

5.10.2 Semi-Intensive (Moderate Depth) Roof Garden Systems

Semi-intensive roof garden systems use a combination of plant species that may include small shrubs and species like grasses and herbs. They are generally limited to low-slope structures of 2:12 or less. Semi-intensive roof garden systems have landscaping that require more regular maintenance than an extensive system, but have limited plant selection because of shallower growth medium depths, such as a sod grass lawn. These systems will require a reservoir layer and may require an irrigation system.

5.10.3 Intensive (Deep) Roof Garden Systems

Intensive garden roof systems use a wide variety of plant species that may include trees and shrubs, and are generally limited to low-slope structures of 1/4:12 or less.

The use of large plants requires a deeper growth medium layer, typically 250 mm or more, which results in greater weight and the need for an increased structural load capacity of the building. Intensive garden roof systems typically require a heavy root barrier and often require irrigation. These systems require a reservoir layer.

Additionally, an efficient drainage layer may be required because of the quantity of water from irrigation and project conditions.

6.0 Cost of Green Roofing

The cost of a green roof varies considerably depending on the type and factors such as site location, depth of growing medium, selected plants, use of irrigation, water proofing area, and requirement of different garden elements and accessories. The initial cost of terrace garden is higher than a normal roof, though in the long run the saved energy pays the investment back.

7.0 Conclusions

Earlier, roof garden systems were considered only for high-end luxury projects for luxury purposes. However, now days most medium to large projects are adopting roof garden systems. They are also being considered energy efficient and eco-friendly and have achieved a green rating, due to which more and more builders and developers have started building green roofs. However sometimes this becomes miserable when the right approach towards designing and waterproofing such a system is not adopted. It will be immensely helpful if one pays attention to all these components while designing a roof garden system. This will help in providing a durable service life for such green roofs.

Podium Waterproofing

[Excerpts from Dr. Fixit Booklet "A Systems Solution to Waterproofing", 2013, pp.28-31; <http://www.doctor-fixit.com/professional-podium.html>]

1.0 Introduction

Many high rise buildings today incorporate landscaped basements and roofs commonly known as plazas or podiums. The basement can vary from habitable space to car parking, however, whatever the usage, it is vital the correct waterproofing system is selected when waterproofing the podium deck. There are many considerations to be taken in to account including deck movement, differential movement, drainage, waterproofing continuity at expansion joints, drainage outlets, landscaping, and most important utilities below the deck. The various usages of over deck slab of podium can be selected based on the client's requirement. Podium slabs is an area where one can plan for facilities such as water bodies, landscape, children play area, sports facilities and car parking etc.

Proper waterproofing system helps to keep out water and pollutants thereby preventing leakages and also protecting structural elements and embedded steel reinforcement from corrosion damage.

2.0 Functional Requirements

There are various functional requirements of a podium slab which need to be satisfied depending on the utility and requirement. The some of the major functional requirements need to be considered are given as follows:

- Large open areas-Excellent tensile and elongation properties to accommodate thermal movements
- Water bodies-Excellent barrier to water ingress and continuous exposure to water
- Landscaping-Resistant to root penetration even for intensive roots
- Sand Filling-Enable sand filling directly on the membrane without protection screed
- Chemical Resistance-Resistance to pesticides
- Medium duty traffic-Resistance to dynamic and Impact load
- Very high impact and puncture resistance-Able to sustain mechanical abuse during construction
- Zero VOC-Environmental friendly, meet the norms of Garden products for waterproofing

3.0 Waterproofing of Podium Slab

The bare podium means the slab which does not provide any service such as water bodies, children play area, roof garden and vegetative garden etc. but only acts as space for car parking has to be waterproofed for rain water only while other podium slabs require much more

detailing. In such bare podium one can use a spray applied highly elastomeric and puncture-resistant waterproofing coating if podium is very large or else a brush applied pitch modified polyurethane membrane coating can be used in relative smaller podium slabs.

3.1 Surface Preparation

Removal of all surface imperfections, protrusions, structurally unsound and loose concrete is important for waterproofing and repairing of the unsound patch with polymer modified mortar using SBR latex for waterproofing is recommended.

Angle fillets all around the periphery of the podium wall with polymer modified mortar prepared with SBR latex for waterproofing and repairs is also a mandatory. Clean all surfaces with compressed air, and ensure they are free of loose materials, oils, form release agents and other contaminants.

Podium having swimming pool, water bodies etc has to be taken further care. Carry out the grouting for light fitting casings, pipes, inserts, etc., provided in the concrete raft floor and walls using a Non-shrink grout for pipe fitting. Wrap the inserts with Leak-proof sealing tape for pipe wrapping to ensure a watertight fitting, before grouting the inserts.

3.2 Priming

Priming is generally not required on concrete substrates for highly elastomeric and puncture resistant waterproofing coating.

3.3 Application

The following characteristics should be considered when selecting waterproofing materials for podium slabs with landscaping and swimming pools. The materials must be:

- Resistant to and unaffected by the liquid it is containing and function under constant submersion and high levels of hydrostatic pressure
- Able to resist the combined effects of exposure to sunlight, weather and intermittent wetting when exposed above the contained liquid's surface
- Compatible with and able to conform to the surfaces to which it is installed, including rough concrete walls, work slabs and compacted earth

The following waterproofing materials are appropriate for use as waterproofing membranes with concrete and masonry substrates:

- APP and SBS polymer-modified bitumen sheet membrane
- Self-adhering polymer-modified bitumen sheet membrane
- EPDM membranes
- PVC (thermoplastic) membrane
- Fluid-applied elastomeric materials
- Cementitious waterproofing
- Crystalline waterproofing

The following waterproofing materials are appropriate for use as waterproofing membranes with earthen substrates:

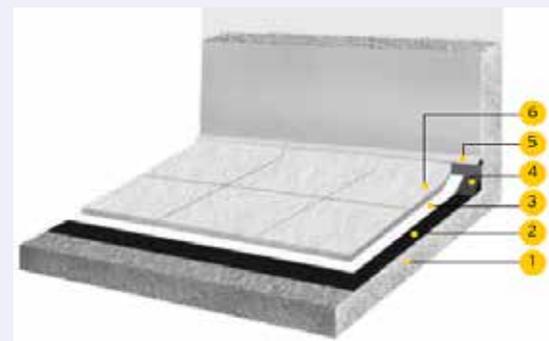
- Bentonite
- EPDM membranes
- PVC (thermoplastic) membrane
- Polyethylene sheets should not be considered as waterproofing membranes but can be used as vapour retarders.

3.3.1 With spray applied highly elastomeric and puncture-resistant coating for very large bare podium

Apply a highly elastomeric and puncture resistant waterproofing coating to achieve minimum thickness of 1.5 mm. For spray applied application, ensure that only compatible equipment can only be used. It cannot be sprayed through other types of commonly available sprayers.

Place a geotextile fabric of 300 gsm over the membrane before laying the concrete screed of 75 mm (average) modified with Integral liquid waterproofing compound for plaster and concrete with 1 : 100 slopes.

It should be properly aligned with drain outlets for efficient drainage of water. A schematic diagram of waterproofing of a bare podium slab is given in Fig. 1.



- | | |
|---------------|----------------------|
| 1. Slab | 2. Dr. Fixit Extensa |
| 3. Geotextile | 4. Angle Fillet |
| 5. Drip Mould | 6. Screed |

Fig. 1: Schematic diagram of waterproofing of a bare podium slab

3.3.2 With pitch modified polyurethane membrane coating for smaller bare podium

Apply pitch modified polyurethane membrane coating by a brush or trowel or squeegee in two coats maintaining the spreading rate to achieve the desired dry film thickness or DFT of 1.5 mm. Air-cure pitch modified polyurethane membrane coating for a minimum of 72 hours at 27°C before placing the protection. Once the coat is dry, lay a layer of geotextile membrane of 300 gsm. After laying the geotextile membrane, overlay a screed of 75

mm (average) of M 20 concrete grade for the protection of the membrane and to provide a proper slope for effective draining of rain water.

3.3.3 Waterproofing of Podium Slab with Landscaping and Swimming Pool

The detail step-by-step procedure is explained as follows:

Apply spray applied highly elastomeric and puncture-resistant waterproofing coating to achieve a minimum thickness of 2 mm. Apply highly elastomeric and puncture-resistant waterproofing coating using only designated equipment. It cannot be sprayed through any other type of commonly available sprayers.

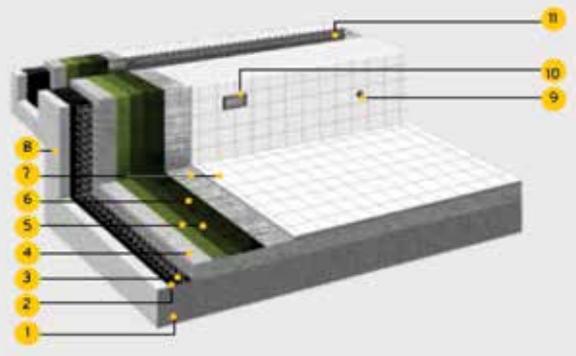
Extend highly elastomeric and puncture-resistant waterproofing coating up to the top and cover the overflow concrete channels all around the periphery of the pool. Over this, place a 3.5 mm fleece backed self-adhesive membrane. Being self-adhesive, it will stick to Spray applied highly elastomeric and puncture-resistant waterproofing coating and will serve as protection for the subsequent short-creting that needs to be done (in case of a swimming pool). Carry out the short-creting over a steel reinforcement installed in accordance to the engineer's advice, and to the required thickness. Use a wooden float to give it a smooth finish. After a thorough curing of at least 3 - 4 days, take up high-performance polymer modified for application over the short-creted surface. Just before this, apply angle fillets in polymer modified mortar admixed with SBR latex for waterproofing and repairs all round the periphery of the swimming pool floor, at the parapet wall junctions. Initiate the application of high-performance polymer modified over a saturated surface dry short-crete. A total of three coats should be applied in all, ensuring that each coat of application dries before taking up the next.

Treat the areas in the pool around the insert pipes and the wall-to-floor junctions by embedding a glass fibre mesh of 2.5 mm x 2.5 mm weighing 50 gsm between the first and second coats. Place them when the first coat is still wet. This will increase the waterproofing protection in these areas.

While the third coat of high-performance polymer modified is wet, broadcast with clean and washed sand liberally and set along with the application. This will provide a key for the subsequent tile adhesives that will be needed to fix the swimming pool tiles. After completing the tiling work, apply epoxy grout to fill the gaps in the tiles. Protect the entire application against chlorine in the water that is generally used to clean the pools. For waterproofing of landscapes, it is extremely important to place self-adhesive bituminous membrane over spray applied highly elastomeric and puncture-resistant waterproofing coating. Provision of slope becomes mandatory in landscaping whether on roofs or podiums. Place drain cell boards from standard companies

over this. The specification of the drain board generally depends upon the amount of water discharge and the kind of landscaping as proposed by the architects. If the drain cell board does not have a geotextile membrane over it, place an appropriate membrane which allows water to trickle through to the underside.

Provision of drainage is absolutely essential, which should be provided by the customer on the advice of the architect or the consultant. Place soil over the geotextile membrane. A schematic diagram of waterproofing of a podium slab having swimming pool and landscaping is given in Fig. 2.



1. Floor Concrete
2. Dr. Fixit Extensa
3. Steel Cage with Pedestal
4. Short Crete
5. Dr. Fixit Fastflex (2 coat)
6. Dr. Fixit Fastflex (3 coat with sprinkled sand)
7. Roff NSA & Roff RTM Tile Grout
8. Concrete Wall
9. Pipe Inlet fitting Dr. Fixit Bathseal Tape & Grout
10. Light fitting casing with Dr. Fixit Bathseal Grout & Dr. Fixit Bathseal Tape
11. Steel Grating

Fig. 2 Schematic diagram of waterproofing of a podium slab having swimming pool and landscaping.

5.0 Leakage Test

Prior to the installation of the landscaping or screeding as the case may be, the waterproofing layer should be subject to a thorough leak test either by water ponding or electronic test method. The usual procedure of water ponding for 48 hrs may be adopted. Any defects in the waterproofing system then can be easily rectified.

6.0 Conclusions

Podiums have multiple utilities and high movement, which means joint-based membrane waterproofing, proves ineffective. A superior seamless membrane with better concrete adhesion and elongation properties can be adopted for a durable waterproofing. Such modern waterproofing material provides a service life of 15-20 years. Podium landscaping is also concept of green roofing and an eco-friendly system.

Case study of Podium Waterproofing

[Excerpts from archives of Dr. Fixit case studies]

1.0 Background

Hiland wood was a major residential project of the Bengal United Credit Belani Group in Kolkata. The entire podium area was 1600 m². The client was interested in an economical waterproofing solution. The architect recommended a cementitious polymeric waterproofing system with a protective screed over it with anti-root treatment.

2.0 Recommendations

- It was suggested for a cementitious grouting to the roof slab as the structure was constructed one year back and grade of concrete was only M25.
- Also suggested to use a priming coat before the cementitious polymeric coating for better bonding.
- Advised to use a fiber mesh on entire cementitious coating and to make a screed over it.

3.0 Working Methodology

- Pressure grouting on roof slab was carried out with a cementitious grout (Fig. 1)
- The Surface preparation was carried out by wire brushing (Fig. 2) to remove the loose and unsound concrete cleaning etc.
- Groove cutting, halloring and patch repairing (Fig.3) were carried out with patch repair mortar, modified with acrylic co-polymer emulsions and additives as per the recommended dosages
- An Acrylic bonding agent (Fig. 4) was used as a slurry coat as primer
- A cementitious polymeric waterproofing coating system (Fig. 5) was applied at SSD condition and entire surface was covered with a fiber mesh (Fig. 6)
- Protective screeds of average 75 mm (Fig. 7) was laid over fiber mesh admixed with liquid waterproofing compound.
- Water curing was done over entire surface for minimum 7 days
- A Polymeric bituminous coating was applied over the screed as anti-root treatment, followed by soil filling and plantation (Fig. 8)



Fig. 1: Surface preparations

Products used: Dr. Fixit, Pidilite

Consultants: 1. Dulal Mukherjee & Associates, Kolkata &
2. M. N. Consultant, Kolkata

