

# Analytical Study of Swimming Pool Waterproofing

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**Abstract**—A swimming pool must be both structurally strong and properly waterproofed to ensure safety, durability, and long-term performance. Structurally, the pool walls and base must withstand soil pressure, hydrostatic forces, and the continuous loading from stored water. Any weakness in concrete quality, reinforcement detailing, or joint design can lead to cracking, deformation, or even structural failure. Cracks not only compromise stability but also create direct pathways for water leakage. This is why reinforced concrete pools must be designed for crack control, adequate thickness, proper concrete mix, and reinforcement placement to resist both internal and external pressures.

Equally important is the waterproofing system, which protects the structure from water loss, moisture ingress, and chemical attack. Swimming pools operate under constant water pressure, so even small defects in waterproofing can lead to significant leakage, deterioration of concrete, and corrosion of reinforcement. Modern waterproofing systems such as HDPE membranes below the raft, SBS membranes on external walls, and PU or flexible cementitious coatings internally offer superior crack-bridging ability, durability, and resistance to aggressive pool chemicals. Proper detailing at joints, pipe penetrations, and corners is essential to maintain a continuous waterproof barrier. When both strong structural design and high-quality waterproofing are integrated, the swimming pool performs efficiently, remains hygienic, and minimizes maintenance costs. Failure in either component can lead to expensive repairs, operational disruptions, and long-term structural damage. Therefore, ensuring structural integrity and selecting an appropriate waterproofing system are critical components in the successful construction and service life of any swimming pool.

## I. PROBLEM STATEMENT

A proposed new construction of a swimming pool at the new and upcoming project. Analyse the current trends of waterproofing and old trends.

This situation created multiple challenges such as:

- Larger area of construction
- Uplift pressure on the swimming pool with moderate environmental conditions
- Continuous Supervision
- Work slow-down and delays in project timeline and climate condition
- Future chances of seepage & damp issues in the raft after completion
- Possibility of long-term maintenance cost and repairs

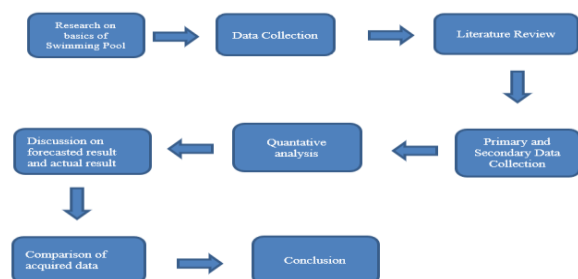
Therefore, a proper construction procedure is required to avoid cost overruns, construction delays, and safety hazards, while ensuring long-term structural durability.

## II. OBJECTIVES:

Following is the objective of the Project Objectives

1. To understand new trend material requirements and specifications of the established material
2. To provide guidelines and performance indicators for improved waterproofing in swimming-pool projects.
3. To compare old trends of construction and new trends of construction with waterproofing through various methods such as quality time and construction cost.

## III. METHODOLOGY



Case Study: Water Proofing Works at LODHA Bellavita NIBM, Pune.

Waterproofing Material and Equipment Specifications.

1. HDPE Sheet

High-Density Polyethylene (HDPE) sheets are widely used for waterproofing and containment applications because of their excellent chemical resistance, durability, and impermeability. Below is a detailed overview of HDPE sheet specifications, properties, and applications related to waterproofing.

Rate as per current market- 650/- per sq. m



Figure 1 HDPE Sheet

Property	Typical Range / Value	Test Standard / Notes
Thickness	0.5 mm – 3.0 mm (common for waterproofing)	ASTM D5199
Width	1 m – 8 m (custom rolls available)	–
Length per Roll	50 m – 200 m (varies by thickness)	–
Density	≥ 0.94 g/cm <sup>3</sup>	ASTM D1505
Tensile Strength at Yield	≥ 16 MPa	ASTM D638
Elongation at Break	≥ 700%	ASTM D638
Tear Resistance	≥ 93 N	ASTM D1004
Puncture Resistance	≥ 480 N	ASTM D4833
Water Permeability	≤ 1.0 × 10 <sup>-13</sup> cm/s (essentially impermeable)	ASTM D5084

UV Resistance	> 90% retained strength after 1600 hrs exposure	ASTM D4355
Chemical Resistance	Excellent against acids, alkalis, and salts	–
Temperature Range	-40°C to +80°C	

2. Sewell Water Bar

A swellable water bar is a pre-formed sealing profile installed at construction joints (new-to-old concrete, casting joints, penetrations) which reacts with water/moisture and expands (swells) to fill the joint gap and any micro-cracks, thereby creating a waterproof seal. They are used in cast-in-situ concrete, pre-cast elements, retaining walls, basements, tunnels, etc. Size of the bar is 10mmx10mmx20mm. Rate as per current market- 450/- per running meter



Figure 2 Water Sewel Bar

Key functions:

- Provides a positive seal when water attempts to ingress.
- Can compensate for micro-movements/cracks at construction joints.
- Simplifies waterproofing compared to fully liquid membranes in certain joint conditions.

3. Styrene-Butadiene-Styrene modified bituminous membrane (SBS)

- BS Modified Bituminous Membrane is a flexible, torch-applied or self-adhesive waterproofing sheet made from bitumen modified with SBS polymer and reinforced with polyester or fiberglass.
- It combines the waterproofing qualities of bitumen with the elasticity, flexibility, and durability of synthetic rubber (SBS polymer).

- Current rate as per current market is 850/- per sq. m zone at the raft edge or transition area.
- Surface preparation: Extend HDPE sheet beyond raft; clean and dry the concrete surface above termination.
- Primer: Apply bituminous primer on concrete (not on HDPE).
- Termination bar: Fix HDPE termination bar or metal strip at top edge of HDPE sheet with sealant.
- SBS laying: Torch or stick SBS membrane onto the primed concrete, overlapping the HDPE termination by ~150 mm.
- Seal joint: Apply PU or bituminous mastic sealant along the interface between SBS and HDPE.



Figure 3 Bitumen Primer



Figure 4 SBS Sheet

#### 4. Polyurethane Magnum

Polyurethane (PU) waterproofing for swimming pools is a liquid-applied elastomeric membrane system used to create a seamless, flexible, and waterproof barrier over concrete surfaces. It protects the pool structure from water leakage, chemical exposure, and structural movement while providing strong adhesion and long-term durability under submerged conditions.



Figure 5 PU Coating

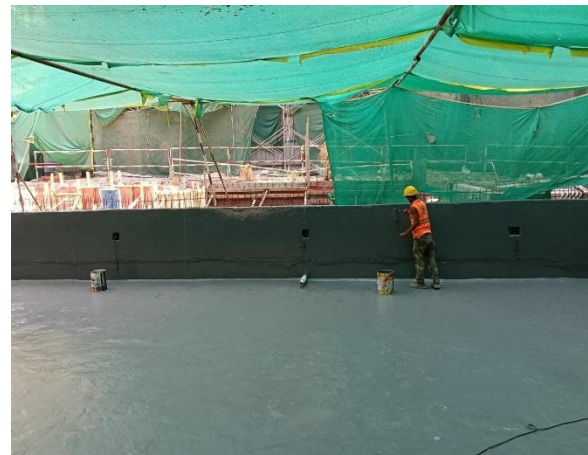


Figure 6 PU Coating Application

#### 5. Geo-textile Fleece of 200 GSM

A 200 GSM fleece is a non-woven fabric material weighing 200 grams per square meter, commonly used in waterproofing and construction applications. It acts as a protective and separation layer for waterproof membranes, helping to prevent punctures, abrasion, and mechanical damage. The fleece also improves the durability and performance of waterproofing systems by providing cushioning and support. In swimming pool construction, 200 GSM fleece is often installed above or below waterproof membranes to enhance protection and ensure long-term waterproofing efficiency.

#### 6. Repair Polymer

Asian Paints Repair Polymer is a polymer-modified repair compound used for repairing and strengthening damaged concrete and plaster surfaces. It improves bonding, durability, water resistance, and crack resistance in repair works such as patch repairs, floor repairs, waterproofing preparation, and restoration of concrete structures.

IV. RESULTS & CONCLUSION

Quality and Durability analysis with old trend and new trend of waterproofing

Category	Old Waterproofing Methods	Modern Waterproofing Systems
Typical Products	Cementitious waterproofing slurry, bituminous primer, acrylic coatings, integral waterproofing compounds	HDPE sheet membranes, SBS modified bituminous membranes, PU Magnum Fleece etc
System Type	Brush/roller applied (liquid or slurry)	Sheet membrane (pre-applied, torch-on, or self-adhesive)
Bond to Concrete	Depends on surface; prone to blistering	Fully bonded membrane systems (no water tracking)
Crack Movement	Cannot accommodate structural movement	Can stretch/flex with structural movement
Leak Detection	Very difficult once tiled	Leak test possible before screeding or tiling
Chemical Resistance	Degrades in chlorinated pool water	HDPE is inert and highly chemical resistant
Maintenance	Needs bonding coat; risk of delamination	Compatible with protection screed before tile laying

Cost analysis with old trend and new trend of waterproofing

For example, Pool size considered: 30 ft × 15 ft × 5 ft average depth (~42 m<sup>2</sup> water surface). Costs using old conventional RCC method:

RCC walls + PCC base

Brick bat coba or cementitious slurry waterproofing

Cement plaster + tiles OR pool paint (old method)

Construction cost analysis of the Swimming Pool using the old trend of construction.

Component item	Cost Range (current market range)
RCC Structure	3.5 Lakhs to 5.1 Lakhs
Waterproofing (brick bat coba)	80,000/- to 1,40,000/-
Plastering	60,000/- to 85,000/-
Finishing	80,000/- to 1,10,000/-
Plumbing	70,000/- to 1,20,000/-
Filtration	50,000/- to 70,000/-
Electrical	30,000/- to 45,000/-
Decking	70,000/- to 1,80,000/-
Total	Approx 9,22,000/-

Maintenance Cost analysis of the above-mentioned Swimming Pool constructed by the old trend.

Component Item	Cost range (current market range)
Crack Repairs	5,000/- to 10,000/-
Tile regrouting	20,000/- to 30,000/-
Tile debonding	10,000/- to 12,000/-
Brick bat coba injections	7,000/- to 10,000/-
Recoating of Waterproofing areas	17,000/- to 25,000/-
Leak detection test	5,000/-
Total	Approx. 77,000/-

Maintenance Cost analysis of a Swimming Pool Constructed by the New Trends.

Component Item	Cost range (current market range)
Maintenance Component	Estimated Cost Range (INR)
Minor Crack Inspection & Repairs	2,000/- to 5,000/-
Joint Sealant & Swellable Bar Maintenance	3,000/- to 6,000/-
Tile Regrouting	8,000/- to 15,000/-
PU Coating Touch-Up	8,000/- to 15,000/-
HDPE/SBS Membrane Inspection	3,000/- to 5,000/-
Leak Detection Test	3,000/- to 5,000/-
Plumbing & Filtration Minor Repairs	8,000/- to 12,000/-
Periodic Cleaning & Chemical Maintenance	12,000/- to 20,000/-
Electrical Maintenance	2,000/- to 5,000/-
Total Estimated Annual Maintenance Cost	Approx. 69,00/-

Construction cost analysis of the Swimming Pool using the new method of construction with waterproofing membranes.

Component item	Cost Range (current market range)
RCC Structure	3.5 Lakhs to 5.1 Lakhs
HDPE Sheet	19,000/-
Swellable Bar at Const. Joint	13,000/-
SBS membrane	68,000/-
PU coating	56,000/-
Plastering	60,000/- to 85,000/-
Finishing	80,000/- to 1,10,000/-
Plumbing	70,000/- to 1,20,000/-
Filtration	50,000/- to 70,000/-
Electrical	30,000/- to 45,000/-
Decking	70,000/- to 1,80,000/-
Total	Approx 12,76,000/-

### V. CONCLUSION

- The construction of a reinforced concrete swimming pool requires a balanced integration of structural engineering principles and advanced waterproofing techniques to ensure long-term performance.
- Structural integrity forms the foundation of a durable swimming pool.
- Properly designed concrete sections, adequate reinforcement, and controlled crack widths help resist soil pressure, hydrostatic forces, and continuous water loading.
- Without structural robustness, waterproofing systems may fail due to movement, cracking, or deformation of the substrate.
- Waterproofing is not merely a finishing activity but a critical protective layer for the structure.
- Effective waterproofing prevents leakage, preserves the structure, and improves serviceability.
- Modern waterproofing systems such as HDPE membranes, SBS membranes, and PU coatings provide superior performance compared to traditional cementitious methods.
- Advanced waterproofing systems offer better flexibility, chemical resistance, and crack-bridging capabilities.
- Proper application, detailing, joint treatment, and quality control are essential for effective waterproofing performance.
- Modern membrane systems significantly reduce seepage, maintenance problems, and structural deterioration.
- The success and longevity of a swimming pool depend on the combined performance of sound structural design and reliable waterproofing systems.
- Poor performance in either structural design or waterproofing can lead to leakage, costly repairs, and operational issues.
- Adoption of modern waterproofing technologies and good construction practices is essential for constructing durable and leak-free swimming pools.

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