

# An Analysis of the Role, Challenges, and Implications of Damp Proof Membrane in Nigerian Buildings

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## Abstract

Dampness remains a pervasive challenge in building construction, particularly within tropical and humid environments such as Nigeria. This article provides an intensive analysis of the role, implementation challenges, and consequences of inadequate damp proof membranes (DPMs) in Nigerian buildings. DPMs are critical barriers designed to prevent the ingress of moisture, predominantly through rising damp, from the ground into the building's superstructure. While their importance is globally acknowledged, their effective application in Nigeria is frequently hampered by a confluence of factors including insufficient awareness, cost-cutting measures, substandard materials, and poor installation practices. This paper explores the technical significance of DPMs, delineates the specific context of dampness in Nigerian construction, identifies the prevalent challenges, and discusses the far-reaching implications for structural integrity, occupant health, and economic sustainability. Recommendations for enhanced policy, education, quality control, and professional practice are proposed to improve DPM efficacy and foster more resilient and healthy built environments in Nigeria.

**Keywords:** Damp proof membrane, DPM, rising damp, Nigerian buildings, building construction, moisture control, structural integrity, building pathology.

## 1. Introduction

The integrity and longevity of any building are intrinsically linked to its ability to resist

environmental degradation, with moisture ingress being one of the most significant and persistent threats (Craven & Walker, 2011). Dampness in buildings is a global phenomenon, but its prevalence and impact are often exacerbated in regions characterized by high humidity, heavy rainfall, and specific geotechnical conditions, such as those found across much of Nigeria (Adekunle, 2018). The consequences of dampness extend beyond mere aesthetic discomfort, leading to serious structural damage, adverse health effects for occupants, and significant economic losses due to repair and depreciation (Baker, 2010). A critical intervention in the fight against dampness, particularly rising damp from the ground, is the installation of a Damp Proof Membrane (DPM). A DPM acts as an impermeable barrier within the building's substructure, preventing capillary action from drawing ground moisture upwards into walls and floor slabs (BS 8102, 2009). Despite its established importance in building science and codified construction standards internationally, the application and effectiveness of DPMs in Nigerian building practices often fall short of optimal requirements. This discrepancy contributes significantly to the widespread problem of damp buildings observable across various residential, commercial, and public structures in the country.

This paper aims to provide an intensive analysis of the role of DPMs in Nigerian buildings. It will elaborate on the technical necessity of DPMs in the context of Nigeria's

climate and soil conditions, investigate the common challenges encountered during their specification and installation, and critically discuss the multifaceted implications of their inadequate implementation. The ultimate goal is to generate a comprehensive understanding that can inform stakeholders – including policymakers, architects, engineers, contractors, and building owners – on strategies to improve the quality and performance of DPMs, thereby enhancing the durability and habitability of Nigerian built environments.

## 2. The Phenomenon of Dampness and the Role of DPMs

Dampness in buildings manifests in various forms, primarily as rising damp, penetrating damp, and condensation (Baker, 2010). While all types contribute to building decay, rising damp is directly addressed by DPMs and is particularly pertinent to foundation and ground floor structures. Rising damp occurs when ground moisture travels upwards through the porous materials of the building fabric, such as concrete, mortar, and bricks, via capillary action (Hall & Hoff, 2012). This phenomenon is driven by hydrostatic pressure and the minute pore structure within construction materials.

### 2.1. Mechanism of Damp Proof Membranes

A Damp Proof Membrane (DPM) is an impermeable material, typically a polyethylene sheet, bituminous membrane, or a liquid-applied coating, positioned within the floor slab and/or walls of a building at or below ground level. Its primary function is to create a continuous barrier that physically blocks the passage of moisture from the ground into the building's internal structure (British Standard 8102, 2009). The effectiveness of a DPM hinges on its impermeability, durability, and most crucially, its correct installation to form an unbroken seal.

Globally, building codes and standards mandate the inclusion of DPMs in new construction to mitigate the risks associated with ground moisture (e.g., International

Building Code, BS 8102). In tropical countries like Nigeria, where soil moisture content can be high due to heavy rainfall and often elevated water tables, the significance of an effective DPM is amplified (Olubunmi & Ojo, 2016).

### 2.2. Types of DPMs Relevant to Nigerian Context

Common DPM materials generally available or specified in Nigeria include:

- **Polyethylene Sheets:** High-density polyethylene (HDPE) or low-density polyethylene (LDPE) sheets are widely used due to their cost-effectiveness, flexibility, and ease of installation. They typically come in varying thicknesses (e.g., 250 microns/1000 gauge) and are laid under concrete slabs and within wall footings.
- **Bituminous Membranes:** These are typically asphalt-impregnated felts or polymer-modified bitumen sheets, often self-adhesive or heat-applied. They offer excellent waterproofing properties but can be more expensive and require specific application techniques.
- **Liquid-Applied Membranes:** These are coatings applied as a liquid that cure to form a seamless, flexible, waterproof barrier. While increasingly used for tanking and roof waterproofing, their application as primary DPMs under slabs is less common in typical Nigerian residential construction but holds potential for complex designs.

### Other damp proof Materials and their applications

#### 1. Flexible Materials

**Bitumen:** A petroleum byproduct applied hot as a coating or on mortar bedding, providing a flexible, water-resistant layer

- **Mastic Asphalt:** Semi-rigid asphalt mixed with sand, forming an impervious layer ideal for roof slabs, floors, or parapets
- **Bituminous Felts:** Sheets made from hessian or jute coated with bitumen, used as an effective barrier against damp for walls and roofs

- **Plastic sheets:** High-density polyethylene (HDPE) or polythene sheets, acting as waterproof membranes, commonly used under floors or concrete slabs
- **Metal Sheets:** Lead, copper, or aluminum sheets for sealing construction joints or forming damp-proof courses (DPC), often coated with bitumen for extra protection

## 2. Semi-Rigid Materials

- **Mastic and asphalt layers:** These materials provide a durable moisture barrier for areas that experience moderate movement or slight distortion, such as parapet walls and roof slabs
- **Combination sheets:** Lead foils sandwiched between bituminous felts offer cost-effective, durable, and highly impermeable DPC solutions

## 3. Rigid Materials

- **Bricks:** Special dense or treated bricks with low water absorption, used in horizontal or vertical DPC to prevent rising damp in walls
  - **Stones or Slates:** Dense stones like granite or trap laid as a two-course DPC, especially effective where high-quality stone is available
  - **Cement Mortar:** Mortar mixed with cement, sand, lime, and sometimes waterproofing additives to form a protective course on walls, floors, or external plaster
  - **Cement Concrete Layers:** Dense concrete layers (1:2:4 or 1:1.5:3 proportion) at plinth level or foundations, sometimes coated with bitumen, prevent capillary water rise
- Typical Applications
- **Walls:** DPM courses and membranes prevent rising and penetrating damp. Flexible materials like bitumen or bituminous felts are recommended, while damp-proof paint may allow internal wall breathability
  - **Floors and Slabs:** Plastic sheets, bituminous felts, or mastic asphalt serve as damp-proof membranes underground floors, protecting against rising moisture

- **Basements and Foundations:** Mastic asphalt, rich cement concrete, or metal sheets provide robust protection against groundwater ingress
- **Roof Parapets and Decks:** Mastic asphalt and flexible sheets accommodate slight structural movement while preventing water seepage
- **Bathrooms and High-Humidity Areas:** Water-resistant paints and damp-proof bricks help maintain hygiene and structural protection in consistently wet environment

## 3. The Nigerian Building Context and Dampness Challenges

Nigeria's geographical and climatic conditions present unique challenges for building construction, particularly concerning moisture management. The country experiences a tropical climate characterized by high temperatures, distinct wet and dry seasons, and often very high humidity (NiMet, 2020). Annual rainfall can be significant, especially in the southern regions, leading to saturated ground conditions for extended periods.

### 3.1. Climate and Geotechnical Factors

The high rainfall often results in elevated groundwater tables, making capillary rise a prominent concern. Furthermore, the diverse soil types across Nigeria, ranging from sandy loams to expansive clays, influence ground moisture movement. Clayey soils, prevalent in many urban centers, can retain significant amounts of moisture, contributing to persistent dampness (Owojori & Olayiwola, 2014). Without an effective DPM, this ground moisture readily penetrates the porous concrete foundations and walls.

### 3.2. Common Building Practices and Material Use

The Nigerian construction industry is characterized by a mix of formal and informal practices. While well-defined building codes and standards exist (e.g., National Building Code, 2007), their enforcement, particularly in the informal sector, is often lax (Ajayi & Aigbavboa, 2017). This leads to a situation where critical elements like DPMs are either

omitted, specified incorrectly, or installed poorly due to a combination of factors:

- **Cost-cutting:** Developers and private builders often prioritize immediate cost savings over long-term building performance, viewing DPMs as an 'unseen' and therefore expendable component.
- **Lack of Skilled Labour:** A significant portion of the construction workforce lacks formal training in modern building techniques, including the correct installation of DPMs.
- **Availability of Substandard Materials:** The market is often flooded with low-quality, thin, or easily degradable polyethylene sheets marketed as DPMs, which fail prematurely.
- **Design and Supervision Deficiencies:** Inadequate detailing by designers and insufficient supervision by qualified professionals during construction contribute to poor DPM execution.

#### 4. The Role of Damp Proof Membrane in Nigerian Buildings

Given the aforementioned context, the DPM plays an indispensable role in ensuring the durability and habitability of Nigerian buildings.

##### 4.1. Prevention of Rising Damp

The primary and most critical role of a DPM is to act as an impermeable barrier against rising damp from the sub-structure foundations and ground slab. By blocking capillary action, it prevents ground moisture from saturating walls, floors, and ultimately, the internal environment of the building (Craven & Walker, 2011). This is particularly vital in areas with high water tables or prolonged wet seasons.

##### 4.2. Protection of Structural Elements

Moisture ingress accelerates the degradation of building materials. Dampness can lead to the corrosion of steel reinforcement within concrete, compromising the structural integrity of foundations and slabs (Adekunle, 2018). It can also cause efflorescence (salt deposits) on internal and external wall surfaces, spalling of

plaster and paint, and the deterioration of mortar joints. A well-installed DPM protects these critical structural elements, extending the building's lifespan and reducing the need for costly repairs.

##### 4.3. Enhancement of Indoor Environmental Quality and Health

Damp environments are conducive to the growth of mold, mildew, and fungi, which release spores and volatile organic compounds (VOCs) into the air. These can trigger or exacerbate respiratory issues, allergies, asthma, and other health problems for occupants, particularly children and individuals with compromised immune systems (WHO, 2009). A functional DPM ensures a dry sub-floor and wall base, creating a healthier indoor environment. It also prevents the musty odors associated with dampness, improving comfort.

##### 4.4. Preservation of Building Aesthetics and Property Value

Damp patches, peeling paint, discolored plaster, and efflorescence significantly detract from a building's aesthetic appeal. Over time, these issues can lead to a substantial reduction in property value and marketability (Ayodele & Alabi, 2011). DPMs help maintain the pristine condition of finishes, protecting the visual and economic value of the investment.

##### 4.5. Improved Thermal Performance

Damp materials conduct heat more efficiently than dry materials. Walls saturated with moisture lose heat more rapidly, potentially increasing energy consumption for cooling in hot climates or heating in cooler seasons (Baker, 2010). A dry building fabric, facilitated by a DPM, contributes to better thermal insulation and energy efficiency, albeit its impact might be less pronounced in constantly hot climates compared to temperate ones.

#### 5. Challenges in DPM Implementation in Nigeria

Despite the clear benefits, the effective implementation of DPMs in Nigerian

buildings faces numerous systemic and practical challenges.

### 5.1. Lack of Awareness and Technical Knowledge

A significant challenge is the pervasive lack of awareness regarding the critical role of DPMs among various stakeholders. Many clients and even some non-specialist builders do not fully comprehend the long-term implications of omitting or poorly installing a DPM (Oluwakemi et al., 2015). Technical knowledge gaps extend to choosing the correct DPM type, specifying appropriate thicknesses, and understanding best practices for installation, such as overlapping and sealing joints properly.

### 5.2. Cost-Cutting and Value Engineering (Misguided)

The construction industry in Nigeria, particularly in the competitive private housing sector, is often driven by cost efficiency. DPMs, being concealed elements, are frequently perceived as an unnecessary expense that can be omitted or substituted with cheaper, substandard materials without immediate visible consequences (Adekunle, 2018). This short-sighted approach invariably leads to costly remedial works later.

### 5.3. Substandard Materials and Quality Control

The Nigerian market, like many developing economies, is susceptible to the proliferation of substandard building materials. Thin, fragile, or non-UV-stabilized polyethylene sheets are often sold as DPMs, which can easily tear during installation or degrade prematurely. A lack of stringent quality control or independent testing of materials at project sites exacerbates this problem.

### 5.4. Poor Installation Practices

Even when good quality DPMs is specified, their effectiveness is jeopardized by poor installation. Common errors include:

- **Inadequate Overlapping:** DPM sheets must overlap by a minimum specified length (e.g., 150-300mm), with joints

taped or sealed, to maintain continuity. This is frequently neglected.

- **Punctures and Tears:** Damage during concrete pouring or subsequent activities creates pathways for moisture.
- **Lack of Continuity:** Failure to link the DPM effectively with the damp proof course (DPC) in walls, or to provide a continuous barrier around services penetrating the slab, creates weak points.
- **Poor Surface Preparation:** Laying DPMs on uneven, rough surfaces without a sand blinding layer makes them vulnerable to punctures.
- **Insufficient Upstand:** The DPM should extend up against perimeter walls to connect with the vertical DPC, a detail often overlooked.

### 5.5. Regulatory and Enforcement Gaps

While the Nigerian Building Code (2007) mandates damp proofing, its enforcement is inconsistent across states and local government areas (Ajayi & Aigbavboa, 2017). Insufficient monitoring by regulatory bodies and a lack of accountability for non-compliance allow poor practices to persist. Corruption and bureaucratic bottlenecks can further undermine effective oversight.

### 5.6. Design Deficiencies

Sometimes, the DPM is inadequately detailed in architectural or structural drawings, or its integration with other building elements (e.g., utility penetrations, foundation-wall junctions) is not thoroughly considered. This leaves room for misinterpretation and poor execution on site.

## 6. Implications of Inadequate DPM

The failure to properly implement DPMs in Nigerian buildings results in a cascade of negative consequences that affect various aspects of the built environment and its occupants.

### 6.1. Accelerated Building Deterioration and Structural Weakness

Persistent dampness from rising moisture leads to the gradual breakdown of building



materials. Efflorescence, which is the crystallization of soluble salts on surfaces, not only disfigures but also causes the disintegration of plasters and paints (Hall & Hoff, 2012). More critically, moisture can penetrate concrete to the level of steel reinforcement, initiating corrosion that reduces the load-bearing capacity of structural elements over time, potentially leading to premature structural failure. The lifespan of the building is significantly shortened, demanding frequent and costly repairs.

### 6.2. Severe Health Risks for Occupants

The most insidious consequence of dampness is its direct impact on human health. Damp-induced mold and mildew growth release allergens, irritants, and sometimes toxic substances (mycotoxins) into the air. Exposure to these can lead to a range of health issues, including respiratory infections, exacerbated asthma, allergies, rhinitis, skin irritations, and headaches (WHO, 2009). In a country like Nigeria where health infrastructure is often strained, preventing such preventable illnesses through effective damp proofing is paramount.

### 6.3. Economic Losses and Reduced Property Value

The economic implications are substantial. Initial cost savings from omitting a DPM are quickly overshadowed by expenses for recurring damp-related repairs (re-plastering, repainting, mold remediation) (Ayodele & Alabi, 2011). Properties with visible signs of dampness fetch lower market values and are harder to sell or rent. The energy inefficiency resulting from damp walls can also subtly increase utility bills for occupants. Furthermore, the cost of extensive rectification, which may involve disruptive and expensive tanking or injection damp proofing, far outweighs the initial investment in a proper DPM.

### 6.4. Compromised Indoor Environmental Comfort

Beyond health, dampness creates an uncomfortable living and working environment. The characteristic musty odor,

cold and clammy surfaces, and visible stains degrade the overall quality of indoor spaces. This can affect mental well-being, productivity in workplaces, and the general satisfaction of home occupants.

## 7. Recommendations for Enhancing DPM Effectiveness in Nigeria

Addressing the challenges of DPM implementation in Nigeria requires a multi-pronged approach involving all stakeholders.

### 7.1. Enhanced Awareness and Education

- **Public Enlightenment Campaigns:** Government agencies and professional bodies (e.g., Nigerian Institute of Building, Nigerian Society of Engineers, Architects Registration Council of Nigeria) should conduct campaigns to educate homeowners and developers on the long-term benefits of DPMs.
- **Curriculum Development:** Integrate comprehensive modules on damp proofing, including DPM specification and installation, into tertiary education programs for architecture, civil engineering, and building technology, as well as vocational training for artisans.
- **Professional Training:** Organize regular workshops and seminars for practicing architects, engineers, contractors, and site supervisors on best practices for DPM installation, quality control, and troubleshooting.

### 7.2. Strengthening Policy and Enforcement

- **Review and Update Building Codes:** Ensure the Nigerian Building Code's provisions for damp proofing are explicit, comprehensive, and align with international best practices.
- **Robust Enforcement Mechanisms:** Implement stricter enforcement of building regulations by local planning authorities. This includes mandatory site inspections at critical stages (e.g., substructure construction) to verify DPM installation.
- **Accreditation and Certification:** Develop schemes for the accreditation of DPM

materials and certified installers, providing consumers with assurance of quality.

### 7.3. Quality Control and Material Standards

- **Material Specification:** Designers should specify DPMs based on recognized standards (e.g., BS EN 13967 for flexible sheets for damp proofing), including minimum thickness and material composition.
- **On-Site Testing:** Encourage basic on-site checks for DPM material quality and integrity before and during installation.
- **Supply Chain Regulation:** Implement measures to curb the influx and sale of substandard DPM materials in the market.

### 7.4. Professional Practice and Collaboration

- **Integrated Design:** Architects and engineers must collaborate closely during the design phase to ensure seamless integration of DPM with other building elements and services.
- **Detailed Documentation:** Provide clear, unambiguous drawings and specifications for DPM installation.
- **Competent Supervision:** Ensure adequate and competent site supervision by qualified professionals who are knowledgeable about DPM requirements and can oversee correct installation.
- **Ethical Practice:** Promote ethical conduct among professionals and contractors, discouraging the omission of DPMs for short-term cost gains.

### 7.5. Research and Development

- **Local Studies:** Conduct more research into the specific moisture characteristics of Nigerian soil types and climatic zones to inform context-specific DPM solutions.
- **Innovative Materials:** Explore the feasibility and performance of locally sourced or produced DPM materials that are cost-effective and environmentally sustainable.

## 8. Conclusion

The damp proof membrane is far more than an optional building component; it is a fundamental guardian of building health, structural integrity, and occupant well-being, especially within the challenging climatic and construction landscape of Nigeria. The pervasive issue of dampness in Nigerian buildings underscores a critical gap between the recognized importance of DPMs and their actual implementation. Challenges stemming from a lack of awareness, misguided cost-cutting, substandard materials, and poor installation practices have led to significant and often irreversible consequences, including structural decay, severe health risks, and substantial economic losses.

Addressing these challenges requires a concerted and collaborative effort from all stakeholders. By prioritizing robust education, stringent policy enforcement, rigorous quality control, and fostering ethical professional practices, Nigeria can significantly enhance the efficacy of DPMs in its built environment. Investing in proper damp proofing is not merely an expenditure; it is an essential investment in the long-term resilience, sustainability, and habitability of Nigerian buildings, ultimately contributing to a healthier and more prosperous society. The lessons learned from the implications of inadequate DPMs must serve as a catalyst for transformative changes in present and future construction practices across the nation.

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