TYPES OF WATERPROOFING FOR A BUILDING

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INTRODUCTION

Concrete is porous and there are many tiny voids within it[1]. As concrete absorbs water, the passage of water molecules will exert hydrostatic stress on the surface of the concrete voids which results in deteriorations such as the crack formation and spalling of concrete. In addition, the presence of moisture in concrete can cause other decorative defects, such as paint blistering, stalactite forming, efflorescence and mold growing. Waterproofing of the building can be accomplished by restricting the water transmittance. An impermeable membrane can be applied to it or surface can be modified and make it impermeable to water. Waterproofing application in the building is vital to increase its service life and avoid the formation of such water leakage defects.

TYPICAL WATERPROOFING MATERIALS

The types of waterproofing that are typically used in the building are listed as follow:

a) BITUMINOUS SHEET MEMBRANE

The bituminous sheet membrane is high strength bituminous fabric sheet which is durable, elastic, high impact resistance, and high acid resistance. The elastic properties of the membrane enable it to resist any type of stress caused by building thermal or structural expansion [2]. Bituminous sheet membrane has a typical lifespan of 30 years [4] and it is suitable to be used on the rooftop and wall of the underground structure [3]. There are two types of bituminous sheet membrane which are hot-applied sheet membrane and cold-applied sheet membrane [1]. Hot applied sheet membrane may release carcinogenic gases and volatile organic compounds (VOCs) during the waterproofing membrane application. The cold applied sheet membrane does not emit poisonous gas because it does not require heating up during the application of the waterproofing membrane. Figure 1 shows the hot-applied bituminous sheet membrane.

Application of a bituminous sheet membrane may require high-quality workmanship in particular to ensure proper sealing, lapping, and finishing of seams at corners, edges, and between sheets. In addition, sheet membranes must be added to a flat finish without voids, honeycombs, or protrusions. Protection boards must be placed as the membrane can puncture and tear during backfilling. Bituminous sheet membrane has poor resistance to UV-radiation and needs to be covered by another protective layer such as cement.

b) THERMOPLASTIC MEMBRANE

Thermoplastic membrane (Figure 2) is made up of polymers such as polyvinyl chloride (PVC), chlorinated polyurethane, or chlorosulfonated polyethylene [1]. The most common type of membrane is glass-reinforced PVC. Thermoplastic membrane has elongation properties, high resistance to chemical and hydrostatic pressure. It can be applied at seams with solvent-based adhesives or by heat-welding. Thermoplastic membranes have the disadvantage which its properties and strength change with the temperature. Besides, it will degrade when in contact with hydrocarbons material such as asphalt, fuel, lubricant oil, etc. Application of the thermoplastic membrane requires the contact surface to have a "floor quality" steel trowel finish to ensure good adhesion. The typical lifespan of the thermoplastic membrane is about 22 to 30 years [5] and it can be applied at the tunnel structure, ponds, swimming pools, the water tank, and underground structure [3].

c) LIQUID-APPLIED MEMBRANE

Liquid-applied membrane can be applied with a brush, spray, roller, trowel, or squeegee, and usually contain urethane or polymeric asphalt (hot or cold-applied) in the solvent base [1][2]. This membrane is usually applied on the positive side of set concrete that expose to water contact and has a service lifespan of 25 years [6]. Liquid-applied membrane has benefits such as it is strong, elastic, low in-place cost, and easy to apply. Despite the benefits, there are disadvantages. To assure the applied membranes' thickness and uniformity, it requires high-quality workmanship for the application of liquid-applied membranes. This type of membrane also has poor resistance to UV-radiation and needs to be covered by another protective layer such as cement. Besides, it contains toxic and hazardous VOCs. The suitable application areas for liquid-applied membrane are rooftops, house porches, terraces, large concrete surface areas (e.g. Warehouse and factory) [3]. Figure 3 shows the liquid-applied membrane at the rooftop.

d) CEMENTITIOUS WATERPROOFING

Cementitious waterproofing is the application of polymer modified cement coatings, where the admixtures can cover the pores in the concrete and make it waterproof. It is easy to apply, readily available, low in-place cost, and durable to chemical attack [2]. However, it required proper mixing and enough layer thickness to ensure excellent waterproofing quality. Besides, it has poor resistance to thermal expansion and contraction that is accommodated by movement joints. Cementitious waterproofing is appropriate to be applied at the kitchen floor, shower stall, bathroom floor, and underground structure. The lifespan of cementitious waterproofing will depend on the quality of workmanship during the waterproofing application and is typically last for about 10 years [7]. Figure 4 shows the application of cementitious waterproofing at the floor slab.

Figure 1: Bituminous Sheet Membrane

Figure 2: Thermoplastic Membrane

Figure 3: Liquid-applied Membrane

Figure 4: Cementitious Waterproofing

CONCLUSION

It is important to select suitable waterproofing materials based on the actual site condition. Sometimes, a hybrid system that consists of various waterproofing materials may be required. The basic properties of each type of waterproofing material are summarised in the table below.

TYPES	PROS	CONS	SUITABLE APPLICATION AREAS	TYPICAL LIFESPAN
Bituminous Sheet Membrane	• Durable • Elastic • High impact resistance • High resistance to acid	• Require high-quality workmanship • Sheet membranes must be applied to a smooth finish without voids, honeycombs or protrusions. • Protection boards need to be installed. • Poor resistance to UV-radiation. • Contain toxic and hazardous VOCs (Hot-applied membrane only).	• Rooftop • Underground structure	30 years
Thermoplastic Membranes	• Elastic • High chemical resistance • High resistance to hydrostatic pressure	• Properties and strength change with the temperature. • Deteriorate when contact with hydrocarbons material. • Contact surface must have a “floor quality” steel trowel finish to ensure good adhesion.	• Tunnel • Ponds • Swimming pools • Water tank • Underground structure	22 to 30 years
Liquid-Applied Membranes	• Strong • Elastic • Low in-place cost • Easy to apply	• Require high-quality workmanship • Poor resistance to UV-radiation. • Protection boards need to be installed. • Contain toxic and hazardous VOCs.	• Rooftops • House porches • Terraces, • Large concrete surface areas (e.g. Warehouse and factory).	25 years
Cementitious Waterproofing	• Strong • Durable • Readily available • Low in-place cost • Easy to apply	• Require high-quality workmanship • Poor resistance to thermal expansion and contraction that are accommodated by movement joints.	• Kitchen floor • Shower stall • Bathroom floor • Underground structure.	10 years

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