

Original research article

Application of waterproof technology in construction engineering

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Abstract: In building engineering, building waterproofing technology is a comprehensive and highly applied engineering science and technology. It is an important part of construction technology. It is important to improve the function of building use and production, quality of life and improve the living environment. Waterproof engineering is a systematic project, which involves the waterproof material, waterproof engineering design, construction technology, the management of the building and other aspects. The task of building waterproofing project is to synthesize all the above factors, to carry out all-round evaluation, select the high-performance waterproof material to meet the requirements, and carry out reliable, durable, reasonable and economical waterproof function engineering design, careful organization, careful construction, maintenance management system to meet the buildings and structures of the waterproof durability, to achieve high quality waterproofing and good comprehensive benefits. At the same time, waterproof engineering is a demanding professional technology, so the construction of specialization is to ensure that the quality of roof waterproofing works the key, if construction operation is not serious, the technology is not enough, and the consequences will inevitably lead to failure of waterproofing works. Quality of waterproofing works the overall quality requirements of building waterproofing works are: impermeable to leakage, to ensure smooth drainage, so that the building has a good waterproof and use function. The quality of building waterproofing works is superior to waterproofing material, waterproof design, waterproof construction and maintenance management.

Keywords: waterproof design; waterproof construction; waterproof material control; finished product protection

Received: 16 February 2018; **Accepted:** 21 March 2018; **Available online:** 2 May 2018

1. The principle of waterproof design

Waterproof engineering should follow the principle of ‘meet the surface fortification’, ‘to prevent the main, anti-row combination’ principle, and the use of ‘multi-channel fortification’, ‘rigid and soft’, ‘node seal’ and other measures, according to different environments, according to local conditions, and the use of various means of comprehensive management to ensure the desired waterproof effect.

Waterproof material selection

At present, the construction market, a variety of waterproof materials, in general can be divided into five categories, namely, waterproofing membrane, waterproof sheet, waterproof coating, sealing materials and seepage plugging and other special purpose waterproof material. And each category can be subdivided, such as waterproofing membrane can be divided into asphalt, rubber, polymer; waterproof coating can be divided into cement-based, complex and polymer class, each material have their own characteristics, it must be based on the location of the waterproofing works, where the environment, design waterproofing grade and functional needs, choose the appropriate waterproof material, give full play to the characteristics of various

materials in order to obtain the best waterproof effect.

Roofing: roof due to its long-term exposure, the sun, rain and snow can be directly eroded, seasonal, day and night temperature changes will make the roof of the expansion and contraction, a priority should be preferred durability, anti-aging ability, and has a certain degree of extension, high heat resistance of waterproof materials, such as polyester tire modified asphalt waterproofing membrane, PVC waterproofing membrane, EPDM waterproof material or waterproof asphalt felt and so on.

Underground: As the underground works in the wet state for a long time, the temperature difference is also small, so in addition to the need to take 'hard and soft' multi-channel fortification, but also should use good corrosion resistance, long life flexible waterproof material, such as glass fiber tires, polyester tire modified asphalt membrane.

Toilet room: the toilet area is generally small, but a lot of yin and yang, and a variety of floor pipes are also many, waterproofing membrane, sheet construction is more difficult, the general choice of waterproof coating is appropriate, the construction is simple and fast, and its coating can form an integral seamless coating, the quality can also be guaranteed, such as polymer cement waterproof coating, modified asphalt coating, polyurethane waterproof coating.

I was involved in the management of a project example, to specify the selection of waterproof material: the roof of the project for the steel roof, the roof two-way span are relatively large (about 180 m), the roof set up a crisscross for water supply and drainage Gong ditch, so the steel plate to connect the patchwork and bolt nodes more, after repeated research, and ultimately determine the use of butyl rubber waterproof tape, one-component polyurethane waterproof coating, one-component polyurethane sealant and other materials to the node waterproof deal with.

Joints waterproof nodes. For the seams, first with 300 mm wide butyl rubber waterproof tape along the seam part of the paste, and then in the sealing tape parts brushing 300 mm, 1.5 mm after the one-component polyurethane waterproof coating. To be seams at the waterproof coating dry film, in the laying of insulation board, heat a layer of PVC waterproofing membrane.

Bolt connection waterproof node. The waterproofing of the bolted joints is difficult, and it is not easy to achieve the desired effect with the general material, and if the deformation occurs, the bolts can easily pierce the waterproofing layer, resulting in the occurrence of leakage. In this regard, we consider the first use but the composition of polyurethane sealant will be wrapped around the entire bolt, and made of circular arc. This can avoid the occurrence of large deformation, the bolt may be damaged on the waterproof layer, but also to facilitate the upper one-component polyurethane waterproof coating construction, and to ensure the quality of waterproof coating.

Applicability analysis. Butyl rubber waterproof tape is a blend of butyl rubber and polyisobutylene, it is a solvent-free environment-friendly sealing adhesive material, mainly has the following characteristics: 7 excellent mechanical properties: bonding strength, tensile strength, elongation and elasticity are very good, for the interface deformation and cracking adaptability; chemical properties are very stable: with excellent chemical resistance, weather ability, aging resistance and corrosion resistance are strong, anti-aging time can be long up to 20 years; 7 reliable application performance: with excellent adhesion, there is gas and water resistance, sealing, low temperature resistance is an ordinary seal cannot match.

2. Basic management

Waterproof layer is attached to the structure of the basic level, its quality will directly affect the quality

of waterproof layer, once in the waterproof layer before the construction should be the first layer of treatment. General basic layer should be solid, flat, the surface without sand, from the skin, cracks and water, moisture content of the requirements of the corners of the corners should also be made arc, corners should be greater than 50mm diameter, sun angle should be greater than 10 mm for the membrane and other needs to brush the primary treatment agent, should control the base treatment agent brushing time, generally only allowed half a day ahead of time.

3. The preparation of waterproof materials

We should be strictly before the construction of the quality of waterproof materials to check. Preferred manufacturers' reputation good, good quality materials to the enterprise to supply waterproof materials, and cannot seek cheap, the use of poor quality waterproof material, but in the end but worth the candle. Waterproof material before use, must also be in accordance with the requirements of the corresponding national norms of waterproof material strength, elongation and other properties of sampling to ensure the quality of waterproof materials.

4. The implementation of technical exchanges and model construction system

Before construction, should deal with the construction workers to conduct a comprehensive technical background, the use of operational personnel on the waterproof construction process, and key parts of the treatment measures are understood.

Large area before the formal construction, should also be the first model of the construction, the construction workers have a deeper understanding of the construction process, and in the construction of the model in advance to detect problems, prevent pre-control, so as not to affect the quality of the entire waterproof and waterproofing works.

(A) Material configuration

In strict accordance with the manufacturers to provide the ratio, the liquid material, powder plus water for modulation, who can be adjusted to adjust the amount of paint to adjust the viscosity to meet the facade and plane construction requirements of different parts of the construction. The slurry should be stirred evenly to ensure that no caking, mixing a good slurry should be used within 3 h. Each layer of paint should be configured according to the corresponding distribution ratio, shall not be confused.

Details of additional construction: should first do the construction of additional layers, and then a large area of waterproof coating construction. The details of the construction should be the first root and other parts of the groove embedded in the seal, the sealing material should be tightly pressed and firmly bonded with the wall, no cracking, bubbling and collapse of the phenomenon. In the ground leakage, root, Yang Yin angle and the entrance of a weak part of the water leakage, should add a layer of carcass reinforcement material, the material width of not less than 300 mm, tower width of not less than 100 mm.

(B) Material brushing

Construction should pay attention to the time interval of each brushing, need to be a brush before the brush dry before the next brushing, usually 87 h or so. Repeated brushing until the design requirements to achieve the thickness of each brushing direction should be painted with the direction of the previous brushing vertical.

5. Pay attention to the details of the site of the waterproof construction site

The details of the main nodes include post-pouring, deformation joints, Yang Yin corner, through the wall, the roof of the pipe or hole, it is the weakest part of the waterproofing works. Because of its large number, and the construction of more difficult, if the waterproof head is not closed, it is easy to cause leakage occurred. According to the experience of previous projects, many of the reasons for the leakage of water at the node part of the problem, and the more so, we should be on the site of the waterproof construction attention. (GB50108-2008) and the 'underground building waterproof structure' (National Building Standard Design Atlas 02J301) in the general structure of the details of the nodes have a clear practice and requirements, we as long as in strict accordance with the implementation of Can ensure that the details of the waterproof water quality, so as to ensure the normal use of the project and durability. Here I choose a more typical of the details of the node, indicating its waterproof practices and quality control points. (1) The bottom plate and the side wall of the transfer site. As the floor and side walls are not pouring at the same time, so how to do waterproof membrane protection and lap is the focus of the site waterproof construction. Construction, you can use masonry permanent protection wall (brick mold) way, the first open shop construction waterproofing membrane additional layer, and then in the additional layer to do a layer of waterproofing membrane, between the two layers of waterproofing membrane full sticky method. In the structure of the floor height of the location of the first coiling of the length of the coiled stubble, generally not less than 300 mm, and take the cover soil or fake 3 tiles on the way to protect the waterproofing membrane. After the completion of the construction of the floor, the surface of the waterproofing membrane will be clean, is the upper waterproof membrane lap, lap length of not less than 100 mm. (2) Basement wall after pouring. After pouring waterproofing is the key to the external wall waterproof construction, if the measures are not appropriate, the quality of the entire external walls of water will have a great impact. Can be used in the post-pouring parts of the prefabricated reinforced concrete cover plate way, the waterproof material on the cover, so that the waterproof layer to form a whole.

Waterproof layer is completed after the strict quality inspection, early detection of the problem, be addressed.

The quality check gives us the last step in 'remedy'. Once the protective layer is completed, it is quite difficult to find a leak in the waterproof layer. This requires that we must in strict accordance with the requirements of the standard requirements of the quality inspection procedures, in order to be able to find the shortcomings in the waterproof construction in advance, the possible leakage of hidden places to repair.

General quality inspection work includes appearance, lap length, waterproof layer thickness, waterproof layer thickness check and closed water test.

6. To strengthen the protection of finished products, timely completion of the construction of protective layer

Finished product protection work is the most easy to overlook the construction of a link, but the quality of the finished product is also the most direct impact on the quality of waterproofing works. Waterproof layer throughout the construction process, should pay attention to its protection; closed water test is completed, the protective layer should be completed in time to avoid construction, so as not to damage the waterproof layer.

Construction workers need to wear soft soled shoes, is strictly prohibited wearing a nail or sharp protruding shoes into the scene, so as not to damage the waterproof layer. Construction process, quality inspectors should be at any time, orderly quality inspection. Such as the discovery of damaged, bad place to

organize personnel in a timely manner to carry out correct and reliable repair, to avoid the generation of bad.

Do not have to accept the acceptance of a waterproof layer on the hole, if you must penetrate the waterproof layer, should be limited to technical management personnel to communicate in order to put forward reasonable remedial measures and timely repair.

Reinforcing bar and template support should minimize the impact of the waterproof layer, if necessary, can be added to the flexible material isolation. Do not throw steel, steel, wrenches and other materials and tools to avoid damage to the waterproof layer.

In the construction process for vulnerable to pollution, damage to the waterproof finished products and semi-finished products to the line of identification and protection, and sent someone to inspect inspection and found that the protective measures are damaged, to timely repair.

Engineering leakage and water a common problem, seriously affecting the normal use of the user, but it is not impossible to avoid. As long as we clearly 'design is the premise, the material is the foundation, the construction is the key, management is to ensure that' the idea of the construction of waterproof engineering in the strict control of the quality of the process to take targeted preventive control measures will be able to achieve expected target.

7. Waterproof engineering control points

Building waterproofing is a comprehensive, practical engineering technology, the use of construction features play a vital role. According to the project supervision practice of several projects, the author puts forward the key points of quality control of building waterproofing works for roofing, basement, toilet, and storage pool. Relevant departments of the waterproofing of the phenomenon of leakage analysis results show that the cause of leakage due to poor material caused by the total 20% to 30%, due to rough construction caused by about 45% to 48%, due to design problems caused by 18%~26%, the quality of building waterproofing works which are four leakage (roof leakage, toilet bath leakage, external wall leakage and basement leakage) problem has become a common quality problems, should pay attention.

(1) The basic control points

Waterproof layer is attached to the main structure of the grassroots level, its quality directly affects the quality of the waterproof layer, the main structure and leveling layer stiffness, flatness, strength, surface slope accuracy, surface improvement without sand, from the skin, of the water content and so are to ensure the quality of waterproof construction, waterproof engineering quality basis. Waterproof layer construction operating conditions of the control points of the climatic conditions of the construction conditions are directly related to the quality of construction, waterproofing works most of the open air operations, climate factors greater impact. During the construction period, rain, frost, frost, fog, wind and temperature below 5 °C or above 35 °C will affect the construction quality of the waterproof layer, but also hinder the smooth construction of construction operations. Hot-melt rolls and solvent-based coatings can be carried out at temperatures above -10 °C; asphalt; modified asphalt and polymer coatings should not be constructed at 0 °C; asphalt-based coatings, high molecular weight polymers paint and rigid waterproof layer, should not be in the temperature of 5 °C in the construction; temperature exceeds 35 °C is all the waterproof layer are not suitable for construction; hot summer midnight due to the production of dew, 5 level and below of wind weather will affect dust sand and base, pollution on the base surface are not allowed to waterproof construction operations. Attention to the waterproof layer and the relevant level of construction cross-section of the waterproof layer of the materials used must be in accordance with the factory certificate and the

experimental report card, at the same time in the field before use must do waterproof test, qualified before use. The layers associated with the waterproofing layer are leveling layer, vapor barrier, insulation layer, isolation layer, protective layer and so on. Waterproof construction is often related to the relevant layers to cross the operation, the quality of the relevant level of the quality of the waterproof layer has a great impact, and even directly affect the success or failure of waterproofing works. In particular, pay attention to the construction of the protective layer, must not hit bad, puncture waterproof layer.

(2) The key point of quality control of membrane waterproof construction

There are a variety of materials, such as hot-stick method, self-adhesive method, mechanical fixation method, embedding method and so on. The construction method should check the contractor's construction standard according to the construction technology standard and the construction process to carry out the direction of the shop, two webs and coil layer and layer, the base of the width and length of overlap to meet the requirements. Coil cold adhesive construction, the adhesive material should be selected according to the performance of supporting the use of adhesive to the staff to carry out, timely sampling test, not wrong, mixed, in this area strict control. Strictly grasp the grass-roots water content to meet the requirements before the paste. Pay attention to control yin and yang angle. Foot bone and other details of the node has been handled.

(3) Waterproofing construction quality control points

Coating waterproof construction according to the thickness of the film is divided into thin coating construction and thick coating construction. Whether it is thin coating used in the brushing method of spraying, or thick coating commonly used method of coating with each other coating; in a simple smear or carcass reinforcement coating (such as glass fiber or chemical fiber) made a cloth with two type of painting, two cloth with three type of painting, and many cloths with many different type of painting should do: anti-waterproof material specifications meet the design requirements; operation and construction methods in line with the provisions of the waterproof coating formulations meet the technical requirements; carcass reinforcement materials used to match the paint (the temperature), the operating time, the amount and order of the ingredients, the mixing strength, the coating variable (times) must be combined with the process requirements, the construction order must be the first high after the low, the first the principle of conduct.

(4) Sealed waterproof material construction quality control points

Sealing materials commonly used mainly modified asphalt and into a polymer seal waterproof material two categories; construction methods vary according to different materials, sub-cold inlay and hot irrigation method two. In order to ensure the construction quality should be in the construction machinery with the first, ingredients and mixing, bonding performance test and embedded backing material control, as well as construction operations and several key aspects of supervision and control. Hot irrigation operation should pay attention to the sealing material on-site plasticization and heating temperature is generally 110~130 °C; the maximum shall not exceed 140 °C, pay attention to the use of the thermometer temperature measurement in the center of the surface under 100 mm. Plastic or heated to the temperature (not less than 110 °C) should be immediately on-site watering, embedded to be higher than the slit 3~5 mm. Cold knitting construction by hand operation, from the bottom of the embedded, to prevent leakage into the virtual fill, pay attention to not produce mixed gas phenomenon; embedded fill in full and full, in order, it is best to use electric or manual caulking gun to operate. Waterproof layer of protective layer material selection and construction should be designed according to design drawings for construction. Protection layer construction should pay attention to the protection of the waterproof layer, in the waterproof layer to do temporary protection measures to prevent the piercing waterproof layer, waterproof layer construction should be carried out early to the construction

process, should not be too long interval to prevent water layer material damage.

(5) Rigid waterproof layer construction requirements

Rigid waterproof layer, including fine stone concrete waterproof layer, cement mortar waterproof layer, block rigid waterproof layer and waterproof concrete construction. Rigid waterproof layer on the foundation of the settlement is not uniform, temperature changes, structural vibration and other factors are very sensitive, so the basic processing requirements must be adhered to.

Conflict of interest

The authors declare no conflict of interest.

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