



ADVANCEMENTS IN WATERPROOFING TO WATERPROOFING SYSTEMS

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Introduction To **Waterproofing Systems**



What Is **Waterproofing** And Why It Is Done?



Why it is required if
I have done concreting?



Not Water tight or Gas tight

What Is **Waterproofing** And Why It Is Done?

- According to ASTM D 1079:
Waterproofing is the treatment of a surface to **prevent** the passage of liquid in presence of hydrostatic pressure.
- **Waterproofing** is the process of making an object or structure waterproof or water-resistant so that it remains relatively unaffected by water or resisting the ingress of water under specified conditions
- Waterproofing is prevention of water and vapour ingress. It's helpful in filling structural cracks and overall protection of structure





Golden Rules In Waterproofing

- ✓ Waterproofing is 3-5% of the construction cost still most sensitive. Cost cutting on waterproofing always end up in spending five to ten times for rectification
- ✓ Do it first time right.
- ✓ All waterproofing products are good. Selection of the right product and the right applicator ensures performance & durability of waterproofing system
- ✓ Waterproofing is always an '**Applicator's Job**' and success of waterproofing purely depends on the applicator.
- ✓ **Reliability and competency** of applicator is of extreme importance, which depends on:
 - ✦ Skilled workmen for installation
 - ✦ Machinery strength
 - ✦ Experience of jobs

Areas For Waterproofing

Basements and retaining walls

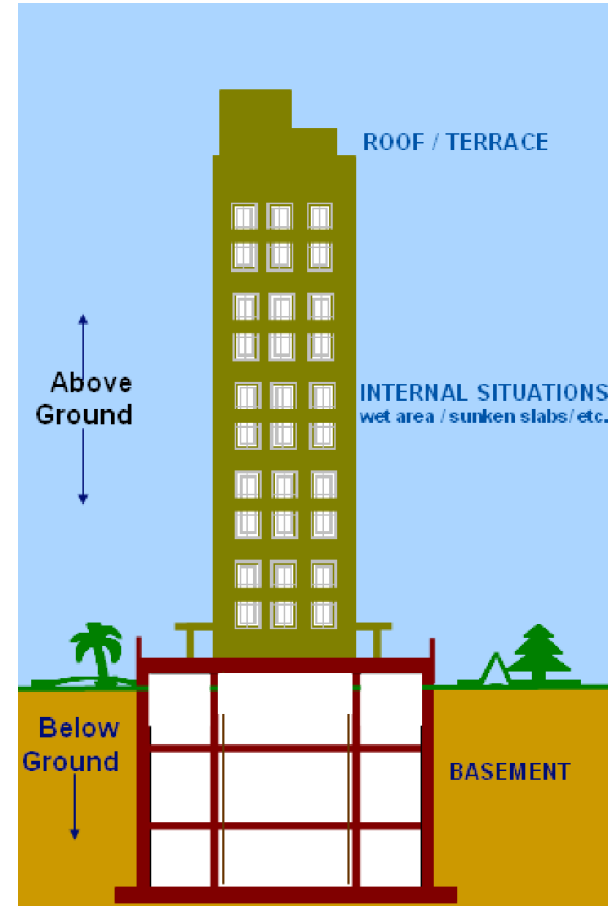
Kitchen, bathroom and balcony

Podium/landscape

Roof/terrace garden

Swimming pool

Water tank etc.



Substructure Waterproofing





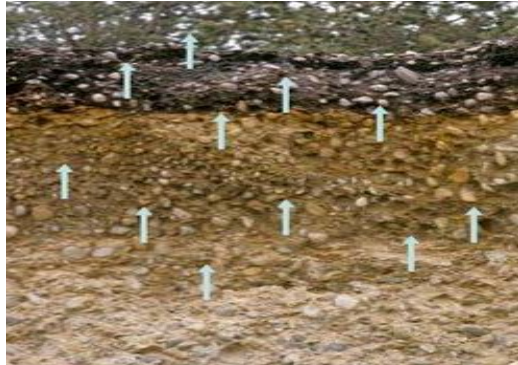
Sources of Leakage



Can You Guess???



Sources of Leakage



Subsoil water rising by capillary action



Defective structural design



Improper construction methodology



Basement Waterproofing Systems

Conventional System

- Cuddapah Stones
- Shahabad Ladi

Crystalline System

- Dry shake
- Admixture
- Slurry

Preformed Membranes

- APP
- SBS
- PVC/TPO
- EPDM
- BENTONITE
- HDPE

Basement Waterproofing - Conventional system

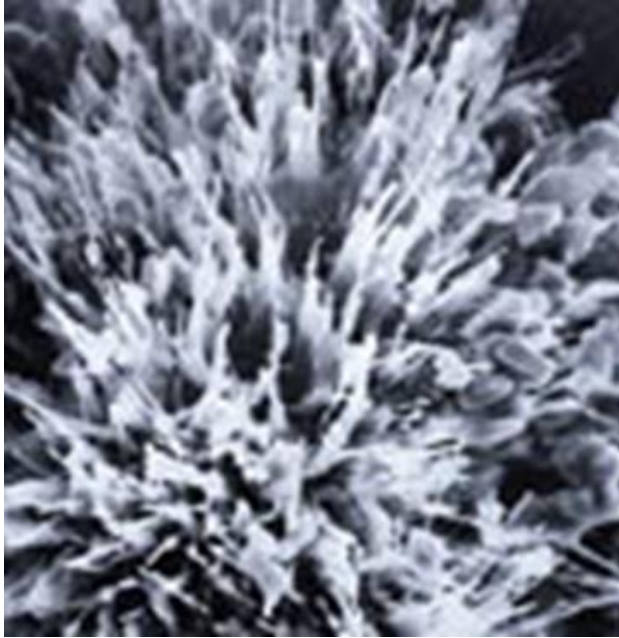
Shahabad Stones



Cuddapah Stones

- Only a pressure reducing system (**Not a waterproofing system**)
- Water finds its way through the joints filled with CM
- Chances of leakages are more if joints are not grouted properly
- Rigid stones in nature - will not accommodate the movement in subsoil
- Resists sub soil settlement to some extent
- Labour intensive work- requires more time for installation
- Chances of health hazards

Basement Waterproofing - Crystalline System



Active chemicals react with the moisture in fresh concrete with the by-products of cement hydration to cause a catalytic reaction, which generates a **non-soluble crystalline formation** through the pores and capillary tracts of the concrete and seals the pores.



Basement Waterproofing - Crystalline System

- Crystalline waterproofing is a process where the active ingredients in a crystalline product react with the free lime and moisture in the concrete to form crystals within the capillary system of the concrete.
- Effectively fills any micro cracks, pores and capillaries inside the concrete with an insoluble crystalline formation that prevents water and water-borne chemicals from entering
- Products are available in two application methods – it can be applied by **Surface Application** or by adding into the concrete, like an **Admixture**.



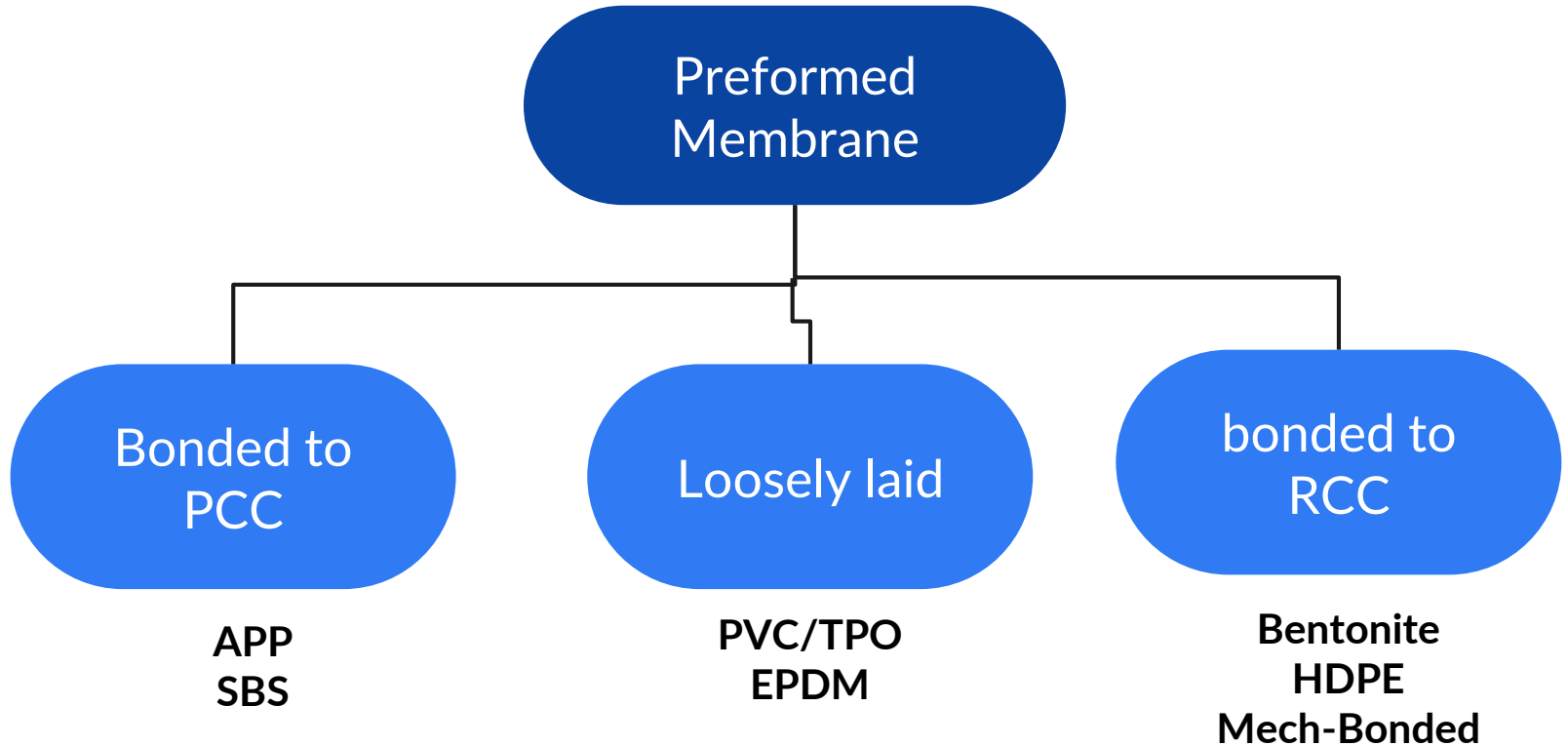
Basement Waterproofing - Preformed Membrane

- A waterproofing membrane is laid onto a surface to prevent water leaks or damage as well as making it easy to maintain
- Prefabricated membranes come in the form of rolls. These are unrolled and laid on a firm surface.





Basement Waterproofing - Preformed Membrane



Basement Waterproofing - APP

- APP membrane, or **Atactic Polypropylene Membrane**, is a special waterproofing material that is manufactured from Bitumen [Atactic polypropylene modified bituminous membranes]
- Fully bonded to PCC
- APP membranes provide superior tensile strength while maintaining critical flexibility
- App membranes are fixed using gas burners



Basement Waterproofing - SBS



- SBS, also known as [Styrene-Butadiene-Styrene](#), refers to the type of polymers that are added to the asphalt.
- SBS is a thermoplastic elastomer that's resistant to harsh abrasions, making it an extremely long-lasting membrane when blended with bitumen, also known as asphalt.
- Fully bonded to PCC.
- Torch applied and cold applied systems are available
- Non reinforced and Reinforced versions are also available .
- Ideal for both raft/pile foundations and for isolated footings.

Basement Waterproofing - EPDM

- EPDM stands for **Ethylene Propylene Diene Monomer**
- EPDM is an elastomeric polymer synthesized from ethylene, propylene and a small amount of diene monomer, compounded with carbon black, processing oils and various cross-linking and stabilizing agents.
- This is a rubber membrane sheet which can be easily spread over the area. It provides very high flexibility and durability





Basement Waterproofing - PVC



- **PVC, Polyvinyl Chloride waterproofing membrane** is a modern roofing/waterproofing material, which is made of high quality flexible (plasticized) polyvinyl chloride
- It is easy to install, water resistant and vapor permeable
- This is a stable, flexible membrane providing high mechanical strength.

Basement Waterproofing - TPO

- **Thermoplastic olefin**, thermoplastic polyolefin (TPO), or **olefinic thermoplastic elastomers** refer to polymer/filler blends usually consisting of some fraction of a thermoplastic, an elastomer or rubber, and usually a filler
- Outdoor applications such as roofing frequently contain TPO because it does not degrade under solar UV radiation, a common problem with nylons. TPO is used extensively in the automotive industry.



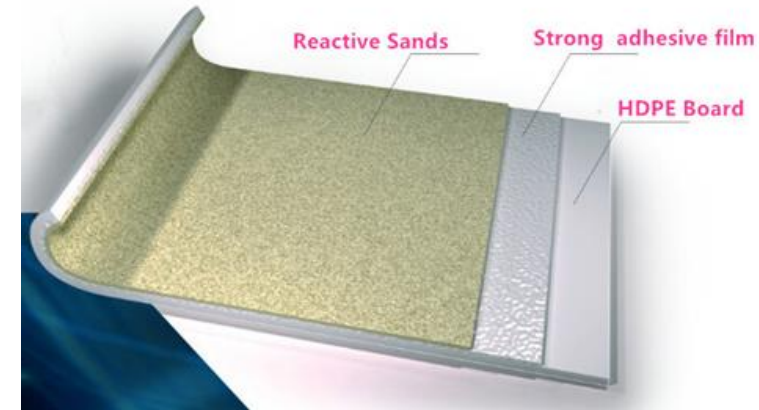
Basement Waterproofing - Bentonite

- Bentonite waterproofing membrane is a high performance self swelling, self healing waterproofing membrane.
- The bentonite used in its manufacture is capable of repeated cycles of wetting and drying without deterioration of its sealing properties and has a higher life expectancy



Basement Waterproofing - HDPE

- HDPE Membranes are based on **High-Density Polyethylene** material, designed to provide water and water vapour protection to water excluding structures, securing concrete from aggressive ground salts and chemicals related corrosion
- Comprises of a HDPE layer, pressure sensitive adhesive (PSA) layer, which is covered by a weather-proof protective layer of sand or acrylic layer
- Enables the membrane bond to underside of the concrete

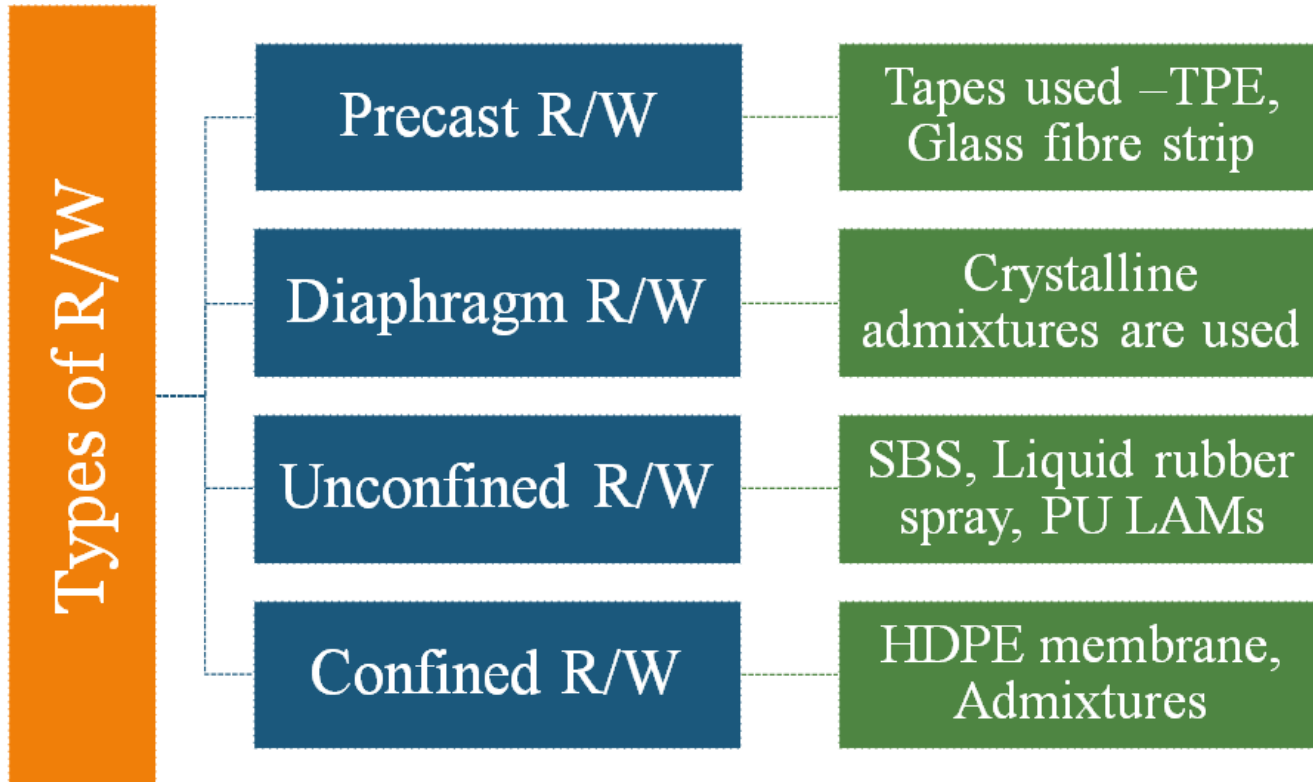


Retaining Wall Waterproofing

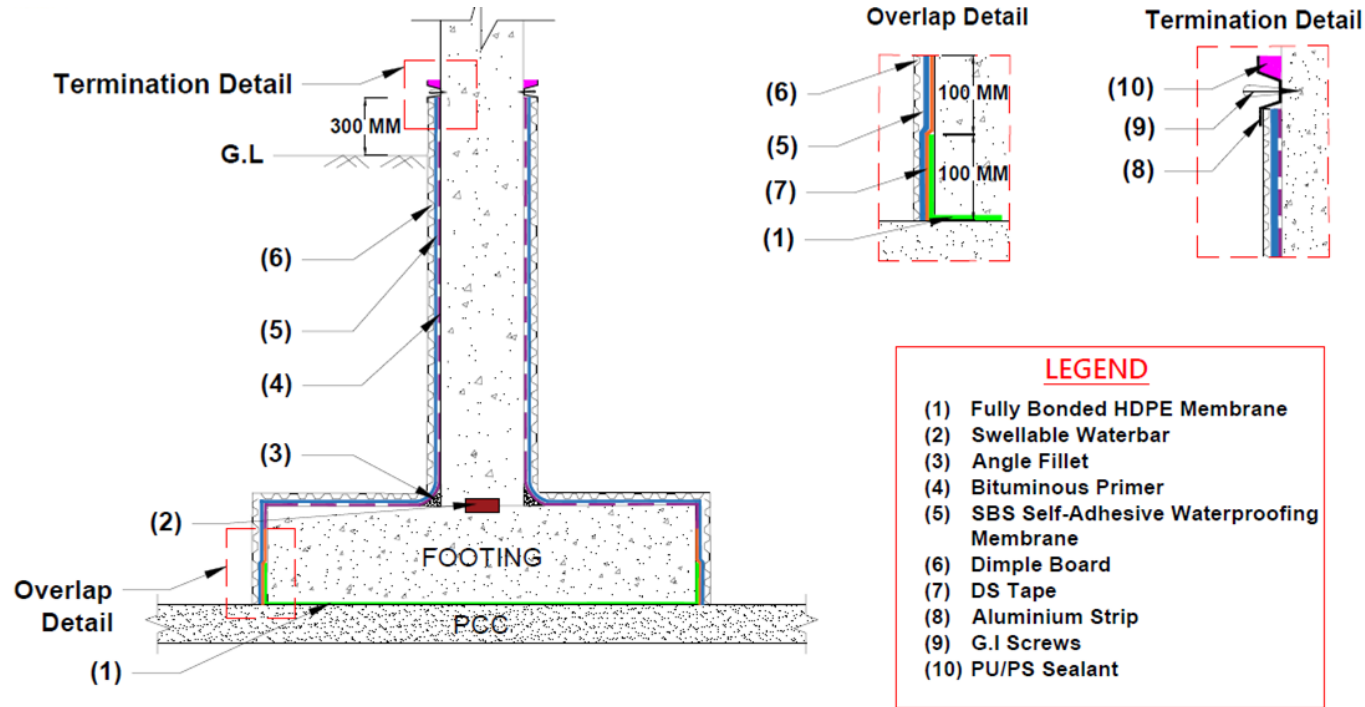


**What are the different types of
Retaining wall?
Can you list them?**

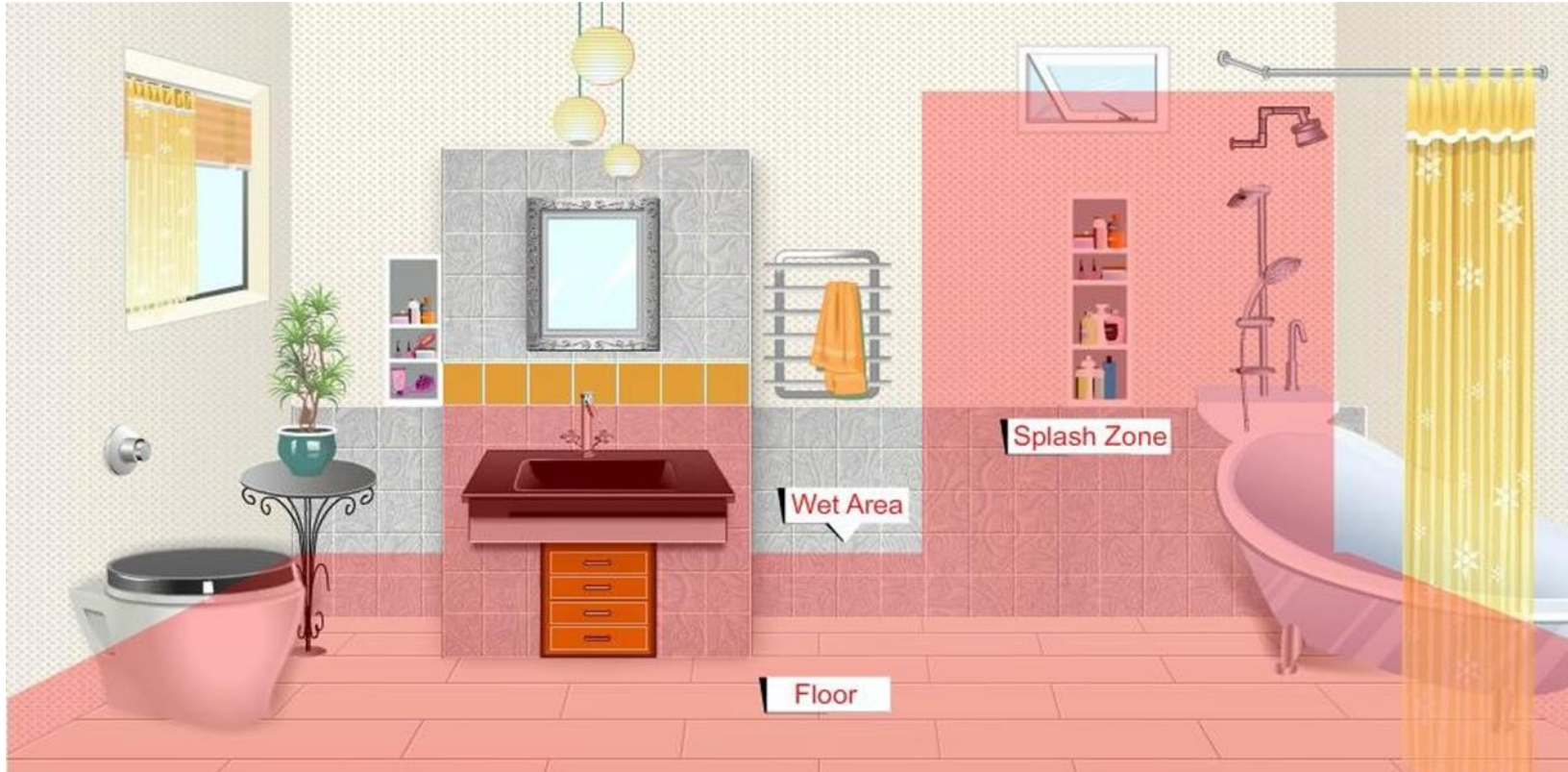
Retaining Wall Waterproofing



Sectional Drawing For Isolated Footing



Wet Area Waterproofing



Do you know?



Cost of good waterproofing @ Rs. 60/sq.ft, considering 50 sq.ft area/toilet, would be around Rs. 3000 which is less that the cost of a good tap for the toilet.



Importance Of Wet Area Waterproofing



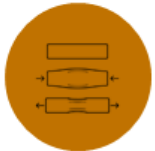
Presence of moisture throughout the year



Vertical areas exposed to water, up to shower height, causes dampness



Waterproofing Constraints



Concreting limitations and cracks

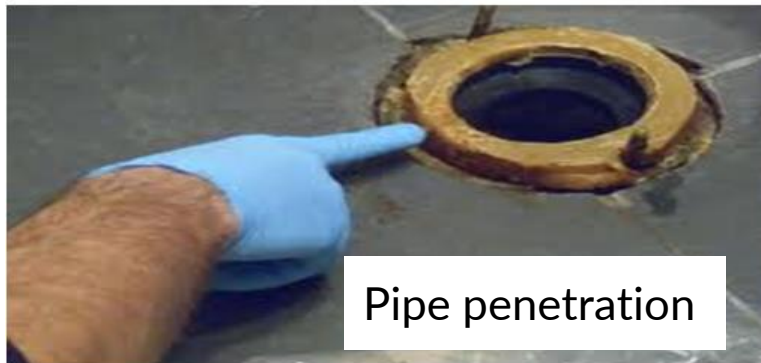
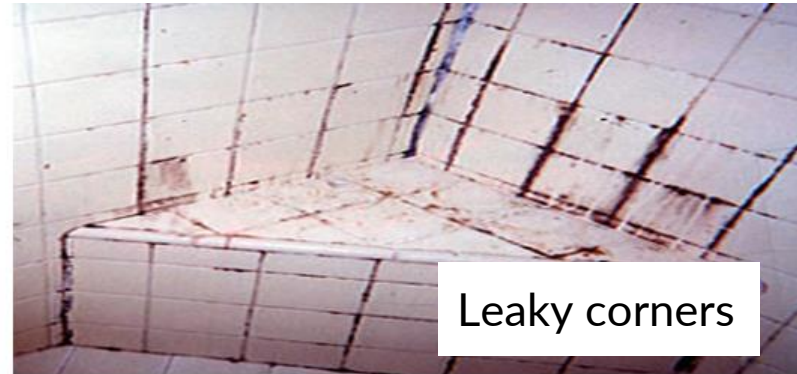


Better Adhesion to substrate, avoiding lateral migration



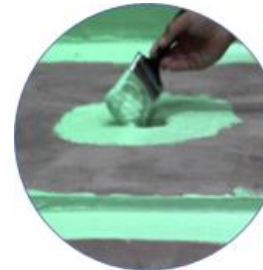
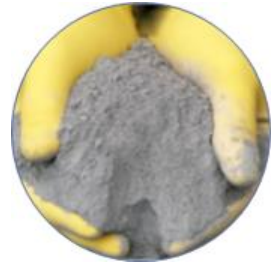
Compatibility to protection systems.

Chances Of Failure In Wet Area



Wet Area Waterproofing - Product Range

- Polymer Modified Waterproof Coating
- Crystalline Admixture/ Coating
- Acrylic Cementitious Coating
- Polyurethane coating
- Water Based Copolymer Coating



Features And Limitations Of These Systems

- **POLYMER CEMENT COATING**

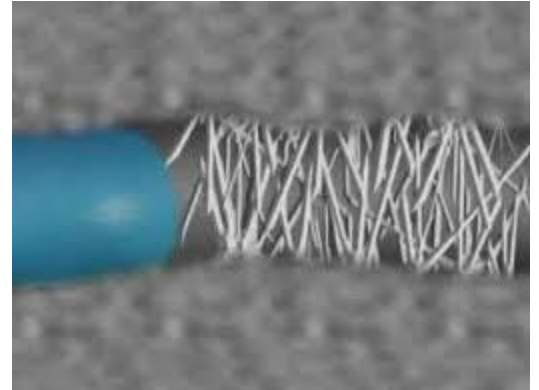
- Based on modified styrene butadiene or acrylic latex that provides waterproofing property
- Strengthens bonding of new and old concrete & plaster
- Enhances strength & water resistance of repair mix-concrete & mortar
- Generally used for waterproofing small roof terraces, sunken portions of toilets
- Very low elongation property. Does not address the shrinkage issues of cement.



Features And Limitations Of These Systems

- **CRYSTALLINE SYSTEM**

- Forms integral part of concreting.
- Does not address the shrinkage of cement.
- Crystal size is less than 500 microns. Concreting in wet area will have quality issues due to space constraint and curing challenges.
- Does not form any physical barrier
- Uniform distribution is not possible
- Performance depends on the concrete quality.



Features And Limitations Of These Systems

- **ACRYLIC CEMENTITIOUS COATING**

- Compensates shrinkage
- Polymerizes the cement present in the compound
- Does not depend on moisture for curing
- Does not require a primer for application and can be applied in damp condition as it needs pre-wetting for better performance.
- Dilution reduces system performance
- Possesses moderate elongation & correct mixing of components is critical for success. Select material with higher elongation for better polymer content



Features And Limitations Of These Systems

- **POLYURETHANE COATING**
 - Good tensile strength and elongation.
 - Suggested for large areas
 - Forms seamless membrane without any joints
 - But, Depends on moisture for curing
 - More curing time is required, in the absence of ventilation
 - Chances of dust accumulation is more.
 - Presence of moisture during application is a problem.



Features And Limitations Of These Systems

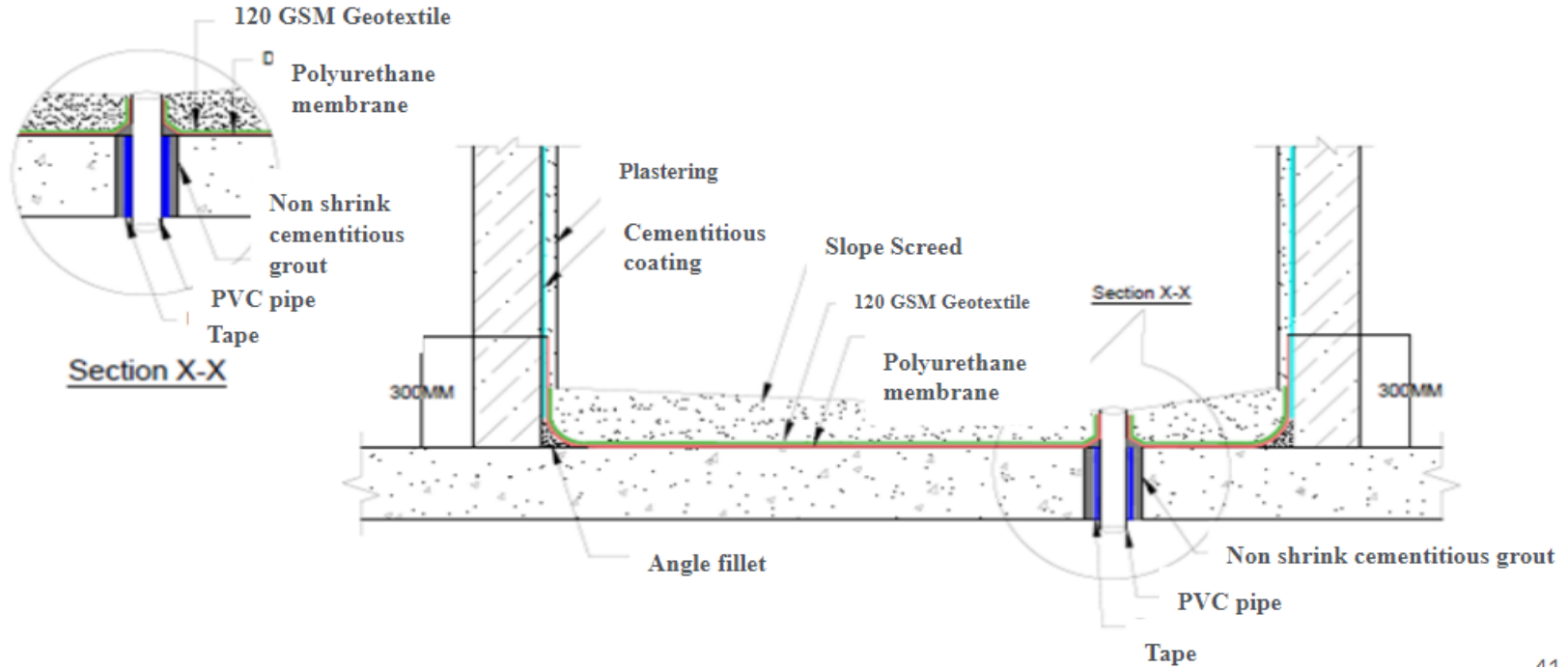
- **WATER BASED POLYMER COATING**
 - Easy to apply
 - Compatible with tile adhesives
 - Can be applied for modular toilets
 - Can be applied for shower area
 - Better technical properties as compared to cementitious systems
 - Does not depend on moisture for curing
 - Faster curing
 - Lesser chances of dilution



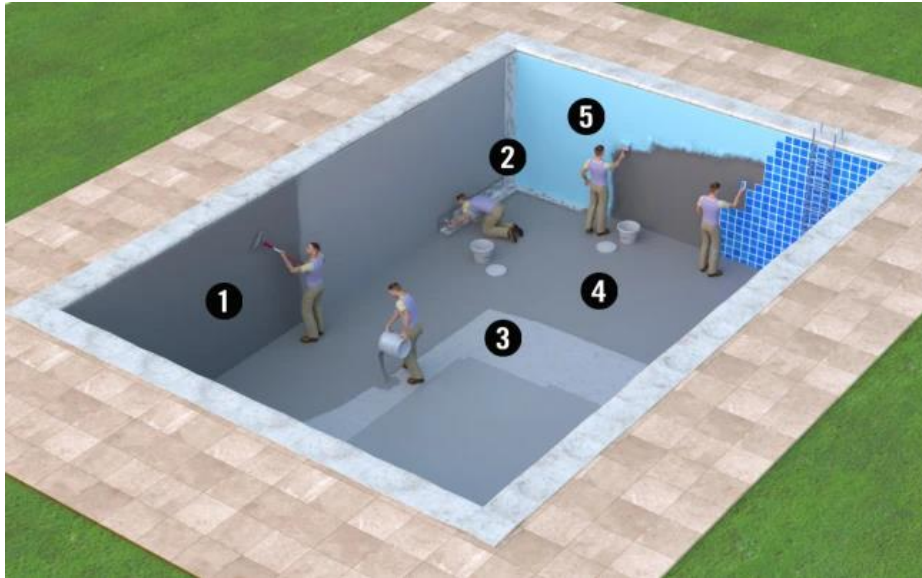


Wet Area / Toilet Waterproofing - System Drawing

Flat
slabs



Tank Waterproofing

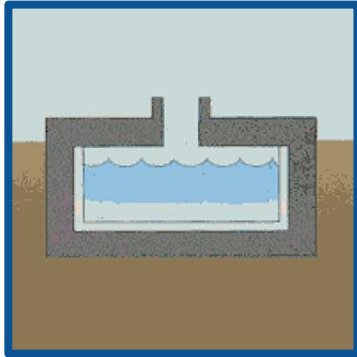


Types Of Water Tank

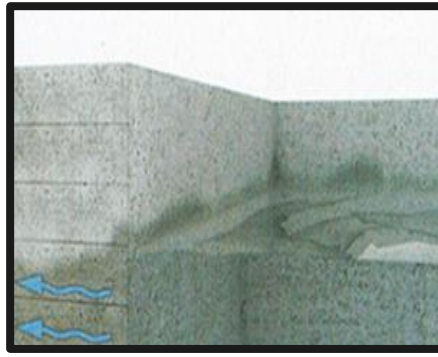
1. Raw water tank
2. Fire water tank
3. Drinking water tank
4. STP/ETP
5. Overhead Water tank



Need for Proper Waterproofing System



Structural
Damage



The materials
cannot assure
waterproof



Water tank structure
is not rigid hence
makes it prone to
water ingress when
structure slightly
moves



Waterproofing
product must be
compatible with
drinking water

Limitations Of Concrete Water Tank



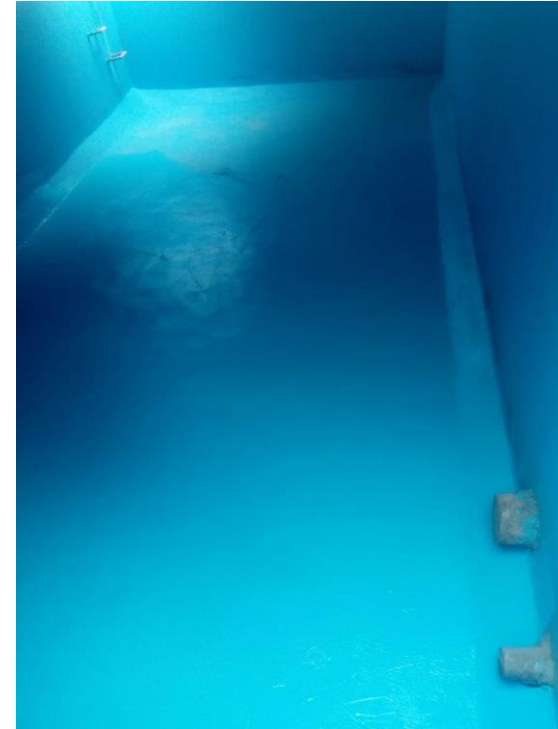
- Workability issues resulting in higher porosity and poor quality of concrete.
- Higher chances of water presence and water pressure.

Consequences Of Poor Waterproofing



Tank Waterproofing - Systems

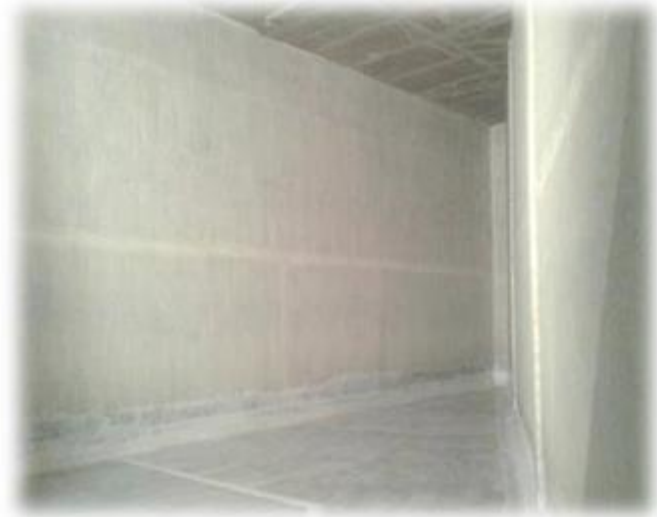
1. Two component acrylic cementitious system
2. Crystallisation systems
3. 100% solids PU systems
4. Epoxy Polysulphide systems
5. Polyurea
6. Water based epoxy systems
7. Coal tar epoxy systems



Tank Waterproofing - Systems

1. Epoxy polysulphide waterproofing

- Combines the features of epoxy and polysulfide to produce a tough and flexible waterproofing membrane
- Excellent abrasion and chemical resistance.
- Non-toxic and complies with BS 6920 Part 1-2000
- No primer is required. Easy to apply with roller, brush or airless spray.
- High bond strength to a variety of substrates.



Tank Waterproofing - Systems

2. Two component high performance seamless polyurethane waterproof coating

- Tensile strength > 6 MPa
- Good adhesion to concrete
- Resistance to hydrostatic pressure >13 bar
- 100% solid content - does not sag while application
- Does not require a primer for application and can be applied in dry condition
- Does not require machines for application, can be applied by brush, roller or towel
- Does not require any protective screed or plastering



3D View of Tank Waterproofing



Terrace/Roof Waterproofing



Terrace/Roof **Waterproofing**

Why we need terrace/roof waterproofing??

- Porosity of concrete
- Cracks on the terrace area mainly causes the leakage issues.
- These cracks are mainly due to exposure to
 - Atmosphere
 - Rain
 - Heat
 - Cold/snow
 - Wind and Dust
 - UV Rays etc





Terrace/Roof Waterproofing

Importance of terrace/roof waterproofing??

- Construction of allied support system after the waterproofing
- Inability to repair during rainy season
- Challenges for Re-waterproofing/Re-roofing at a later stage



Concerns / Problems



Water Leakage ???



Heat Gain ???



Poor Application???



Time ???



Accountability ???



Terrace / Roof Waterproofing - Benefits

- Safeguards the structural integrity of the building
- Provides higher value to the property
- Provides a protection against heat, provides cooler comfort overall resulting in Energy efficiency
- Simplified and reduced maintenance needs and related costs
- Prevents future leaks
- Protection against water ingress



Places Vulnerable To Leakages

At joints. Corners and details



Traditional Sheet Membranes do not adequately address these...

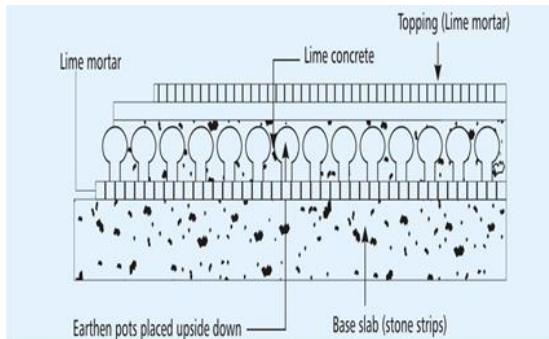
Roof Waterproofing - Conventional System



China Mosaic



Lime surkhi



W/P WITH LIME CONCRETING & INSULATION WITH EARTHEN POTS

Mud phuska



Brick bat coba

Terrace / Roof **Waterproofing** - Product Range

1. Preformed membranes
 - a. APP
 - b. SBS
 - c. PVC
 - d. TPO
 - e. EPDM etc
2. Acrylic & cementitious coatings

3. PU LAM's
 - Polyurethane
 - Polyurea



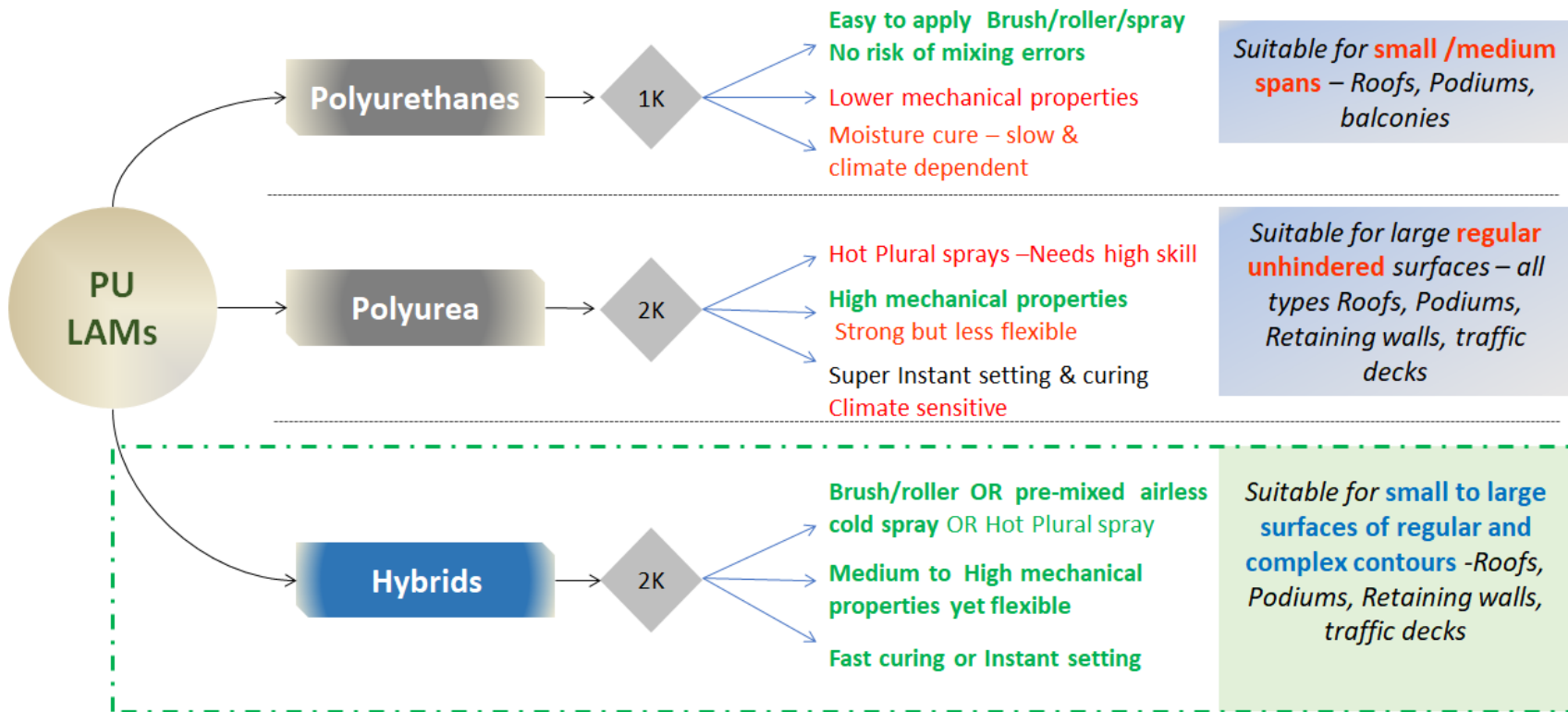


Terrace / Roof **Waterproofing** - Product Range

Liquid applied membrane waterproofing

- This method is more flexible than cementitious waterproofing
- Fluid-applied waterproof products are liquid coatings containing a base of urethanes, rubbers, plastics, vinyls, polymeric asphalts, or combinations thereof, which are applied to the surface usually by spraying or rolling
- The fluid-applied membranes are easy to apply, conform to the surface texture and irregularities of the concrete and do not have seams

Terrace / Roof Waterproofing - Product Range



Terrace / Roof **Waterproofing** - Product Range

Polyurethane

- Has good tensile and elongation properties and also can bridge cracks up to 2mm.
- Can adapt to any surface.
- When applied, forms a seamless membrane without any joints.
- Even if the membrane gets damaged, can be easily repaired locally.



Terrace / Roof **Waterproofing** - Product Range

Polyurethane

- Depends on moisture for curing
- Requires substrate moisture less than 8% before application of PU Coating.
- Requires a protection layer/ UV resistant topcoat.
- There are chances of dust accumulation and polyurethane coatings have a tendency of absorbing the dust



Terrace / Roof **Waterproofing** - Product Range

Polyurea

- Has good tensile and excellent elongation properties to take care of the thermal stresses and dynamic loading.
- Being an instant setting membrane, it does not depend on moisture for curing.
- Forms a seamless membrane without any joints.
- Application is fast as it is spray applied and can cover large area in a single day with skilled technicians for application.



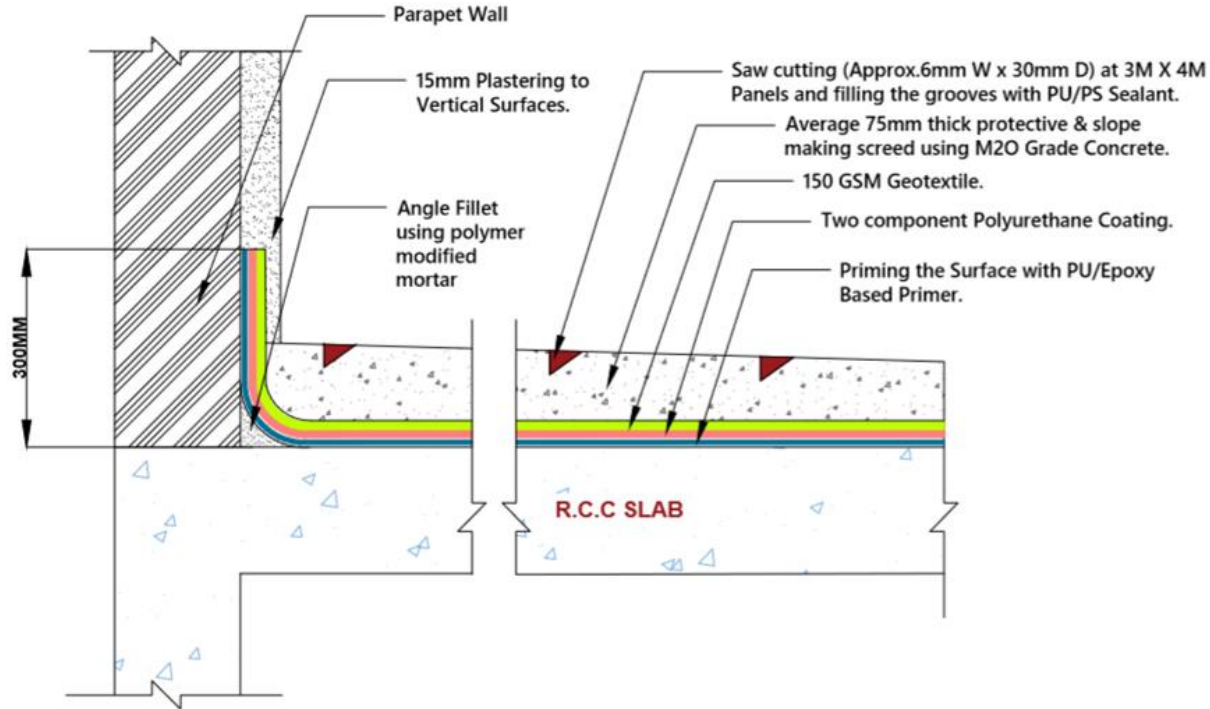
Terrace / Roof **Waterproofing** - Product Range

Polyurea

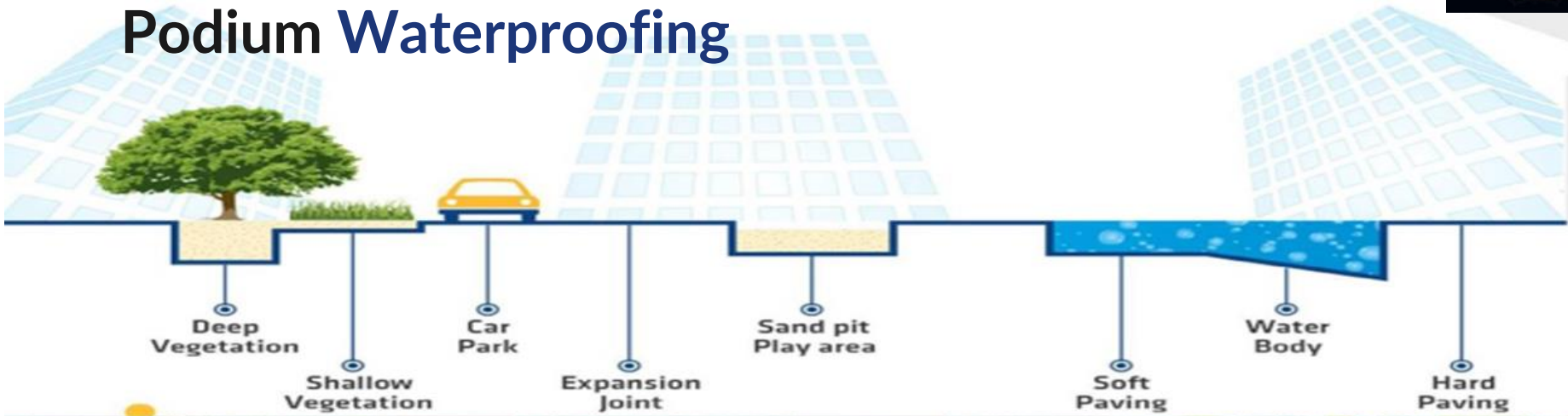
- Cannot be applied by brush/roller.
- Requires substrate moisture less than 8% before application of Polyurea Coating.
- Requires a protection layer/ UV resistant topcoat.



Sectional Drawing



Podium Waterproofing



Podium Waterproofing

- Podium is most critical structure from utility point of view and it's a slab where almost all heavy utilities are planned.
- Multifunctional utilities:
 - Fire brigade truck movements – Driveways for heavy vehicles,
 - Driveways and parking for LMV
 - Green concept – Landscapes / Plantations
 - Lifestyle – Swimming pool / jogging track / playing courts



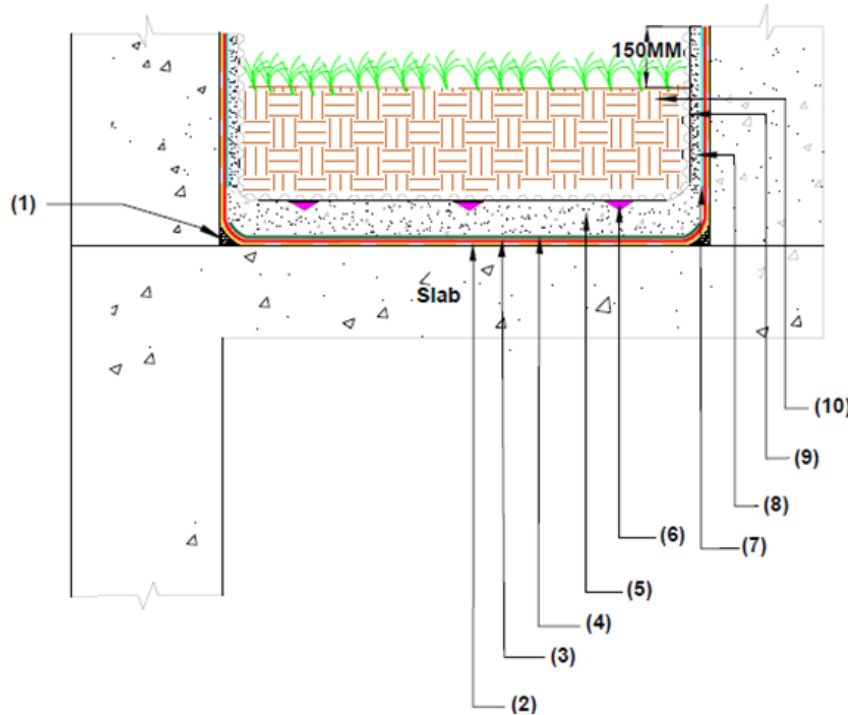
- It is designed to the top slab of basements / utility areas where water penetrations is not allowed

Product Range

- Cementitious coating
- Prefabricated Membranes
- Crystalline admixtures
- PU LAMs
 - Polyurethane
 - Polyurea
 - Hybrid polyurea



Podium Waterproofing - System



1. Angle Fillet
2. Primer
3. PU/Polyurea based Waterproofing
4. 120GSM Geotextile Fabric
5. 75mm Thick M20 Grade Sloping Screed
 - a. Secondary layer Root resistant Waterproofing
6. Groove filled with sealant
7. Bond coat with sand sprinkling
8. 15mm Thick protective plastering on vertical surface
9. 10mm Thick thermally bonded drain board
10. Soil filling as per site requirement



Any Questions



THANK YOU