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Water Proofing System in Concrete Structures

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Abstract: *Water proof structure is a design concept that aims to repel water and prevent any moisture from seeping into the materials used in construction. This type of structure is particularly important in areas prone to heavy rainfall or flooding, as it helps maintain the integrity and durability of the building. Water proof concrete is formulated with additives and admixtures that create a barrier against water infiltration, making it ideal for areas prone to high levels of humidity or moisture. By incorporating this technology into construction projects, builders can ensure that their structures remain protected from the damaging effects of moisture, such as mold growth, deterioration of building materials, and potential structural issues. The use of abstract damp proof concrete represents a forward-thinking approach to building design and can greatly enhance the durability and longevity of a building.Crystalline admix water proofing with water stops, water proofing with Atactic Polypropylene membrane, and injection are the water proofing systems most commonly used in basements. Using non-shrinking cementitious grout for waterproofing, concrete must have crystalline admixtures made of cementitious powder and water. For toilets in non-sunken places, water proofing with an elastomeric cementitious coating is used. In sunken areas, brick jelly cement concrete with inherent water proofing compound is used.In this paper it deals with the different types of water proofing system..*

Keywords: Water proof concrete

I. INTRODUCTION

Waterproofing is an essential element in preserving the integrity of concrete structures. Concrete is a porous material that is susceptible to damage from water infiltration, which can lead to deterioration and structural issues over time. By applying a waterproofing membrane to the surface of the concrete, moisture is prevented from seeping into the material and causing damage. Waterproofing also helps to extend the lifespan of the concrete structure, saving time and money on costly repairs in the long run.

In addition to protecting the concrete itself, waterproofing also helps to protect any embedded steel reinforcement within the structure. Steel reinforcement is commonly used in concrete construction to provide added strength and stability, but it is vulnerable to corrosion if exposed to moisture. By waterproofing the concrete, the likelihood of corrosion occurring is significantly reduced, ensuring the structural integrity of the building for years to come.

There are various methods of waterproofing concrete structures, including using liquid-applied membranes, sheet membranes, and integral waterproofing additives. Each method has its own advantages and limitations, depending on the specific needs of the project. Properly waterproofing a concrete structure requires careful planning and consideration of factors such as climate, water exposure, and the intended use of the building. By incorporating waterproofing into the construction process, engineers and contractors can ensure that the concrete structure remains durable, safe, and aesthetically pleasing for many years.

Damp proof concrete is a type of concrete that is specifically designed to prevent moisture from seeping through its surface. This type of concrete is commonly used in areas that are prone to high levels of humidity or moisture, such as basements or crawl spaces. Damp proof concrete is typically made with additives such as waterproofing agents or special admixtures that help to create a barrier against moisture penetration. Additionally, the surface of damp proof concrete is often sealed with a waterproof coating to further enhance its resistance to water infiltration.

One of the key benefits of damp proof concrete is its ability to prevent water damage and mold growth in buildings. By effectively blocking moisture from entering the concrete, damp proof concrete helps to maintain the structural integrity

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of a building and prolong its lifespan. Furthermore, damp proof concrete can also help to improve indoor air quality by reducing the risk of mould spores and other allergens from thriving in damp environments. Overall, damp proof concrete is an essential building material that not only enhances the longevity of structures but also contributes to a healthier and more comfortable living environment.

In general, water permeability of exposed concrete structures such as pavement and bridge deck affect the durability and corrosion of the reinforcing steel in the structure. Water-related problems such as freezing and thawing also cause serious degradation in reinforced concrete. Permeability is known to be influenced by the quantity, kind, and spread of the pores present in a substrate. Therefore, infrastructures need to be inspected and maintained over time

Waterproofing is an essential aspect of building construction and maintenance. It helps to prevent water damage and deterioration caused by moisture, which can lead to costly repairs and even structural failure over time. There are several types of waterproofing methods and materials available, including membranes, coatings, sealants, and drainage systems. Membrane waterproofing involves the application of a thin layer of material, such as a sheet or liquid that forms a barrier against water penetration. Membranes can be made from a variety of materials, such as rubber, bitumen, Polyvinyl chloride or polyurethane. They are often used in areas that are prone to moisture, such as roofs, basements, and foundations. Coating waterproofing involves applying a protective layer of material, such as a paint or sealant, to the surface of a structure to prevent water penetration. Coatings can be applied to a variety of surfaces, such as concrete, masonry, and metal. Sealant waterproofing involves filling gaps and joints with a water-resistant material, such as silicone or polyurethane, to prevent water from entering the structure. Sealants are often used around windows, doors, and other areas where there may be gaps or joints. Drainage systems are designed to remove excess water from the building envelope and prevent water from accumulating around the foundation. They can include systems such as French drains, sump pumps, and gutters. Proper installation and maintenance of waterproofing systems is essential to their effectiveness. Regular inspections and repairs can help to prevent water damage and extend the life of the structure. It is also important to choose the appropriate waterproofing method and materials for the specific needs of the structure and its environment.

OBJECTIVE

The broad objective of this study is as under:

- Waterproof concrete is to prevent water from infiltrating the structure and causing damage to the building. This is particularly important in areas that experience heavy rainfall or are prone to flooding, as water infiltration can weaken the structural integrity of the building and lead to costly repairs.
- Waterproof concrete is to provide a durable and long-lasting solution for structures that are exposed to harsh environmental conditions. By preventing water from entering the concrete, waterproofing helps to extend the lifespan of the building and reduce maintenance costs in the long run.

II. METHODOLOGY AND DESIGN

Waterproof concrete is a crucial technology in the construction industry, as it enhances the durability and longevity of concrete structures in various environmental conditions. The methodology behind waterproof concrete involves the incorporation of various admixtures and additives to improve the water resistance of the concrete mixture. Some of the common admixtures used in waterproof concrete include superplasticizers, fly ash, silica fume, and water repellents, which help reduce the permeability of the concrete and enhance its resistance to water penetration.

In addition to admixtures, the methodology of waterproof concrete also involves proper concrete mix design and construction practices. The proper selection of concrete mix proportions, curing methods, and construction techniques are essential to ensure the successful implementation of waterproof concrete. Proper compaction of the concrete mixture, adequate cover thickness, and effective joint sealing are also crucial factors in achieving a watertight concrete structure. Overall, the methodology of waterproof concrete requires a combination of proper materials selection, mix design, and construction practices to achieve a durable and waterproof concrete structure.

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No.	Materials	Examples	Effect on Concrete
1	Macro	Silanes, siloxanes	Showed to have the ability to resist water absorption by 98% and increase Static water contact angle to 164 in the treated sample
		Silicates containing compounds	Reduced water absorption up to 98.5% and showed the lowest chloride penetration depth of 1 mm compared to the control sample
2	Micro	Polymers	Reduced water absorption up to 98.96% and decreased chloride penetration depth to 1 mm in the treated sample
3	Nano	SiO2, ZnO2 and nano clay	Could reduce chloride penetration by 69% and increase static water contact angle to 142°

Table1. Classification of agents based on the material

Surface Coating

Surface coatings are the waterproofing methods applied on the surface of substrates either by dipping, brushing and/ or spraying to serve as coatings. They are usually applied for repair or improvement of service life of an infrastructure. They can be polymers, silanes, and siloxane-based additives. Some additives have low water absorption and high -water vapor transmission.

Micro Materials

Micro materials are basically polymers as well as their dispersions and emulsions. Here, the reduction of water absorption was noticed to be up to 98.96%. Also, the maximum reduction of 94% reduction in chloride ingress was reported. In addition, long term durability of the substrate in the acidic environment was compromised.

Nano materials

Nano materials used here are nano-SiO2, ZnO2, and Nano clay. These Nano materials were incorporated to improve water repellence. Static water contact angles of 120°, 130°, and 142° were reported.

III. CONCLUSION

According to the studies analyzed in this paper, the following conclusions are drawn:

- External coating and membrane are one of the common techniques of water proofing concrete structure.
- Most of the researchers were used of surface coating.
- Use of polymer-based materials, silicates containing compound,cementing materials and some of the Nano materials are the futuristic approach for this domain.
- Internal mixing of hydrophobic material in concrete are proved more stable and provide better performance for water proofing structures.

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REFERENCES

[1]. IRC SP-53:2010, "Guidelines on use of modified bitumen in road construction"
[2]. IRC SP: 53-2002, 2004, 2010 "Guidelines on use of Polymer and Crumb Rubber Modified binder.
[3]. D.X. Ma, Y. Liu, Y. Lai, The Influence of Pore Structure on the Waterproof Performance of Polymer Modified Mortar, Applied Mechanics and Materials 584–586 (2014) 1130–1134.

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[4]. S. Bohus, R. Drochytka, L. Taranza, Fly-Ash Usage in New Cement-Based Material for Concrete Waterproofing, Adv. Materials. Research 535–537 (2012) 1902–1906.

[5]. M.Z. Jumaat, M.H. Kabir, M. Obaydullah, A Review of the Repair of Reinforced Concrete Beams, Journal of applied Science Research 2 (6) (2006) 317–326.

[6]. S. Kenai, R. Bahar, Evaluation and repair of Algiers new airport building, Cement and Concrete Composites 25 (2003) 633–641.

[7]. R. Bahaskaran, N. Palaniswamy, N.S. Rengaswamy, A review of differing approaches used to estimate the cost of corrosion (and their relevance in the development of modern corrosion prevention and control strategies), Anti-corrosion method and materials 52 (1) (2013) 29–41.

[8]. Brito J. De, Discussion of proactive maintenance strategies in façades ' coatings of social housing, Journal of Building Appraisal 5 (2009) 223–240. [19] J. Lin, D. Scott, Assessment of Significances of Building Failure Induced by Foundation Failure, Building Integration Solutions, AEI, 2006.

[9]. Y. Liu, J. Wu, J. Chen, Mechanical properties of a waterproofing adhesive layer used on concrete bridges under heavy traffic and temperature loading, Int. J. Adhes. Adhes. 48 (2014) 102–109.

[10]. F. De-cheng, X. Meng, W. Wen-ding, Analysis of the Influence of Cement Concrete Deck Moisture Content on the Bonding Performance of Waterproof Adhesion Layer, Journal of Highway and Transportation Research and Development 8 (2) (2014) 31–36.

[11]. G.G. Litvan, Waterproofing of parking Garage Structures with Sealers and Membranes The Canadian Experience, Construction and Building Material 10 (1) (1996) 95–100.

[12]. W. Grantz, T. Lion, S. Egon, Waterproofing and Maintenance. Tunnelling and Underground Space Technology, Elsevier Science Limited 12 (2) (1997) 111– 124.

[13]. L. Basheer, D.J. Cleland, A.E. Long, Protection provided by surface treatments against chloride induced corrosion, Materials and Structures 31 (1998) 459–464.

[14]. J. Mirza, C. Abesque, Evaluation of surface sealers for concrete hydraulic structures exposed to low temperatures, Materials and Structures 44 (2011) 5–12.

[15]. M.V. Diamanti, A. Brenna, F. Bolzoni, M. Berra, T. Pastore, M. Ormellese, Effect of polymer modified cementitious coatings on water and chloride permeability in concrete, Construction and Building Materials 49 (2013) 720–728.

[16]. D.V. Gemert, L. Czarnecki, M. Maultzsch, H. Schorn, A. Beeldens, P. Łukowski, E. Knapen, Cement concrete and concrete–polymer composites: Two merging worlds, Cement Concrete. Composite. 27 (9–10) (2005) 926–933.

[17]. W. Yao, Q.Q. Hu, Y. Mu, J.B. Chen, F.Q. Zhao, Polymer Modified Cementitious Waterproofing Coatings: Application and Problems, Advance Material. Research. 936 (2014) 1378–1381.

[18]. J.B. Kardon, Polymer-Modified Concrete: Review, Journal of Materialin Civil Engineering 9 (2) (1997) 85–92.

[19]. Y. Ohama, S. Ramachandran, Polymer-Modified Mortars and Concretes, Noyes Publications, United States of America, 1995.

[20]. D. Fowler, Polymers in concrete: a vision for the 21st century, Cement. Concrete Composite. 21 (5–6) (1999) 449–452.

[21]. K.-R. Wu, D. Zhang, J.M. Song, Properties of polymer-modified cement mortar using pre-enveloping method, Cement Concrete Research. 32 (3) (2002) 425–429.

[22]. S. Faiz, U. Ahmed, ''Mechanical and Durability Properties of Mortars Modified with Combined Polymer and Supplementary Cementitious Materials, Journal of Materials in Civil Engineering 23 (2011) 1311–1319.

[23]. H. Qianqian, L. Shaojie, L. Peixin, C. Xiaomeng, Development of Tailings Based Polymer-modified Waterproof Mortar, Advanced materials Research 878 (2014) 157–162.

[24]. R. Selvaraj, M. Selvaraj, S.V.K. Iyer, Studies on the evaluation of the performance of organic coatings used for the prevention of corrosion of steel rebars in concrete structures, Progress in Organic Coatings 64 (4) (2009) 454–459.

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[25]. M.R. Jones, Dhir R K andGill J P ‘‘Concrete Surface Treatment: Effectof Exposure Temperature on Chloride Diffusion Resistance”, Materials Cement and Concrete Research 25 (1) (1995) 197–208.

[26]. X. Xingxin, C. Sun, X. Chen, L. Qin, J. Yu, Investigation on the aging properties of silicone coating in marine concrete, Advanced Materials Research 366 (2012) 296–300