

## Waterproofing – A highly risky business!

**Waterproofing of roofs and basements is a very risky business. If planned during the design stage, it costs a fraction of the overall project cost. However, if inadequate attention is paid to it during design or execution, it can become extremely expensive to repair after the structure starts leaking.**

### Specification

The designer is responsible for complete specification for waterproofing. He is also responsible for compatibility of the waterproofing products with the other products which form the construction process. He is also responsible for the execution methodology which is frequently based on site conditions. Specifying a product and making sure that it will work properly in a particular site and making sure that it is used correctly is extremely important. The quality of engineers and site labour many times dictate the quality of watertightness that is achieved on site.

### Design Responsibility

Who takes final design responsibilities? This is an interesting question to answer. Although detailed engineering is the purview of the structural designer, it is often thought that waterproofing details are to be specified by the architect. The architect feels that the specifications will be given by either the product manufacturer or the “waterproofing agency” who is typically a contractor with no exposure to detailed engineering of the structure. At the end, everybody feels comfortable when the waterproofing contractor is asked to give a 10 year guarantee on stamp paper. When the structure starts leaking, the waterproofing contractor cannot be physically brought back for repairs due to various reasons. The architect and structural designer disclaim responsibility since the guarantee is given by the contractor and the ultimate sufferer is the client.

In this confused scenario, it makes sense to appoint a **waterproofing consultant** who is to be involved from Day one of the design process. This consultant will comment on the basement design depending on ground strata (geotechnical report), water table, site formation, depth of basement, kind of drainage required based on what the basement is to be used etc. For the building roof, he will take into consideration possible leakage through proposed expansion joints, leakage through walls, kinds of projections in the façade of the building and all other places where it may leak in the future. Indeed, the architect may have to change his design details in various areas just to make sure that water leakage does not occur in the future. The waterproofing consultant will be responsible for detailed engineering input to be incorporated in the drawings for site execution.

### Lowering Designer Risk by avoiding common pitfalls

Given the ambiguity as to the specific roles and responsibilities of the architect and consulting engineer, together with the inadequate time allocated to thinking about making the below-ground structure watertight, certain pitfalls are common in the

design of typical projects. These pitfalls can be avoided through the correct choice of supplier and of products.

Let's focus on how to reduce the designer's risk in choosing both suppliers and products for their specification. The following are points to consider in general when specifying for a waterproofing solution, and how to overcome the risks at this point in the process:

**Product compatibility:** A typical example is plasticizer incompatibility with the Ready mix concrete specified. Due to this the concrete slab may crack just after casting and water leakage is assured if this is the topmost slab. A waterproofing consultant will ask for and ensure that this point is checked with the RMC supplier. In other cases, products from different companies are specified for use in the same concrete mix. This assures incompatibility and nobody is then certain how failure has occurred.

**Tropical Conditions:** India is a tropical country with a different climate than that of western countries. What works in the west may not work in India all the time. Has the product been tested in Indian conditions? Ask yourself if the product will work here. Ask the contractor to give Indian references and Indian test results.

Questions to ask regarding products to be used for roofing or basements:

**Climate:** How well does the product stand up to heat and cold cycles in our country? Will it melt? Will it deteriorate after a few cycles of heat and cold? Will it be affected by UV rays if it is exposed? Will the lapping of membranes open up due to the heat?

**Water:** How does the product react to hard water, salt water or deionised water? Will the swellable properties of the product be affected by salts in the water? How well does it tolerate alternate wetting and drying cycles? For example, swelling waterstops are sometimes adversely affected by salt in the water. They also lose their swelling ability after a few wet-dry cycles.

**Waterstop:** In Indian conditions, no joint is completely dry during construction. Also, curing is ongoing. Swelling type waterstops may swell even before the next stage of concrete is cast thus rendering the waterstop useless. Is this "site factor" kept in mind during specification?

**Concrete cover:** Many waterproofing products clearly need to be encased or embedded in concrete or plaster. They should not be exposed to the environment directly. What is the minimum cover required? Some swelling waterstops required a high cover of concrete. If placed improperly on site, bursting pressure due to swelling may "blow out" the concrete. What are the precautions to be taken to ensure that such failures do not occur at site?

**Skill:** Does the product require a skilled applicator? Many a time, a "skilled applicator" is a person who is appointed by the manufacturer at the last moment who does not have adequate skills or equipment required to execute the job in a technically correct manner. Since the manufacturer guarantees "only the product" and not application, it is hard to pin down the manufacturer. The applicator says that

the product has failed and is in no way responsible. Again the ultimate sufferer is the client.

**Contaminants:** Is the product affected by dirt, shuttering oil, salts and other contaminants in the water? Will delamination or debonding occur due to this?

**Gas:** Bentonite based systems are affected by carbon dioxide. If this is the case, other products may need to be used.

**Bonding:** Chemical bonding or physical bonding? What is the basic waterproofing mechanism? Epoxy or polymer bond coats typically fail in moist conditions. Rising vapour from roofs exert enough pressure to “pop out” the membrane.

### **Conclusion**

Waterproofing is a highly risky business. The price to be paid by the client in case of leakage is very high. In a typical Indian scenario, bad construction practices with unskilled labour coupled with lean supervision can lead to considerable waterproofing failures. Keeping this in mind, a robust, fault tolerant system of waterproofing is to be designed with detailed engineering. Planning for all aspects of waterproofing of the structure during the design stage is essential, including product selection based on climate, compatibility of various products, site problems and ground water and rain conditions based on a long term cycle. An independent waterproofing consultant's input can reduce the risk considerably.