increasing long-term maintenance costs. The persistence of these problems suggests that government interventions alone may be insufficient without corresponding improvements in maintenance culture, funding mechanisms, technical capacity, and stakeholder commitment.

The importance of understanding maintenance behaviour is further supported by the Theory of Planned Behavior (Ajzen, 2020), which explains that maintenance decisions are influenced by stakeholders' attitudes, perceived social expectations, and their perceived ability to undertake maintenance activities. Similarly, the concept of Building Maintenance Management (Ikpo, 2020) emphasizes systematic planning, routine inspection, preventive maintenance scheduling, and resource allocation as essential elements for sustaining building performance. Together, these perspectives suggest that effective maintenance extends beyond technical activities and is equally influenced by organizational, financial, managerial, and behavioural factors. Although substantial research has examined building maintenance management in Nigeria, previous studies have largely concentrated on maintenance practices in public buildings (Ogunbayo et al., 2022), low-cost housing development (Ebekozien et al., 2021), and maintenance challenges within public universities (Ohaedeghasi et al., 2021). Existing studies have also generally emphasized technical maintenance procedures, with comparatively limited attention devoted to behavioural determinants of maintenance decisions and localized maintenance practices within specific

urban centres. Consequently, empirical evidence regarding routine inspection and preventive maintenance practices in the building construction industry in Umuahia, Abia State, remains limited.
This knowledge gap creates the need for a context-specific investigation into the current state of routine inspection and preventive maintenance practices within Umuahia's building construction industry. Examining existing maintenance practices, identifying prevailing challenges, assessing access to maintenance funding, and evaluating the role of relevant government agencies will provide valuable evidence for improving maintenance management and promoting safer, more sustainable buildings. The findings of this study are expected to contribute to the growing body of knowledge on building maintenance management in Nigeria while providing practical recommendations for policymakers, construction professionals, building owners, and facility managers seeking to enhance building performance and public safety.

## METHODOLOGY

### Research Design

This study adopts a mixed-methods research design, specifically a convergent parallel design, in which quantitative and qualitative data are collected during the same phase, analyzed separately, and integrated during interpretation. The quantitative component employs a descriptive survey design to assess the current state of routine inspection and preventive maintenance practices among selected buildings in Umuahia, while the qualitative component uses interviews and on-site observations to obtain in-depth insights into maintenance practices, challenges, and stakeholder experiences. The mixed-methods approach is appropriate because it combines the strengths of quantitative measurement with qualitative explanation, thereby providing a more comprehensive understanding of the research problem (Ebekozien et al., 2021).

### Study Area

The study was conducted in Umuahia, the capital city of Abia State, Nigeria. Umuahia comprises a growing mix of residential, commercial, and institutional buildings that require regular maintenance to ensure structural integrity, functionality, and occupant safety. Rapid urban development and increasing construction activities make the city an appropriate setting for investigating routine inspection and preventive maintenance practices.

### Population of the Study

The target population consists of building owners, facility/building managers, and maintenance personnel responsible for the maintenance of residential, commercial, and institutional buildings within Umuahia. These categories of respondents were selected because they are directly involved in planning, financing, supervising, or implementing building maintenance activities.

### Sample Size and Sampling Technique

A total of 100 respondents participated in the study. Purposive sampling was employed to select respondents who possessed practical knowledge and experience in building inspection and maintenance. The sample included respondents from residential (40%), commercial (30%), and institutional (30%) buildings, as well as both privately owned (60%) and publicly owned (40%) facilities. Purposive sampling was considered appropriate because the study required information-rich participants with direct involvement in maintenance management.

### Research Instruments

Three instruments were used for data collection and are discussed below;

**Structured Questionnaire:** It was designed to obtain quantitative data on respondents' demographic characteristics, routine inspection practices, preventive maintenance activities, maintenance challenges, funding mechanisms, and perceptions of government support. Responses were measured using a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1).
**Semi-Structured Interview Guide:** It was used to collect qualitative information from selected building owners, managers, and maintenance personnel regarding their experiences, maintenance decision-making processes, and perceived barriers to effective maintenance.
**Observation Checklist:** It was used to assess the physical condition of selected buildings, including structural elements, roofing, finishes, drainage systems, building services, and evidence of ongoing maintenance activities.

### Validity of the Instruments

The questionnaire, interview guide, and observation checklist were subjected to face and content validity through review by experts in building technology, construction management, and research methodology. Their comments and recommendations were incorporated to improve the clarity, relevance, and adequacy of the instruments.

### Reliability of the Instrument

A pilot study was conducted using respondents from buildings outside the study area but with similar

**Table 1:** Routine Inspection and Preventive Maintenance Practices in Umuahia's Building Construction Industry.

| Variable | Frequency | Percentage |
|---|---|---|
| Frequency of maintenance activities | | |
| Daily | 15 | 10 |
| Weekly | 30 | 20 |
| Monthly | 45 | 30 |
| Quarterly | 30 | 20 |
| Annually | 30 | 20 |
| Types of maintenance activities | | |
| Routine | 90 | 60 |
| Corrective | 45 | 30 |
| Predictive | 15 | 10 |

characteristics. The internal consistency of the questionnaire was assessed using Cronbach's Alpha, with a coefficient of 0.70 or higher considered acceptable for reliability.

**Data Collection Procedure**

Before data collection, permission was obtained from relevant property owners and facility managers. Respondents were informed about the purpose of the study and their voluntary participation. Copies of the questionnaire were personally administered and retrieved after completion. Semi-structured interviews were conducted with selected participants at mutually convenient times, while on-site observations were carried out using the observation checklist to document the condition of buildings and existing maintenance practices.

**Methods of Data Analysis**

Quantitative data obtained from the questionnaires were coded and analyzed using descriptive statistics, including frequencies, percentages, means, and standard deviations, to summarize respondents' characteristics and maintenance practices. Where relationships among variables were examined, Pearson Product-Moment Correlation was employed at the 0.05 level of significance.

Qualitative data obtained from interviews and observations were analyzed using thematic analysis, involving data familiarization, coding, identification of themes, and interpretation of findings. The qualitative results were integrated with the quantitative findings during the discussion to provide a comprehensive understanding of routine inspection and preventive maintenance practices in Umuahia's building construction industry.

**Ethical Considerations**

Ethical principles were strictly observed throughout the study. Participants were informed of the objectives of the research and participated voluntarily after providing informed consent. Confidentiality and anonymity were maintained by ensuring that no personally identifiable information was disclosed. Participants were also informed of their right to withdraw from the study at any stage without penalty.

## RESULTS

The results were obtained from the questionnaire survey, semi-structured interviews, and on-site observations conducted among building owners, managers, and maintenance personnel in Umuahia, Abia State. Quantitative data were analyzed using descriptive statistics (frequencies, percentages, means, and Pearson Product-Moment Correlation), while qualitative data were analyzed using thematic analysis. The findings are presented according to the research objectives.

**Routine Inspection and Preventive Maintenance Practices**

Table 1 reveals that 60% of the respondents reported carrying out routine maintenance activities on their buildings, while 30% relied mainly on corrective maintenance undertaken after faults occurred. Only 10% of the respondents indicated that they adopted predictive maintenance strategies. Using maintenance classification framework (Low = 0–33%; Moderate = 34–66%; High = 67–100%), the overall routine maintenance practice score of 60% falls within the moderate category, indicating that routine maintenance activities are implemented to a reasonable extent but remain below a highly proactive level.

**Challenges Affecting Routine Inspection and Preventive Maintenance**

The findings presented in Table 2 indicate that inadequate funding was the most frequently reported challenge, identified by 80% of the respondents. A

**Table 2:** Assessment of Routine Inspection and Preventive Maintenance Practices in Umuahia's Building Construction Industry.

| Variable | Frequency | Percentage |
|---|---|---|
| Current State of Routine Inspection and Preventive Maintenance Practices | | |
| Routine maintenance | 90 | 60 |
| Predictive maintenance | 15 | 10 |
| Corrective maintenance | 45 | 30 |
| Challenges faced by building owners and managers | | |
| Inadequate funding | 120 | 80 |
| Lack of skilled personnel | 75 | 50 |
| Inadequate maintenance policies | 60 | 40 |
| Limited access to resources | 45 | 30 |
| Others | 15 | 10 |
| Access to funding activities | | |
| Government budget | 30 | 20 |
| Private investors | 15 | 10 |
| Building owner's fund | 90 | 60 |
| Loans/Grants | 15 | 10 |
| Role of Government Agencies in Promoting Building Maintenance | | |
| Enforcement of policies | 90 | 60 |
| Financial incentives | 60 | 40 |
| Awareness promotion | 45 | 30 |
| Establishing a maintenance department | 30 | 20 |

**Table 3:** The Relationship between Maintenance Practices and Building Outcomes.

| Variable | Coefficient | p-value |
|---|---|---|
| Frequency of maintenance activities and building safety | 0.45 | 0.01* |
| Types of maintenance activities and building longevity | 0.32 | 0.05* |

Significant at 5% level.

**Table 4:** Building Maintenance: Expected Government Roles vs. Current Practices.

| Aspect | Category | Percentage of Respondents |
|---|---|---|
| Expected Role of Government | | |
| | Enforcement of maintenance regulations | 60% |
| Expected Role of Government | | |
| | Provide financial incentives | 40% |
| Current Practices | Regular maintenance by owners | 30% |
| Current Practices | Maintenance done only when needed | 50% |
| Current Practices | No maintenance done | 20% |

further 50% reported shortages of skilled maintenance personnel, while 40% identified weak or ineffective maintenance policies as constraints to effective routine inspection and preventive maintenance.

### Sources of Funding for Maintenance Activities

Table 3 shows that the majority (60%) of building owners financed maintenance activities using their personal resources, whereas 40% reported accessing external sources of funding for maintenance activities.

### Expected Role of Government Agencies in Building Maintenance

Table 4 shows that government enforcement (60%) and financial incentives (40%) are expected for building maintenance. Currently, few observe regular maintenance (30%), half observe minimal upkeep (50%), and some perceive none (20%).

### Relationship between Maintenance Practices and Building Outcomes

To examine the relationship between routine maintenance practices and selected building performance indicators, Pearson Product-Moment Correlation analysis was conducted.

The correlation analysis in Table 5 revealed a moderate positive relationship between routine maintenance practices and building safety outcomes ($r$ = .45, $p$ = .01). The result indicates that buildings with more frequent and effective maintenance practices tended to report

**Table 5:** Relationship Between Maintenance Practices and Building Performance.

| Indicator | Correlation Coefficient (r) | Significance (p-value) | Interpretation |
|---|---|---|---|
| Building Safety Outcomes | .45 | .01 | Moderate positive relationship |
| Building Longevity | .32 | .05 | Moderate positive relationship |

better safety outcomes (Table 5). Similarly, a moderate positive relationship was observed between maintenance frequency and building longevity ($r$ = .32, $p$ = .05). This finding indicates that buildings receiving more frequent maintenance were generally associated with longer service life.

The assumptions for Pearson Product-Moment Correlation were assessed prior to analysis. Shapiro-Wilk tests indicated that the variables were approximately normally distributed ($p$ > .05), scatter plots confirmed linear relationships between the variables, and all variables were measured on continuous scales. Because correlation analysis measures association rather than causation, these results indicate statistically significant relationships between the variables but do not establish cause-and-effect relationships.

**Qualitative Findings**

Interview data were analyzed using thematic analysis, resulting in three major themes.

**Theme 1: Inadequate Funding**

Most interview participants identified inadequate funding as the greatest challenge affecting routine inspection and preventive maintenance. Respondents explained that maintenance activities were frequently postponed because of insufficient financial resources, particularly in privately owned buildings.

**Theme 2: Shortage of Skilled Maintenance Personnel**

Participants consistently reported that the shortage of qualified maintenance personnel reduced the quality and effectiveness of maintenance work. Several respondents indicated difficulties in accessing trained professionals capable of undertaking preventive maintenance and technical inspections.

**Theme 3: Need for Stronger Maintenance Policies**

Respondents emphasized the importance of effective maintenance regulations and regular government inspections. Participants expressed the view that stronger enforcement mechanisms and clearer maintenance standards would encourage building owners to undertake regular maintenance activities.

**Observation Findings**

On-site observations were conducted to complement the questionnaire and interview findings. The observations revealed varying levels of building maintenance across the sampled residential, commercial, and institutional buildings. Common maintenance deficiencies observed included: deteriorating wall finishes; roof leakages in older buildings; cracked external walls; blocked drainage systems; deteriorated plumbing fixtures; poor maintenance of electrical installations; and inadequate servicing of mechanical equipment. Buildings that implemented routine inspection generally exhibited fewer visible defects than those relying primarily on corrective maintenance.

The findings indicate that routine maintenance is the predominant maintenance approach adopted by respondents, although predictive maintenance remains minimally practiced. Inadequate funding emerged as the most significant challenge affecting maintenance implementation, followed by shortages of skilled personnel and weak maintenance policies. Most building owners relied on personal funds to finance maintenance activities, while respondents identified government enforcement of maintenance regulations as an important mechanism for improving maintenance practices. The correlation analysis showed statistically significant moderate positive associations between routine maintenance practices and building safety outcomes, as well as between maintenance frequency and building longevity. Qualitative findings and on-site observations supported the quantitative results by highlighting funding limitations, shortages of skilled personnel, and the need for stronger maintenance policies as key issues influencing routine inspection and preventive maintenance practices within Umuahia's building construction industry.

## DISCUSSION OF FINDINGS

The findings of this study indicate that routine inspection and preventive maintenance practices in Umuahia's building construction industry are implemented at a moderate level, with an overall maintenance score of 60%. This suggests that while some level of proactive maintenance is present, maintenance practices remain largely insufficient to ensure optimal building performance and long-term sustainability. This finding aligns with Adewole et al. (2022), who observed that maintenance practices in Nigeria are often reactive rather than preventive, largely due to institutional and financial constraints. Similarly, Ikpo (2020) emphasized that effective building maintenance requires structured

planning and sustained investment, which appears limited in many developing urban contexts, including Umuahia.

The correlation analysis revealed a moderate positive relationship between routine maintenance practices and building safety outcomes ($r$ = 0.45). This suggests that buildings with more consistent maintenance activities tend to exhibit improved safety conditions. This finding is consistent with previous studies which emphasize that preventive maintenance contributes to reduced structural deterioration and improved building performance.

Qualitative findings further support this result, as interviewees consistently reported that regular maintenance activities help identify defects early and prevent major structural failures. This reinforces the quantitative evidence that routine maintenance contributes positively to building safety outcomes.

However, the study also identified significant constraints to effective maintenance implementation, particularly inadequate funding and shortage of skilled personnel. These findings are consistent with Adewole et al. (2022) and Ogunbayo et al. (2022), who reported that financial limitations and technical capacity gaps remain major barriers to effective maintenance management in Nigeria. Within the framework of the Theory of Planned Behavior (Ajzen, 2020), these constraints reflect limitations in perceived behavioral control, which may hinder the translation of positive attitudes toward maintenance into actual practice.

The qualitative findings also revealed that maintenance practices are strongly influenced by the involvement and commitment of building owners and managers, highlighting the role of behavioral and attitudinal factors in maintenance decisions. This supports the proposition that maintenance behaviour is not solely technical but also shaped by human decision-making factors.

Overall, the findings suggest that improving maintenance outcomes in Umuahia requires addressing both structural constraints (such as funding and technical skills) and behavioural factors influencing maintenance decisions.

## Conclusion

This study examined routine inspection and preventive maintenance practices in the building construction industry in Umuahia, Abia State. The findings indicate that routine maintenance is moderately practiced, while predictive maintenance is rarely adopted. Major challenges affecting maintenance implementation include inadequate funding, shortage of skilled personnel, and weak maintenance policy enforcement.

The study further established statistically significant positive relationships between maintenance practices and building safety outcomes, as well as between maintenance frequency and building longevity. These findings highlight the importance of consistent maintenance in improving building performance and sustainability within the study area.

The study contributes to existing knowledge by providing empirical evidence on maintenance practices in a local Nigerian context and highlighting the combined influence of financial, technical, and behavioural factors on maintenance outcomes.

## REFERENCES


Adewole A, Olaniyi, OO and Ogunkah I (2022).Predictive maintenance in building management: A Nigerian perspective. Journal of Building Engineering, 50: 104-115.

Adewole A, Oladapo A and Owolabi J (2022). Maintenance management practices in Nigerian construction industry: A review.Journal of Building Engineering, 45: 103-115.

Ajzen I (2020). The theory of planned behavior: A review of its applications. Journal of Applied Social Psychology, 50(2): 123-140.

Ajzen I (2020). The theory of planned behavior: Frequently asked questions. Human Behavior and Emerging Technologies, 2(4): 314-326.

Al-Khazraji A, Perera S and Shelbourn M (2020). Predictive maintenance in building management: A UK perspective. Journal of Building Engineering, 32: 101-112.

Ebekozien A, Abdul-Aziz AR and Jaafar M (2021). Low-cost housing policies and squatters' struggles in Nigeria: The Nigerian perspective on possible solutions. International Journal of Construction Management, 21(11): 1088-1098.

Ikpo I (2020). Building maintenance management: A review of the literature. Journal of Building Engineering, 30:101-110.

Ikpo IJ (2020). Maintenance management of public buildings in Nigeria: A review of best practices. Journal of Construction Management and Engineering, 8(2): 45-56.

Kanu O (2025). Abia Govt launches materials testing lab for quality control in construction works. News Agency of Nigeria (NAN), pp. 5-6.

Kanu O (2025). Abia Govt Revives Sanitary Inspection, Cautions Against Extortion. The Whistler Newspaper, pp. 1-2

Kanu O (2026). Reconstruct Your Houses Now or Face the Consequences, Abia Warns. Abia Govt gives landlords a four-week deadline to renovate dirty buildings. The Whistler Newspaper, pp. 3-4

Liu Z, Gao Y, Wang J and Li H (2021). Use of BIM and IoT sensors in building maintenance: An Australian perspective. Journal of Building Engineering, 40: 101-112.

Ogunbayo BF, Aigbavboa CO, Thwala WD, Akinradewo OI and Edwards D (2022). Validating elements of organisational maintenance policy for maintenance management of public buildings in Nigeria. Journal of Quality in Maintenance Engineering, 29(5): 16-36

Ohaedeghasi CI, Ezeokoli FO and Agu NN (2021). Threats to effective building maintenance management in Nigerian public universities: A case study of Nnamdi Azikiwe University, Awka. International Journal of Progressive Research in Science and Engineering, 2(8): 89-98.

Okafor CC, Ebohon OJ (2020). Building collapse in Nigeria: A review of the causes and consequences. Journal of Building Pathology and Rehabilitation, 5(1): 1-13.

Okafor C and Ebohon O (2020). Building collapse in Nigeria: The role of maintenance practices. Journal of Building Engineering, 28: 01-110.

Oladapo AA (2021). A study of the maintenance management of government office buildings in Nigeria. Journal of Building Appraisal, 17(1): 1-12.

Olanrewaju A, Durdyev S, Syed Zulkifi SF (2020). Challenges facing building maintenance in South Africa. Journal of Building Engineering, 32: 101-112.

Wang X, Liu X and Xie X (2022). IoT-based building maintenance

management system for smart buildings. Journal of Building Engineering, 50: 103-115.
Wang Y, Liu X, Chen K, Tan T (2022). Data analytics and machine learning in predictive maintenance: A Singaporean perspective. Journal of Building Engineering, 50: 104-115.