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The Effects of Dampness on Some Faculty Buildings in Enugu State University of Science and Technology

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Abstract

Dampness is a common issue in buildings across tropical West Africa, including Nigeria, due to persistent rainfall and high humidity. This study investigates the causes, effects, and preventative measures associated with dampness in faculty buildings at Enugu State University of Science and Technology (ESUT). It utilizes visual assessments, expert interviews, and a structured questionnaires distributed among professionals: Architects, Builders, Quantity Surveyors. The data collected were analyzed using the following statistical tools: Simple Percentages, Weighted Mean Scores, Relative Importance Index (RII). The research has revealed that the four most outstanding causes of dampness in some faculty buildings in Enugu state university of science and technology, Agbani are leakages from roof and plumbing system, rain penetration, and rising damp from soil highlighting both structural risks and potential health concerns for occupants. The paper recommends that construction professionals and building occupants should collectively adopt the following measures for damp prevention in buildings: provision of good roofing, integral water proofing, special construction techniques, avoidance of leakage of water, provision of DPM and provision of DPC.

Keywords: Causes, Dampness, Effects, Moisture, and Preventive measures.

Introduction

Dampness refers to the presence of unwanted moisture within the structural components of a building. It typically affects walls, floors, roofs, and other elements, and is particularly prevalent in older buildings or structures exposed to poor construction practices and environmental factors. In regions like Nigeria with tropical climates, dampness is an increasingly common problem due to high humidity, persistent rainfall, and inadequate maintenance practices. According to Ubi, Obun, and Agbor (2020), dampness may occur due to water seepage from external sources or condensation from within. The presence of moisture—either through gravitational or hygroscopic means—can lead to material degradation, corrosion of steel reinforcements, and mold growth. These conditions compromise not only the structural integrity of buildings but also the health and safety of their occupants. Professional construction bodies in Nigeria have been criticized for failing to address the root causes of structural failures, many of which can be linked to dampness. The psychological and financial toll of building component failure—ranging from material loss to injury and even fatalities—is severe and demands urgent attention. In Enugu, several residential and institutional buildings have shown signs of inadequate maintenance, despite being relatively new. Windows, doors, and wall surfaces often exhibit signs of decay caused by moisture. Water is one of the most damaging elements in the deterioration of building materials. As Hetreed (2008) and Burkinshaw and Parrett (2004) point out, water ingress—whether through poor roofing, inadequate drainage, or structural cracks—can cause irreversible damage. Similarly, Haverinen-Shaughnessy (2007) links indoor dampness to health risks such as respiratory infections, particularly in cases where mold and poor air quality are present. The failure to maintain buildings properly contributes significantly to reduced lifespans, defeating the purpose of long-term infrastructure investment. As Melvin (2012) observes, buildings should serve as durable assets for accommodation and productivity. Unfortunately, this goal is undermined by the neglect of moisture control measures during design, construction, and occupancy. Addleson (1977) identified three primary categories of building failure: dampness, movement, and chemical/biological degradation. These are often aggravated by poor design, substandard workmanship, and lack of adequate maintenance. This study builds upon these insights to examine the specific case of faculty buildings at ESUT.

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In the light of the above, the objectives of the research paper are to:

i. identify the major causes of dampness in faculty buildings at ESUT,
ii. examine the effects of dampness on these buildings, and
iii. evaluate appropriate preventive measures for addressing dampness in the affected structures.

Review of Literature

Understanding Dampness in Building

Dampness refers to the presence of excessive moisture within building materials and structures. According to Burkinshaw and Parrett (2004), moisture content can be categorized into capillary, equilibrium, hygroscopic, total, and potential moisture content. Cotgrave (2005) further describes dampness as the result of capillary action drawing water into building elements such as walls and floors. The World Health Organization (WHO) defines moisture in buildings as "any visible, measurable, or perceived result caused by excessive moisture that leads to indoor climate issues or durability problems in building components." Moisture can travel in both liquid and vapor forms via processes such as capillary suction, diffusion, convection, gravity, and wind pressure. Moisture-related issues are common in Nigerian buildings due to climatic factors like high humidity, heavy rainfall, and inadequate construction practices. The presence of water in buildings accelerates oxidation in metals (leading to corrosion), encourages fungal and insect infestations in wooden components, and causes chemical degradation in building materials (Hollis, 2002). Suryakanta (2015) describes dampness as the presence of moisture in elements such as floors, walls, and roofs—ultimately impacting both structural performance and indoor air quality. The key purpose of any dampness assessment is to identify its source and recommend corrective and preventive actions (Halim *et al*., 2012).

Gunnbjornsdottir *et al*. (2006) found that over 18% of buildings across Europe exhibited signs of dampness, with causes ranging from construction defects to material aging. WHO (2009) reported similar issues in North America and Asia. In China, a study comparing rural and urban homes revealed that older bungalows lacking mechanical ventilation experienced more severe damp problems than modern apartments (Kong *et al*., 2013–2014). Locally, Ubi *et al*. (2020) investigated dampness in residential buildings in Calabar and found that the issue significantly affected structural performance and occupant well-being. In Ghana, Agyekum *et al.* (2013–2014) documented poor awareness among occupants regarding dampness causes and remediation. Despite a global body of work on this issue, the Nigerian context—especially in public institutions—remains under-researched.

Sources of Dampness

Hollis (2000) identifies four main categories of moisture entry in buildings:

i. Rising Damp

Caused by capillary action drawing moisture from the ground into porous materials such as bricks, stone, and mortar. It is common in older buildings lacking proper damp-proof courses. Rising damp can be particularly expensive to treat (Ahmed and Rahman, 2010).

ii.. Condensation

Occurs when moist indoor air contacts colder surfaces, leading to water droplets forming on walls, windows, and ceilings. This often results in mold growth, stained walls, and decay of finishes. It is exacerbated by poor ventilation (Curtis, 2007; Burns, 2010).

iii. Roof and Pipe Leakages

Faulty plumbing or damaged roofs can allow rainwater to enter building interiors. Poor roof slope, loose tiles, and improperly joined pipes contribute significantly to this issue (Gopal, 2015; Brett, 2004).

iv. Penetrating Damp: Occurs when water seeps through damaged or porous external walls. It often results from construction defects or weathering, and is driven by wind, pressure, and gravity (Marshall, 2003; Beall, 2000).

Causes of Dampness in Building

Numerous factors can contribute to dampness. Kportufe (2015) lists key causes such as rain penetration, high water tables, poor soil drainage, and climatic conditions. Suryakanta (2015) also notes design flaws, substandard materials, and poor workmanship.

Key causes include:

i. Improper Design

   Irregular forms and poor material choices increase the risk of moisture accumulation. Architects must factor in appropriate damp-proofing methods during the design stage.

ii. Environmental Conditions

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Wind, humidity, and temperature variations weaken building envelopes over time, especially during peak rainy seasons. These conditions increase thermal movement and stress on materials.

iii. Poor Workmanship
Deviations from specified standards—such as using thinner damp-proof courses—can render protection ineffective.

iv. Low-Quality Materials
Bricks, plaster, or concrete with poor density and high porosity enable water to travel easily through capillary action.

v. Inadequate Ventilation
Lack of proper airflow leads to condensation, which can intensify mold growth and create persistent damp conditions. Ventilation systems should have sufficient dehumidification capacity.

Effects of Dampness in Building

Hollis (2000) highlights the strong correlation between dampness and building deterioration. Dampness leads to: Decay of wooden elements, Corrosion of steel reinforcements, Staining and disfiguration of wall finishes, Efflorescence (white salt deposits) on walls, Damage to electrical systems and floor finishes, Unpleasant odours and poor indoor air quality, Structural weakening and eventual collapse. For instance, corrosion significantly reduces the ductility and bonding strength of steel-reinforced concrete, increasing the risk of collapse during stress events like earthquakes. Dampness is also a public health concern. It contributes to poor indoor air quality, respiratory issues, and what WHO refers to as "sick building syndrome."

Dampness Preventive Techniques in building:

Oxley (2011) defines damp-proofing as any method used to prevent moisture ingress into a structure. Effective strategies include: Proper Site Selection ie. Ensure water tables remain at least 10 feet below the surface, even during wet seasons.
Surface Drainage- Grade the ground away from the building to prevent water accumulation.
Roof Design- Provide sufficient slope and effective gutter systems to prevent leaks.
Surface Treatment: Using water-repellent coatings to seal surfaces (e.g., bitumen, silicates).
Integral Damp-Proofing: Adding waterproofing compounds to concrete mixes during construction.
Guniting/Shotcreting: Spraying high-strength cement mortar to seal vulnerable surfaces.
Pressure Grouting: Injecting cement-sand mix into structural cracks or voids.
Damp-Proof Courses (DPC): Installing impermeable layers in walls and floors to block moisture paths.

Research Method/Methodology

This section presents the responses of construction professionals regarding the perceived causes of dampness in selected faculty buildings at Enugu State University of Science and Technology, Agbani. The population for the study comprised the Registered professionals: Architects, Builders, Quantity Surveyors, and Estate valuers. This is because they are professionals that built the structure and know more about building. The random sampling technique was employed to select respondents a total of 197 population size. Taro Yamane (1967) formular was used to get the sample size of 131.

$N/1+n(e)^2$

$197/1+197(0.05)^2$

$197/1.4925=131$

A total of 131 questionnaires were distributed, of which 100 were returned fully completed and usable for analysis. Follow-up efforts were made to improve response rates, and confidentiality was assured to encourage honest participation.

Data were analyzed using the Relative Importance Index (RII) to rank the significance of each factor.

Results and Discussion of Findings

The perceived causes of dampness in the Faculty Buildings in ESUT are discussed in Table 1

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Table 1: Perception of Construction Professionals on the Causes of Dampness in Faculty Buildings at ESUT

Causes of Dampness	1	2	3	4	5	Efx	Fx	Mean	RII	Rank
Leakages from roof and plumbing system	0	3	12	27	58	440	100	4.4	0.88	1st
Rain penetration	0	2	15	33	50	431	100	4.3	0.86	2nd
Rising damp from roof and plumbing system	0	6	14	29	51	425	100	4.2	0.84	3rd
Defective construction	0	6	27	35	32	393	100	3.9	0.78	4th
Poor quality of materials	12	8	16	36	28	360	100	3.6	0.72	5th
Climatic condition leading to condensation	13	6	25	27	29	353	100	3.5	0.7	6th
Defective orientation of building	21	35	34	7	3	236	100	2.4	0.48	7th
Moisture trapped during construction	38	32	11	11	8	219	100	2.1	0.42	8th

Source: Researcher's field survey 2025

Key:
Scale: 1 = Very Insignificant, 5 = Very Significant
RII: Relative Importance Index

Interpretation of Results

From the table above, the top three most significant causes of dampness identified are:

i. Leakages from roofs and plumbing systems (RII = 0.88)
ii. Rainwater penetration (RII = 0.86)
iii. Rising damp from soil (RII = 0.84)

These three factors had an RII greater than 0.80, which indicates a very high level of significance. This suggests that moisture ingress from above and below the structure—due to poor roofing, plumbing issues, and capillary action—is a major concern in ESUT's faculty buildings.

Moderately significant factors (RII between 0.60 and 0.80) include:
Defective construction methods (RII = 0.78)
Poor quality materials (RII = 0.72)
Condensation from climatic conditions (RII = 0.70)

These were acknowledged by respondents as meaningful contributors to dampness but were ranked lower than the first three.

Lastly, two factors were found to have low significance (RII < 0.60):
Defective building orientation (RII = 0.48) and Moisture trapped during construction (RII = 0.42)

These results imply that while orientation and construction moisture can contribute to dampness, they are not primary concerns in the study area.

The Effects of Dampness in Building are discussed in Table 2

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Table 2: Effects of Dampness in Building

Effects of Dampness	1	2	3	4	5	Efx	Fx	Mean	RII	Rank
Causes softening, deterioration and peeling off of plaster	0	0	0	19	81	481	100	4.8	0.96	1st
Causes blistering of paint and disfiguration of walls	0	0	0	22	78	478	100	4.7	0.94	2nd
Reduces the whole life of the structure	0	0	0	24	76	476	100	4.7	0.94	2nd
Surface efflorescence	0	0	0	32	68	468	100	4.6	0.92	4th
Floors of buildings remains ugly since they cannot be cleaned well	0	0	1	41	58	457	100	4.5	0.91	5th
Causes corrosion of metals used in building construction	0	0	0	45	55	455	100	4.5	0.9	6th
Causes rots to the wooden members	0	0	12	30	58	446	100	4.4	0.88	7th
Destruction of carpets used on the floors of damp building.	0	0	15	35	50	435	100	4.3	0.86	8th
Destruction of electrical installations	0	2	10	54	34	420	100	4.2	0.84	9th
Mould growth	3	7	9	32	49	417	100	4.1	0.82	10th
Unpleasant smell and poor air quality.	2	13	25	30	30	373	100	3.7	0.74	11th
Unhygienic conditions	10	14	19	26	31	354	100	3.5	0.7	12th

Researcher's field survey 2025

Interpretation of Results

Out of the twelve effects assessed, ten items had an RII greater than 0.80, indicating a very high significance. Two items had an RII between 0.60 and 0.80, indicating a high but moderate significance. Most Significant Effects (RII ≥ 0.94):

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Deterioration and peeling of plaster (RII = 0.96), Blistering of paint and disfiguration of walls (RII = 0.94), Reduction in overall structural lifespan (RII = 0.94).

These were ranked as the most severe impacts of dampness. The findings align with literature stating that water ingress severely compromises the appearance and strength of building elements. Other Highly Rated Effects (RII 0.82 – 0.92): Salt deposits (efflorescence), floor deterioration, corrosion of metals, and wood decay were all ranked highly. These affect both the functionality and safety of the building environment.

Moderately Significant Effects:

Unpleasant smells and poor indoor air quality (RII = 0.74) and Unhygienic conditions (RII = 0.70). Although acknowledged as effects of dampness, these were perceived as less critical compared to structural or material damage.

The Preventive Measures for Dampness in Faculty Buildings at ESUT are shown in Table 3

Table 3 Analysis of Preventive Measures for Dampness in Faculty Buildings at ESUT

Preventive Measures for Dampness	1	2	3	4	5	Efx	Fx	Mean	RII	Rank
Provision of good roofing	0	0	10	29	61	451	100	4.5	0.9	1st
Integral water proofing treatment	0	0	12	28	60	448	100	4.4	0.89	2nd
Special constructional Technique	0	3	8	35	54	440	100	4.4	0.88	3rd
Avoidance of leakages of water pipes	0	1	16	29	54	436	100	4.3	0.87	4th
Provision of DPM	2	1	18	29	50	424	100	4.2	0.84	5th
Provision of DPC	1	3	19	37	40	412	100	4.1	0.82	6th
Surface treatment	5	7	33	25	30	368	100	3.6	0.73	7th
Avoidance of condensation	18	25	22	25	10	284	100	2.8	0.56	8th

Researcher's field survey 2025
Scale: 1 = Very Insignificant, 5 = Very Significant

Interpretation of Results

Highly Rated Preventive Measures (RII ≥ 0.80):

Provision of good roofing (RII = 0.90) was the highest-ranked measure, emphasizing the importance of sound roofing systems to prevent rainwater intrusion.

Integral waterproofing treatment (RII = 0.89) and special construction techniques (RII = 0.88) were also highly valued for preventing moisture ingress during construction.

Avoidance of plumbing leakages (RII = 0.87), DPM (RII = 0.84), and DPC (RII = 0.82) were similarly considered essential.

These six measures are considered very effective and form the core of moisture prevention strategies for buildings in the study area.

Moderately Effective:
Surface treatment (RII = 0.73) was rated lower, suggesting that while helpful, it may not be as reliable or durable as more structural methods like DPC or waterproofing.
Least Effective:
Avoidance of condensation received the lowest RII score (0.56), indicating that professionals consider it a less impactful solution in this context—likely due to the dominance of external water sources (rain, roof leaks) over internal moisture. The most critical causes of dampness identified were: Leakages from roofs and plumbing systems, Rainwater penetration through building envelopes, Rising dampness from soil. Conversely, the least significant causes identified were: Moisture trapped during construction, Defective orientation of buildings. These were considered relatively minor contributors to damp problems in ESUT's faculty buildings.

The data revealed that dampness has severe structural and environmental consequences, including: Peeling and deterioration of plaster, Paint blistering and wall disfiguration, Reduction of the building's structural lifespan, Surface efflorescence (salt deposits), Corrosion of metals and electrical system failures.

Less significant effects include: Unpleasant smells and poor indoor air quality (Unhygienic living/working conditions). These findings confirm that both the physical integrity of buildings and occupant well-being are compromised by dampness.

Preventive Measures

The most effective preventive strategies, as identified by respondents, include:

i. Provision of good roofing (RII = 0.90)
ii. Integral waterproofing treatments (RII = 0.89)
iii. Special construction techniques (RII = 0.88)
iv. Avoidance of plumbing and roof leakages (RII = 0.87)
v. Use of damp-proof membranes and courses (DPM and DPC) (RII ≥ 0.82)

On the other hand, avoidance of condensation was ranked the least significant preventive measure (RII = 0.56), indicating that external water sources are the dominant threat in this context rather than interior humidity or ventilation issues.

Conclusion

The research has revealed that the four most outstanding causes of dampness in some faculty buildings in Enugu state university of science and technology, Agbani are leakages from roof and plumbing system, rain penetration, and rising damp from soil. While the least significant impact in causing dampness in some faculty buildings in Enugu state University of science and technology are moisture trapped during construction and defective orientation of building.
Secondly, of all the twelve indices assessed as effects of dampness in building; ten were rated very high. This implies that these indices are very significant effects of dampness in some faculty building in ESUT Agbani. Therefore, the effects of dampness ranked accordingly are: Deterioration and peeling off of plaster; Blistering, bleaching of paints and disfiguring of wall; Reduces the whole life of the structure; surface efflorescence, causes rots to the wooden members; Destruction of floor carpets; Floors of the building remain ugly; Corrosion of metals used in building; Mould growth; Unhygienic conditions; Unpleasant smell and poor air quality. However, surface unhygienic conditions was recognized as an insignificant effect of dampness in building in some faculty in Enugu state university of science and technology, Agbani.
Thirdly, of all the eight preventive measures assessed in this research, six were rated very high as acceptable measures for dampness prevention in Agbani. These measures ranked in descending order of significance include: provision of good roofing; integral water proofing; special construction techniques; avoidance of leakage of water; provision of DPM and provision of DPC. However, only avoidance of condensation in building was rated very low. This is showing that; it is not a significant measure for damp prevention in the study area.

REFERENCES

Agyekum, K., and Ayarkwa, J. (2014). Dampness in walls of residential buildings: The views of building construction professionals in Ghana. *Africa Development and Resources Research Institute Journal, 7*(2) 19–36.

Agyekum, K. J., Ayarkwa, C., and Koranteng, C. (2013). Level of knowledge of building occupants on dampness in walls of residential buildings in Ghana. *Modern Management Science and Engineering, 1*(2), 1–16.

Agyekum, K. J., Ayarkwa, C., and Koranteng, C. (2014). Perceptions of building occupants on effectiveness of practiced damp remediation measures in Ghana. *Journal of Environment and Earth Science, 4*(1), 54–65.

Ahmad, A., and Abdul Rahman, F. (2010). Treatment of salt attack and rising damp in heritage buildings in Penang, Malaysia. *Journal of Construction in Developing Countries, 15*(1), 93–113.

Alhorr, M. (2016). Prioritizing project performance criteria within client perspective. *Research Journal of Applied Sciences, Engineering and Technology, 3*, 1142–1151.

Asamoah, A. S., Forson, A. G., and Boakye, D. A. (2012). A review of epidemiological studies of asthma in Ghana. *Ghana Medical Journal, 46*, 23–28.

Asamoah, R. O., John, S. A., Bannor, P., and Ofei-Nyako, K. (2017). Construction practices contributing to rising damp in Kumasi Metropolitan and Ejisu Municipal Assemblies in Ghana. *Journal of Construction Engineering*. https://doi.org/10.1155/2017/1562750

Beall, C. (2000). Water penetration in building envelopes. *RCI Interface*. http://www.rci-online.org/interface/2000-10-beall.pdf

Briffet, C. (1994). *Building maintenance technology in tropical climates: Investigating dampness problems in buildings*. Singapore: Singapore University Press.

Burkinshaw, R. (2010). The rising damp tests of Camberwell Pier: Potential height of moisture rise in brickwork and the effectiveness of a modern chemical injection cream damp coursing application. *Journal of Building Appraisal, 6*, 5–19.

Burkinshaw, R. (2012). Rising damp Part 1: Case study examples and Lambeth Pier test: How to isolate ground-sourced rising damp by Burkinshaw Method. *Journal of Building Survey, Appraisal and Valuation, 1*(1), 1–15.

Burkinshaw, R., and Parrett, M. (2004). *Diagnosing damp*. Coventry: RICS Book.

Burns, G. (2010). What is rising damp? Burns Property Care Services. http://burnspropertycare.com

Curtis, R. (2007). Damp causes and solutions. *Technical Conservation Research and Education Group*. Edinburgh: Historic Scotland, Longmore House, Salisbury Place, EH91SH. http://www.historicscotland.gov.uk

Gladstone, S. K. (2015). The devastating effect of rising damp in the construction industry. *Industrial Engineering Letters, 5*(10), 30–39.

Gunnbjornsdottir, M. I. (2006). Prevalence of respiratory symptoms in relation to indoor dampness: The Rhine study. *Thorax, 61*, 221–225.

Halim, A. A., Harun, S. N., and Hamid, Y. (2012). Diagnosis of dampness in conservation of historic buildings. *Journal of Design + Built, 5*. http://ejournal.um.edu.my

Haverinen-Shaughnessy, U. (2007). Moisture as a source of indoor air contamination. In *Proceedings: EnVIE Conference on Indoor Air Quality and Health for EU Policy, Helsinki, Finland, 12–13 June 2007*.

Hetreed, J. (2008). *Damp House: A Guide to the Causes and Treatment of Dampness*. London: Estates Gazette.

Hollis, M. (2000). *Surveying buildings*. Coventry: RICS Books.

Hollis, M. (2002). *Surveying buildings*. Coventry: RICS Books.

Hyvarinen, A. Teija M. and Asko V. (2002). Fungi and antinobacteria in moisture-damaged building materials: Concentrations and diversity. *International Biodeterioration and Biodegradation, 49*, 27–37.

Kothari, C. K. (2009). *Research methodology, method and techniques*. 2nd ed. New Delhi: Wishua Prakashan.

Kportufe, G. S. (2015). The devastating effects of rising damp in the construction industry. *Industrial Engineering Letters, 5*(10).

Mudarri, D., and Fisk, W. J. (2007). Public health and economic impact of dampness and mold. *Indoor Air, 17*, 226–235.

Nicol, S. (2006). The relationship between housing conditions and health — Some findings from The WHO LARES Survey of eight European cities. In *Proceedings of ENHR Conference Housing in an expanding Europe: Theory, Policy, Participation and Implementation, Ljubljana, Slovenia, 2–5 July 2006*.

Oliver, A. (2017). *Dampness in buildings*. BSP Professional Books. ISBN: 0-63201932-8.

Oxley, T. A., and Gobert, E. G. (2011). *Dampness in buildings*. 2nd ed. Oxford: Butterworth Heinemann.

Punima, I. A. (2008). *The repair and maintenance of houses*. London: Estates Gazette.

E-SSN: 3115-5456
10.36108/ijba/5202.10.0250

Riley, M., and Cotgrave, A. (2005). Dampness in buildings. Division of Sustainable Development. http://folders.nottingham.edu.cn

Rirsch, E., and Zhang, Z. (2010). Rising damp in masonry walls and the importance of mortar properties. *Construction and Building Materials, 24*(10), 1815–1820.

Suryakanta. (2015). Dampness in building — Causes, sources and effects. *CIVILBLOG.ORG*. http://www.civilblog.org

Suryakanta. (2017). 6 methods to prevent dampness in buildings. *CIVILBLOG.ORG*. http://www.civilblog.org

Trotman, P., Sanders, C., and Harrison, H. (2004). *Understanding dampness*. BRE Bookshop.

U. S. Environmental Protection Agency. (1991). *Building air quality: A guide for building owners and facility managers*. ISBN: 0-16-035919-8.

Ubi, O., Obun, and Agbor. (2020). Effect of damp and treatment methods on residential buildings in Calabar Metropolis of Cross River State. *International Journal of Research Granthaalayah, 8*(8), 372–376. https://doi.org/10.29121/granthaalayah.v8.i8.2020.1206

WHO Regional Office for Europe. (2009). *Damp and mould health risks, prevention and remedial actions: Information brochure*. Copenhagen: WHO.

Yang, D. Yui, P., and Liu, J. (1997). *Salt attack and rising damp: A guide to salt damp in historic and older buildings*. Red Rover Textprint. ISBN: 978-09805126-4-9.

Zeeshan, T. *(2016). Damp walls: Causes, effects and remedies. [Online] Your Article Library.* *http://yourarticlelibrary.com* *(Accessed 11 July 2017).*