

OPEN ACCESS

*Correspondence

Nwokonta Chigozie, Innocent

Article Received

09/10/2026

Accepted

13/10/2026

Published

14/10/2026

Works Cited

Nwokonta Chigozie, Innocent & Eguzouwa Chinemerem., (2026). The Use of Asphalt as a Damp-Proof Membrane Material in Building Construction. *Journal of Current Research and Studies*, 3(5), 70-77.

*COPYRIGHT

© 2026 Nwokonta Chigozie;

Innocent. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms

The Use of Asphalt as a Damp-Proof Membrane Material in Building Construction

Nwokonta Chigozie, Innocent ¹ & Eguzouwa Chinemerem²

¹Department of Architecture, Faculty of Environmental Studies, Abia State University Uturu, Nigeria.

²Department of Architectural Technology, School of Environmental and Design Technology, Ogonnaya Onu polytechnic Abia State Nigeria

Abstract

Moisture ingress represents one of the most insidious and structurally damaging phenomena in building construction. Without adequate protection, moisture compromises structural integrity, fosters indoor microbial growth, and diminishes thermal performance. Among the various mitigation strategies developed over the past century, asphalt has emerged as a premier material for damp-proof membranes (DPMs) and waterproofing systems. This paper provides a comprehensive examination of asphalt's physical and chemical properties, its appearance, color, and texture, and its various application methodologies in construction. Furthermore, the distinct advantages of asphalt over alternative waterproofing systems are critically evaluated through an academic lens, highlighting its enduring relevance in modern architectural engineering.

Keywords: Asphalt, damp-proof membrane, moisture ingress, waterproofing, building construction, material science.

1.0 Introduction

Moisture control is a foundational pillar of building physics and structural engineering. Water infiltration—whether originating from rising damp, penetrating damp, precipitation, or hydrostatic pressure from groundwater—poses a continuous threat to the durability of building envelopes. To interrupt capillary action and hydrostatic transmission, the installation of a continuous damp-proof membrane (DPM) or damp-proof course (DPC) is mandated by international building codes.

Asphalt, a complex mixture of dark brown-to-black bituminous materials, has historically served as a workhorse in civil engineering and architectural construction. Valued for its viscoelasticity, inherent hydrophobicity, and longevity, asphalt functions exceptionally well as a monolithic damp-proof membrane. This paper explores the material characteristics of asphalt, its practical applications in damp-proofing, and the distinct advantages that secure its status in contemporary construction methodologies.

2.0 Definition and Material Composition of Asphalt

In the context of building construction and waterproofing, asphalt is defined as a sticky, black, and highly viscous liquid or semi-solid form of petroleum, occurring naturally or produced as a residue from the fractional distillation of crude oil. Chemically, asphalt is composed primarily of high-molecular-weight hydrocarbons known as bitumens, which are dispersed within a continuous phase of malens and asphaltenes, combined with mineral aggregates, fillers, and polymers.

Asphalt (bitumen) is widely used as a damp-proof membrane because it forms a seamless, moisture-resistant barrier that stops capillary water movement through foundations and walls.

What Asphalt/Bitumen Does in Damp-Proofing

Bituminous damp proofing is an asphalt-based coating applied to below-grade walls and foundations to resist moisture migration and block capillary rise through porous materials such as concrete block or cast-in-place concrete Polyguard Products. It is not designed to resist hydrostatic pressure but is effective where soil moisture—not groundwater—is the concern.

Mastic asphalt, a refined form of asphalt with mineral fillers, is also recognized as a true DPM, used successfully for more than a century on major structures RJ Evans Flat Roofing Limited.

Asphalt differs fundamentally from coal tar (though both are bituminous), exhibiting superior resistance to ultraviolet degradation and atmospheric oxidation. When utilized for damp-proof membranes, asphalt is typically categorized into specific grades:

Mastic Asphalt: A dense, void less mixture of graded limestone aggregate and asphalt cement. Unlike pavement asphalt, mastic asphalt is formulated to be impermeable to both moisture and water vapor under hydrostatic pressure.

Oxidized (Blended) Asphalt: Produced by blowing air through hot petroleum residues, resulting in a rubbery, weather-resistant material commonly used in built-up roofing and membrane systems.

3.0 Appearance, Color, and Texture

The physical and sensory attributes of asphalt are distinct, serving both functional and diagnostic purposes during installation and post-construction inspections.

3.1 Color

Asphalt is universally characterized by its dark, monochromatic aesthetic. In its raw, unweather state, high-grade waterproofing asphalt exhibits a deep, lustrous black or very dark brownish-black coloration. This dark hue is attributable to the high concentration of complex aromatic hydrocarbons and asphaltenes. Over time, when exposed to solar radiation (ultraviolet light), surface oxidation may induce a dull charcoal-grey patina, though this oxidation is typically restricted to the outermost micro-layers and does not compromise the bulk material's waterproofing efficacy.

3.2 Texture

The texture of asphalt varies significantly depending on its formulation and temperature state:

Molten State: During application, heated mastic asphalt possesses a fluid, semi-viscous texture resembling a thick, glossy syrup or lava. It can be poured, screeded, or spread across horizontal and vertical planes.

Cured State (Mastic Asphalt): Once cooled and cured, asphalt presents a smooth, dense, and homogeneous texture. When finished by hand-rubbing or wood-floating, it exhibits a uniform, fine-grained matte or semi-gloss finish. It is entirely void of the rough, open-graded surface texture found in road-paving asphalt, ensuring that micro-voids capable of harboring capillary moisture paths are eliminated.

Types of Asphalt Materials Used as DPM

Cold-applied emulsified asphalt coatings — water-based, applied by brush, roller, or spray; low odor and VOC-compliant

Hot-applied asphalt — heated to fluid form and mopped on; strong adhesion but requires careful handling

Mastic asphalt — semi-rigid, perfectly impervious, and seamless; forms around complex details and is long-lasting

Bituminous felt or sheet membranes — flexible rolls sealed with bitumen; used on roofs and parapets

ASTM-classified asphalts — Types I, II, and III defined in ASTM D449 for damp proofing and waterproofing applications

4.0 Application Methodologies in Building Construction

The deployment of asphalt as a damp-proof membrane requires precise execution to ensure continuity, integrity, and bond strength with the substrate. The two primary methodologies utilized in building construction are mastic asphalt application and pre-formed bituminous membrane installation.

4.1 Mastic Asphalt Tanking and Damp-Proofing

Mastic asphalt is delivered to the construction site in solid blocks. These blocks are remelted on-site in specialized, mechanically agitated transporters or mixers (often referred to as asphalt boilers) at controlled temperatures ranging from 200°C to 230°C.

Substrate Preparation: The concrete or masonry substrate must be clean, dry, structurally sound, and primed with a bituminous primer to promote chemical and mechanical adhesion.

Application Process: The molten asphalt is ladled onto the substrate and spread manually using wooden floats (a process known as "asphalting" or "mastic application"). It is typically laid in multiple successive layers (often two layers totaling 20mm to 30mm in thickness) to eliminate any potential pinholes or faults. Joints between successive applications are meticulously lapped.

Vertical and Overhead Application: For basement tanking (resisting negative or positive hydrostatic pressure), vertical surfaces are coated using specialized grade mastics applied in multiple thin lifts, often supported by expanded metal lathing mechanically fixed to the substrate.

4.2 Pre-Formed Bituminous Sheet Membranes

In contemporary construction, modified asphalt is frequently manufactured into flexible sheets or rolls (polymer-modified bitumen membranes, such as SBS or APP modified sheets).

These membranes are applied via the torch-applied method (where a propane torch melts the underside of the roll as it is unrolled and bonded to the primed substrate) or the self-adhesive method (featuring a cold-applied pressure-sensitive adhesive backing).

They are deployed extensively beneath floor slabs, behind retaining walls, and as damp-proof courses (DPCs) in masonry cavity walls.

How Asphalt DPMs Are Applied

Surfaces must be clean, dry, and free of laitance or release agents to ensure adhesion

Coatings are applied in uniform, continuous layers without pinholes

Mastic asphalt tanking may be applied internally or externally to create a seamless waterproof lining for basements and retaining walls

Protective boards or screeds are often added to prevent damage during backfilling

Where Asphalt DPMs Are Used

Below-grade foundation walls and footings

Basements and retaining walls (tanking systems)

Roof slabs, parapets, and flat roofs (bituminous felt or membranes)

Floors, balconies, and moisture-prone areas

Historic and modern buildings (mastic asphalt DPMs)

5.0 Advantages of Asphalt as a Damp-Proof Membrane

Asphalt possesses a unique constellation of chemical and physical properties that render it exceptionally advantageous as a damp-proof membrane material compared to polyethylene, PVC, or liquid-applied polyurethane alternatives.

Advantages of Asphalt as a DPM

Seamless and fully bonded, reducing leak paths.

Impervious to moisture, preventing damp penetration.

Durable and long-lasting, especially mastic asphalt.

Resistant to soil salts and suitable for buried environments.

Environmentally friendly options, such as carbon-zero mastic asphalt.

Cost-effective compared to full waterproofing systems.

5.1 Absolute Impermeability

The fundamental requirement of a DPM is resistance to water and water vapor. Mastic asphalt is, by design, a void less solid. Because the mineral filler tightly packs within the asphalt cement matrix, it achieves a hydraulic conductivity approaching zero. It prevents both liquid water transmission and moisture vapor diffusion, acting as an absolute barrier.

5.2 Monolithic Continuity

Unlike sheet membranes that rely on glued, taped, or heat-welded seams—historically the weakest points in a waterproofing envelope—mastic asphalt is applied in a molten state. As successive spreads cool and fuse, they form a continuous, seamless, monolithic blanket across the entire floor plate or structural shell. This eliminates vulnerability to seam failure and root or pressure penetration at joints.

5.3 Durability and Longevity

Asphalt is chemically inert, resistant to soil acids, alkalis, and salts commonly found in foundation sub-grades. It does not rot, biodegrade, or hydrolyze when continuously exposed to moisture. Properly installed asphalt damp-proof membranes frequently outlast the design life of the building itself, often performing without failure for 50 to 100 years.

5.4 Self-Healing and Viscoelastic Properties

Because asphalt is a viscoelastic material, it possesses a limited capacity to accommodate minor structural movements, thermal expansions, and micro-cracking of the substrate without fracturing its waterproof barrier. Furthermore, under slight compressive loads, warm asphalt exhibits self-healing characteristics, sealing minor abrasions or stresses autonomously.

5.5 Versatility and Adaptability

Asphalt can be molded to irregular geometries, penetrations, corners, and angles with absolute fidelity. Whether applied to horizontal floor slabs, vertical foundation walls, inverted roofs, or complex architectural curves, molten asphalt conforms precisely to the substrate, eliminating air pockets that could otherwise accumulate condensation

Stages in the preparation of Asphalt

Asphalt pavement construction typically follows a multi stage process that includes planning, site preparation, base installation, binder and surface layers, compaction, and finishing.

1. Planning and Site Evaluation

A project begins with site evaluation, soil assessment, drainage planning, and material selection

Contractors inspect soil quality, existing pavement, and required pavement thickness to ensure proper design.

2. Site Preparation and Demolition

This stage includes clearing debris, removing old pavement, grading, and establishing proper slope for drainage.

Proper drainage prevents water damage and premature pavement failure.

3. Sub Base / Base Layer Installation

A crushed stone or gravel base is placed and compacted to form a stable foundation

Key tasks include:

- Spreading aggregate evenly
- Compacting to required density
- Ensuring correct thickness based on traffic loads

A strong base prevents settlement, cracking, and potholes.

4. Tack Coat or Bonding Layer

Before asphalt is applied, a tack coat—a thin layer of liquid asphalt—is sprayed to ensure bonding between layers. This prevents slippage and improves waterproofing.

5. Binder Layer Installation

The binder course is the first asphalt layer placed over the base. It contains larger aggregates and provides structural strength

It is:

- Spread by a paving machine
- Compacted with rollers to achieve density

6. Surface Layer (Wearing Course) Installation

The surface course is the final asphalt layer, made of finer aggregates for a smooth, durable finish.

This layer:

- Provides skid resistance
- Withstands weather and traffic
- Is spread and compacted to the specified thickness

7. Compaction

Compaction occurs at multiple stages and is essential for pavement longevity. Rollers compress the asphalt to remove air voids and achieve required density.

Improper compaction leads to early cracking and moisture infiltration.

8. Finishing and Curing

Final steps include:

- Smoothing surface imperfections
- Forming butt joints and transitions to existing pavement
- Allowing the asphalt to cool and cure before opening to traffic

9. Quality Control and Inspection

Post construction testing ensures the pavement meets specifications. Tests include:

- Density and compaction checks
- Thickness verification
- Surface smoothness and drainage evaluation

6.0 Limitations and Mitigation

Despite its profound advantages, asphalt DPMs present certain operational challenges:

Thermal Sensitivity: Unmodified asphalt can soften at elevated temperatures (leading to flow or creep on vertical surfaces) and become brittle at very low temperatures. Mitigation: Modern formulations incorporate polymers (e.g., SBS - Styrene-Butadiene-Styrene) to stabilize the thermal performance window.

Application Hazards: The application of hot mastic asphalt requires specialized skilled labor, high-temperature equipment, and stringent occupational health and safety protocols to mitigate burn risks and fume inhalation.

Limitations and When Asphalt Should Not Be Used

Bituminous coatings cannot resist hydrostatic pressure and may fail where groundwater is present.

They do not bridge cracks or self-heal like elastomeric membranes.

Temperature swings and UV exposure can degrade coatings before backfilling.

Bituminous felt does not withstand heavy structural movement.

Where high water tables, clay soils, or poor drainage exist, full waterproofing membranes are required instead of simple asphalt damp proofing.

Asphalt damp proofing is moderately effective for blocking soil moisture and vapor, but not effective against liquid water or hydrostatic pressure, so its performance depends heavily on-site drainage and soil conditions.

What Asphalt Dampproofing Does Well

Asphalt-based damp proofing is designed to resist moisture migration through concrete by stopping capillary water movement.

It forms a thin, continuous coating that reduces water vapor transmission into basements.

When paired with good drainage and well-drained soils, it performs reliably as a basic moisture barrier.

It meets minimum building code requirements for foundations not exposed to groundwater pressure

What Asphalt Dampproofing Cannot Do

It is not waterproofing and is not designed to stop liquid water.

It cannot resist hydrostatic pressure from groundwater.

It will not bridge cracks that form in concrete walls; the coating is brittle and fractures with movement.

It deteriorates faster when exposed to temperature swings or UV before backfilling.

Overall Effectiveness Rating (Based on Field Use & Standards)

Condition	Effectiveness of Asphalt Damp proofing
Moisture vapor only	Good – slows vapor transmission
Capillary moisture (no pressure)	Good – intended purpose
Light incidental moisture	Fair – works if drainage is excellent
Hydrostatic pressure	Poor / Fails – not designed for this
Crack bridging	Poor – brittle, does not self-heal

Why Effectiveness Depends on Site Conditions

Asphalt damp proofing works only when water is not allowed to accumulate against the foundation.

Sources emphasize that it is suitable only where soil moisture is present but groundwater pressure is not.

If drainage fails or heavy rain saturates the soil, the coating can allow leaks or fail entirely.

When Asphalt Dampproofing Is Appropriate

Well, -drained granular soils.

Low water table.

Unfinished basements or crawlspaces.

Foundations where only minimum code compliance is required.

Projects where cost is a major factor (asphalt is inexpensive and easy to apply).

When It Should Not Be Used Alone

Clay soils that hold water.

High water table sites.

Finished basements or living spaces.

Any location where hydrostatic pressure is possible.

Foundations prone to cracking or movement.

7.0 Conclusion

Asphalt remains one of the most reliable, durable, and scientifically robust materials for damp-proof membrane construction. Its dense, monolithic structure, combined with absolute impermeability to water and water vapor,

provides infallible defense against moisture-induced structural degradation. While modern polymer-modified sheets and liquid coatings offer installation shortcuts, traditional mastic asphalt and advanced bituminous membranes continue to set the industry benchmark for long-term sub-structure waterproofing and damp-proofing engineering.

References

- 1) Bleszynski, J. (2018). *Waterproofing and Damp-proofing in Building Construction*. London: Construction Press.
- 2) British Standards Institution. (2020). *BS 8210: Code of practice for mastic asphalt in building and civil engineering*. London: BSI.
- 3) Illston, J. M., & Domone, P. L. J. (2010). *Construction Materials: Their Nature and Behaviour* (4th ed.). Spon Press.
- 4) Lagaros, N. D., & Papadrakakis, M. (2012). *Structural Integrity and Durability of Building Materials*. Elsevier Science.
- 5) Schunck, E., Oster, H. J., & Schüssler, R. (2003). *Roof Construction Manual: Pitched Roofs*. Birkhäuser.
- 6) White, R. F. (2015). *Building Physics: Heat, Air and Moisture: Fundamentals and Engineering Methods with Examples and Exercises*. Wilhelm Ernst & Sohn.