A Reports on

WATER PROOFING OF BASEMENT

Department Of Civil Engineering

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A REPORT ON

WATERPROOFING OF BASEMENT

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INTRODUCTION:

Waterproofing is the arrangement to resist water to penetrate through different parts of the structure. It is needed anytime whether a structure is built at ground level or below ground. Ground water in the soil causes hydrostatic pressure to be exerted underneath basement floors and against contribute to mold, decay and other moisture related problems. So taking necessary steps to make the structure waterproof is badly needed. Over the past two decades, the construction industry has had technological advances in waterproofing materials. The ramifications of failing to waterproof or waterproofing inadequately can be horrendous. . Hydrostatic pressure can cause major structural damage to foundation walls and is likely to using these technologies to make their structures waterproofed.

WHAT IS WATERPROOFING:

Waterproofing is the formation of an impervious barrier, which is designed to prevent water entering or escaping from various sections of building structures. It often refers to the steps to prevent penetration of water in its liquid state and possibly under pressure and also to the resistance to humidity or dampness. Such items may be used in wet environments or under water to specified depths. Internal areas that are needed to be waterproofed include bathrooms, shower recesses, laundries and toilets. While, external areas waterproofed extends to roofs, planter boxes, podiums, balconies, terraces, retaining walls and swimming pools.

HOW WATER PERMEATES IN THE UNDERGROUND STRUCTURES:

Soil contains a huge amount of water in its pores. Soil with fine grain like clay, silts, loam has capillary system of water in them. The underground water can rise about 6 m by these capillary systems. In case of granular soils like gravel, coarse sand etc. the capillary rise of water is negligible. Ground water level varies with seasons. In the rainy season a huge amount of water enters in the soil. The ground water level rises.

This underground water has its own pressure which varies with the depth. When the depth increases, the hydrostatic pressure increases. Soil itself has also its own pressure. This total pressure is applied on the walls the floor of basements, or underground structures.

Concrete as well as masonry itself absorbs water when they are dry or when concrete has numerous voids and becomes permeable. So the underground water enters in the concrete base, walls. It decreases the strength of concrete. Hydrostatic pressure forces water in through cracks in **foundation walls**, through openings caused by expansion and contraction of the footing-foundation wall joint and up through floor cracks.

In the hilly areas this underground water flows to low land or river, canal, sea. This water has velocity which varies with the slope of its passage. This velocity creates more hydrostatic pressure on the walls and floor of basement. In the areas where it rains often has a lot of water in the ground. It also raises the hydrostatic pressure and makes underground water to enter in the materials of structures.

WATER DAMAGES IN BASEMENTS:

Water which enters or escapes from buildings can have immediate and long term undesired effects. Apart from damage to the buildings contents, structural damage is unavoidable if the problem persists. The casualties of water damage include:

- Majority of building materials have a considerable shorter life span when subjected to moisture or emersion over a prolonged period of time.
- Even the highest quality concrete contains a network of pores and capillaries and, without adequate damp-proofing protection, this may result in dampness or leaks causing deterioration of internal finishes, mould formation and a health hazard, especially in heated environments where damp concrete is a haven for bacterial development. So concrete loses strength and cracks are formed.
- Where chlorides and oxygen are present, corrosion to the reinforcement in concrete, steel beams, lintels, metal door frames etc. will occur. Where sulfates are present in the surrounding soils and groundwater, serious deterioration of the cement matrix can occur, both situations causing untold damage to the structure.
- Rotting of timber structures and finishes such as floor joints, beams, floors, studs, skirting, architraves and frames.
- Swelling of plasterboards and the subsequent separation of ceramic tiles.
- Electrical hazards causing the possible short circuit of lighting and power points.
- The blistering of paint.
- Unsightly deterioration of the building facade.

SOME WATER PROOFING MATERIALS:

❖ ADMIXTURES:

Admixtures are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes. In normal use, admixture dosages are less than 5% by mass of cement and are added to the concrete at the time of mixing. Admixtures are being produced industrially all over the world.

The materials used to produce Permeability Reducing Admixtures or PRAs vary, but they generally fall into three categories.

The largest category consists of hydrophobic, or water-repellent, chemicals derived from soaps or fatty acids, vegetable oils, and petroleum. These materials form a water-repellent layer along pores in the concrete, but the pores themselves remain open.

The second category is finely divided solids—either inert or chemically active fillers such as talc, clay, siliceous powders, hydrocarbon resins, and coal-tar pitches. These materials densify the concrete and physically limit the passage of water through the pores. Some experts also consider supplementary cementing materials (SCMs) to be in this category.

The third category consists of crystalline products—proprietary active chemicals in a carrier of cement and sand. These are hydrophilic materials that increase the density of calcium silicate hydrate or generate crystalline deposits that block concrete pores to resist water penetration. The various types of materials can be used alone or in combination to give different levels of performance.

❖ FERROCEMENT:

Ferrocement is a form of reinforced concrete. But it differs from the conventional type of reinforcement. Ferrocement consists of Portland cement or Portland Pozzolan cement, sand, water, admixtures and most significantly wire mesh. It is applied over layers of woven or expanded steel mesh and closely spaced small-diameter steel rods rebar. It can be used to form relatively thin, compound-curved sheets of concrete ideal for such applications as hulls for boats, shell roofs, and water tanks. It is also used to fill the cracks of reinforced concrete such as beam, column and slab. Ferrocement provides a high tensile strength to mass ratio

and a better resistance to fire, earthquake, and corrosion or cracking than traditional materials. It also provides a crack free, tough dependable surface free, from danger of leakage.

There are different types of methods of casting ferrocement. The most common method is building a skeleton steel which is welded to the desired shape on either of sides of which are tied several layers of stretched meshes. This is strong enough, so that mortar can be filled in by pressing for one side and temporarily supporting from the other side.

❖ WATER PROOFING MEMBRANE:

A waterproofing membrane is a layer of material that prevents the passage of water. . It is generally very light and fragile, similar in thickness. The membrane is usually placed between two layers. The membrane is bonded to other materials, often directly to the wall or to a hard secondary material, and placed inside a wall cavity. These layers allow water to penetrate half of the wall, but block it from penetrating into the other half. Thus both layers protect the waterproofing membrane and create a physical part that separates the waterproof and the non-waterproof areas. A waterproof membrane may hold water back completely in most situations, but if it gets too warm or cold, small amounts would go through. A water-resistant layer would allow penetration regardless of temperature.

Examples: Bitumenus Felts, Mastic Asphalts, Silicon, Epoxy, different Polymers

In Bangladesh polythene sheets are mostly used as water proofing membrane.

❖ TAR AND BITUMEN:

Bituminous waterproofing systems are designed to protect residential and commercial buildings. Bitumen (asphalt) is a mixed substance made up of organic liquids that are highly sticky and viscous, and are waterproof. Bitumen felt papers are made industrially which are used as water proofing membrane. Felt paper or asphalt felt paper is a sheet material impregnated with bitumen (asphalt), similar to tar paper. It has an unwoven fabric that is produced by matting fibers under pressure. The fibers form the structure of the fabric.

❖ BENTONITE:

Sodium Bentonite, a clay material, has enjoyed a steady upsurge in popularity over the past several years. In panel form, bentonite has become the choice of a growing number of architects and builders. Bentonite works because it can absorb a tremendous amount of water. As it takes in water, the clay swells to 15 times its original volume and pushes itself to cracks and voids. When it reaches its maximum volume, it stays in these areas permanently to seal against water. Firm panel's 4x4-foot corrugated cardboard with clay particles held within the flutes of the cardboard. The panels can be nailed, fastened with a powder-actuated tool, or simply laid in place for horizontal applications.

❖ WATERPROOF CEMENT:

Any number of products and systems are available to help protect concrete structures from damage due to water, from coatings to sealers to membranes and more. Enormous amounts of effort and money are spent to design and apply such protection, with varying degrees of effectiveness. One method that can simplify the protective process is to make concrete with admixtures that reduce its permeability—in effect to make the concrete itself waterproof.

Water proofing cement is mainly cement processed by mixing water proofing additives and epoxies. So it is easy to use. There is no need to arrange additives or membrane.

METHODS OF WATER PROOFING:

Waterproofing is a critical component of any building structure. The four keys to successful waterproofing are:

· taking proper consideration at the design stage
· choosing the right product for the job
· taking adequate preparation
· managing the correct application.

1. WATER PROOFING FOR SIMPLE BASEMENT IN ORDINARY SOIL:

Simple basements of shallow depth generally retaining wall is built around it to resist the pressure of soil. In order to make the basement waterproof different waterproofing additives are mixed with the reinforced concrete or waterproof cement is used. Then a brick wall is made around the retaining wall. For further arrangement to resist water penetrate in the wall waterproofing membrane is used. Waterproofing membrane can be placed between the retaining wall and brick wall.

In order to make the floor or base of the basement waterproofing additives are also used. After leveling and dressing water proofing membrane is placed. On this membrane CC layer is built. Then the reinforced concrete mixed with additive is placed on it.

2. WATER PROOFING FOR LARGE STRUCTURAL LOAD AND DAMP SOIL:

Generally for large buildings having basement or underground parking lot of more depth are provided with mat or raft foundation. In this case at first shore piles are placed around the basement wall. Reinforced retaining walls are built as the basement wall. Around the retaining walls brick walls are built. The space between the shore pile and the brick walls is filled with sand. A waterproofing membrane like bitumen felt can be placed between the brick wall and the retaining wall or on the outer surface of the brick walls. When the structure is built on damp soil with low load bearing capacity, for advanced waterproofing a ferrocement layer can be built on the inner side of the shore piles. We can also use additives on the outer surface of brick wall and in the reinforced concrete of the retaining walls.

In order to make the lowest part of the structure the floor of the basement waterproof, waterproofing membrane and waterproofing additive are used in the reinforcement concrete. The waterproofing membrane is placed between the sand layer and the CC layer.

In our country polythene is mostly used as waterproofing membrane. After leveling and dressing, 2 or more layers of polythene are laid. Then the CC layer is built. On this layer reinforced concrete is cast.

CURE:

There is no permanent cure for a water damaged basement. We can just restrict the water to come inside the basement room. But we cannot cure the damaged wall or floor. We can use sodium bentonite on the inner surface of the wall. It will cover the crack and absorb water. We can also make ferrocement layer on the wall. It also prevents water to come inside.

But when a basement wall or floor is penetrated by water we cannot stop that penetration. So it is the best to take necessary steps to make the basement walls and floor waterproof.

IMPORTANCE OF WATER PROOFING IN BANGLADESH:

Bangladesh is a country situated on the land that was created by deposition of soil in the Bay of Bengal. The soil of our country is mostly deposited by the numerous rivers across our country. The soil is mainly silt, clay which has great capacity to hold water in the pores. We have the Himalayas in the north and the Bay of Bengal in the south. The height of our land from sea level is very small. We have numerous rivers flowing on our land and our country is the catch basin of the huge water to the Bay of Bengal. For the geographical environment of our country it rains a lot in the monsoon. So the ground water level rises then. The water of melting ice of the Himalayas also passes through the rivers across our country. So the level of ground water level rises and drops in different time of the year.

So the structures of our country are in a great risk to be attacked by ground water. In the other hand the process of quality control of building in our country is not good enough due to lack of knowledge of the laborers and corruption in this sphere. For this reason many basements as well as underground parking lots or storages face huge damage to be permeable to underground water. It is very important to us to take necessary actions to prevent our structures from ground water.

CONCLUSION:

It is necessary for the basement of home or commercial building to be waterproof at all times. Damp, leaking, or flooded basement is a usual nightmare of any homeowner or building owner. The reason is quite obvious. It is a hassle if such problems occur especially during rainy or winter season. When it rains, the basement is usually an area in your place where rainfall is accumulated. During or after winter, melted glacier or snow could accumulate and flood the basement. The awareness and understanding of waterproofing has grown significantly over the last decade. More and more people are recognizing the important role that waterproofing elements play in today's building industry.

APPENDIX:

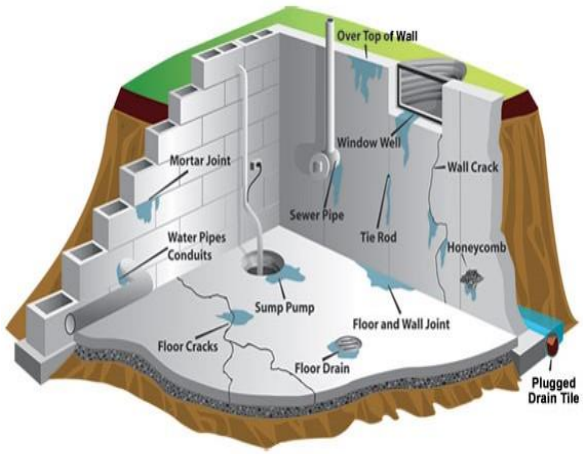

Fig 1: Wet Basement

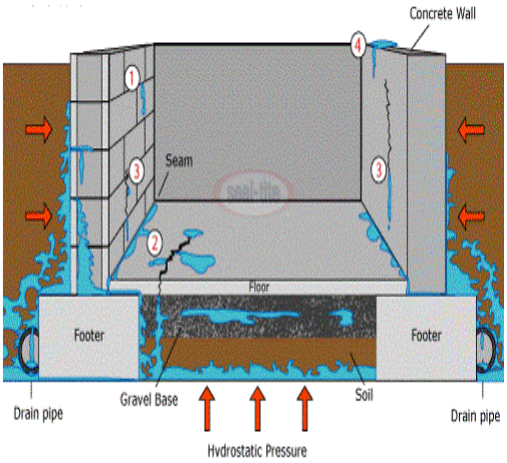

Fig 2: How Water Permeates in the Basement Wall

Fig 3: Water Damages in Basement

Fig 4: Waterproofing Admixture

(i) (ii)

Fig 5(i) & (ii): Casting Ferrocement on Shore Pile

Fig 6: Ferrocement Layer on Shore Piles

Fig 7: Bitumen Felt Layer on Exterior Brick wall

Fig 8: Bitumen Felt

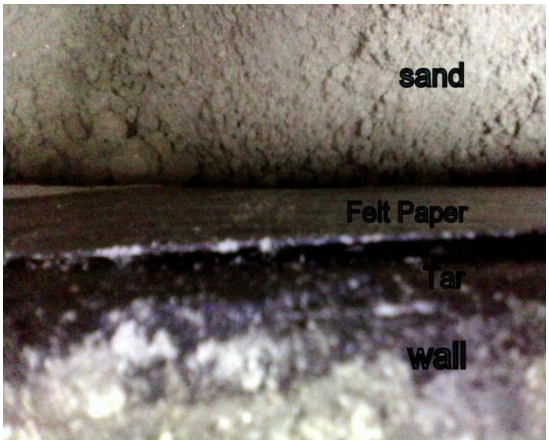

Fig 9: Position of Brick Wall, Felt Paper & Sand Fill

(i) (ii)

Fig 10(i) & (ii): Reinforcement Wall & Brick Wall around the Basement

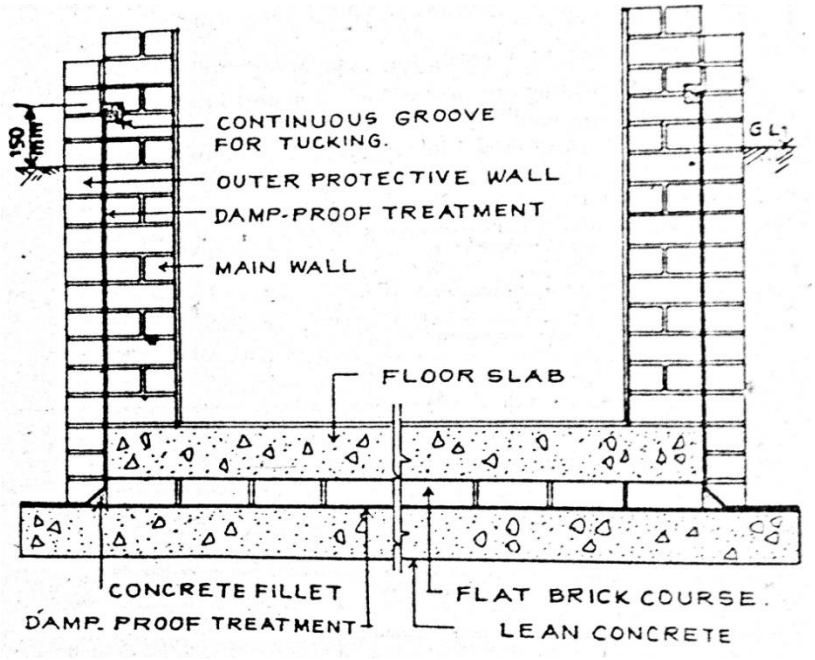

Fig 11: Water Proofing For Simple Basement in Ordinary Soil

Fig 12: Overall Site

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SITE EXPLORATION:

SKS Tower

Plot No: 7, Mohakhali,

Dhaka: 1206

Site Engineer: Engr. Md. Shamim Islam

Contract No: 01760619700