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# Experimental investigation on properties of concrete with waterproofing compound

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**Abstract: Concrete is a construction material, used in wide variety of situations. So it is very important to consider its durability as it has indirect effect on economy, serviceability and maintenance. In case of hydraulic and water retaining structures, concrete is directly exposed to water or humid environment. Hence, permeability of concrete becomes major concern for the durability of such structures. Water proofing compounds can be used to improve the pore structure of concrete and hence to reduce the water permeability of concrete. Nowadays, a number of waterproofing products are available in market which works on reduction of permeability of concrete. Few of them are required to be added while mixing the concrete ingredients and few others are applied on the concrete surface. The main aim of this project is to study the effect of waterproofing compounds added at ratio of 2%,6% &10% to the concrete and its durability and mechanical properties of concrete are determined.**

**Keywords – Compressive, Flexural and Split-Tensile strength, Durability, Waterproofing compound**

## I. INTRODUCTION

In present study waterproofing compound was used in concrete. The main objective of this project was to study the effect of waterproofing compound in concrete. There are two ways for water to penetrate through the concrete. When concrete is under hydrostatic pressure on one surface, water passes through the channels formed by the interconnecting cracks and voids to the other surface. The other way for the passage of moisture through the concrete from the wet side to the dry side is by capillary action. Water proofing admixtures can be use to improve the pore structure of concrete and hence to reduce the water permeability of concrete. An integral waterproofing admixture is a combination of admixtures that have the ability of producing concrete with reduced permeability. In case of hydraulic and water retaining structures, concrete is directly exposed to water or humid environment. More severe damage in concrete changes the capillary pore structure (crack widths) and increases permeability parameters. Water proofing admixtures are used toreducethe water permeability of plain concrete. In present experimental work, water proofing chemical is used in concrete to evaluate its performance and effect on properties of concrete. The water proofing admixture was added during mixing of concrete ingredients.

## II. MATERIAL USED

The materials used for this experimental work are cement, sand, aggregate, water, steel fibers, and fly ash.

**Cement:** Ordinary Portland cement of 53 grade was used with specific gravity 3.15 in this experiment conforming to I.S. – 12269- 1987.

**Sand:** Locally available sand zone II with specific gravity 2.74, water absorption 2% and fineness modulus 2.8, conforming to I.S. – 383-1970.

**Coarse aggregate:** 20 mm of crushed aggregate with specific gravity 2.75, moisture content 0.25% Water absorption 0.6%.

**Water**: Portable water was used for the experimentation.

**Reinforcement:** Beam casting while using10 mm HYSD Bar main reinforcement and 8 mm HYSD lateral ties.

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## III. EXPERIMENTAL PROCEDURE

**Mix Design:**

The proportions for normal mix of M25 Normal Mix are 1:1:2 with water cement ratio 0.4. In the present study method for mix design is the Indian Standard Method. The mix design involves the calculation of the amount of cement, fine aggregate and coarse aggregate in addition to other related parameters dependent on the properties of constituent material. The modifications are made and quantities of constituent materials used to cast Reinforced concrete.

**Batching, Mixing and casting of beams**:

Batching, mixing and casting operations was carefully done. The Concrete mixture was prepared by hand mixing on a watertight platform. The coarse Aggregates and fine aggregates were weighed first with an accuracyof 0.5 grams. On the watertight platform, the coarse and fine aggregates were mixed thoroughly. The Cement was mixed dry to uniform color separately. To this mixture, the required quantity of cement, added.

These were mixed to uniform color. Then water was added carefully so that no water was lost during mixing. The moulds were filled with by weight of cement was added to this. The top surface of the specimen was leveled and finished. After 24 hours the specimens were demoulded and were transferred to curing tank where in they were allowed to cure for 7 & 28 days.

**Workability Test**

Workability is carried out by conducting the slump test. As per I.S. 1199-1959 on ordinary concrete and waterproof concrete.

**Compressive strength test**

The compressive strength of concrete is one of most important properties of concrete in most structural applications. For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for M25 grade of concrete. After curing, these cubes were tested on Compression Testing machine as per I.S. 516-1959. The failure load was noted. In each category two cubes were tested and their average value is reported. The compressive strength was calculated as follows, Compressive strength (MPa) = Failure load / cross sectional area.

**Flexural strength test**

For flexural strength test beam using reinforcement specimens of dimension 500x100x100 mm and were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank where in they were allowed to cure for 28 days. These flexural strength specimens were tested under two point loading as per I.S. 516-1959, over an effective span of 600 mm divide into three equal parts and rest on Flexural testing machine. The load is normally increased & failure load is noted at cracking of beam specimen. In each curing periods two beams was tested and their average value is reported. The flexural strength was calculated as follows. Flexural strength (MPa) = (P x L) / (b xd2), Where, P = Failure load, L = Centre to centre distance between the support = 600 mm, b = width of Specimen=150 mm, d = depth of specimen= 150 mm.

**Split tensile strength**

For Split tensile strength test, cylinder specimens of dimension 150 mm diameter and 300 mm length were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank where in they were allowed to cure for 7 & 28 days. These specimens were tested under compression testing machine. Each curing period two cylinders were tested and their average value is reported. Split Tensile strength was calculated as follows as split tensile strength: Split Tensile strength (MPa) = $2P / \pi DL$, Where, P = failure load, D = diameter of cylinder, L = length of cylinder.

## IV. EXPERIMENTAL RESULTS

**Fresh concrete**:

The fresh concrete properties slump test is shown in table No.1.

Table No.1:- Result of Slump test

| Water cement ratio | Test results (mm) | value of true slump (mm) |
|---|---|---|
| 0.4 | 45 | 25-50 |

**Hardened concrete**:

The hardened concrete specimen properties are checked by compressive strength, split tensile strength and flexural strength.

**Compressive strength**:

The compressive strength of cube specimen is checked after 7 & 28 days in compressive testing machine. The result of compressive strength in Table no.2

Table No.2 Compressive Strength test

| Days | % of adding admixture | COMPRESSIVE STRENGTH(Mpa) |
|---|---|---|
| 7 days | cc | 18.35 |
| | 2% | 17.36 |
| | 6% | 18.78 |
| | 10% | 18.05 |
| 28 days | cc | 31.86 |
| | 2% | 31.78 |
| | 6% | 32.05 |
| | 10% | 31.95 |

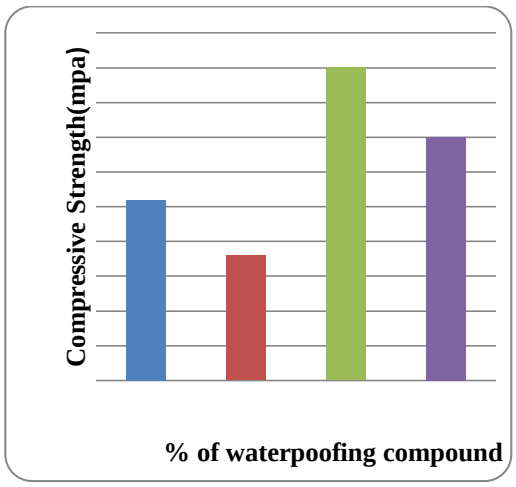


**Chart-1 Analysis of Compressive Strength at 28 days**

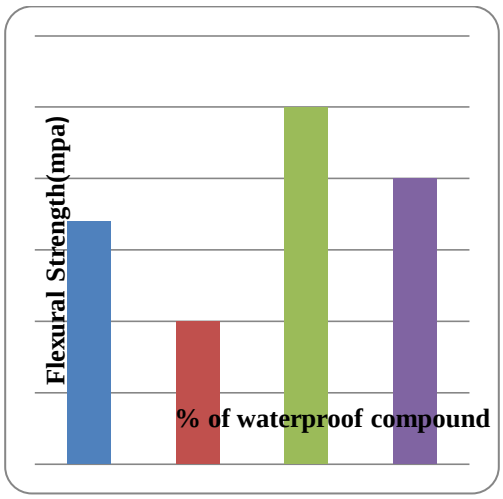


**Chart-2 Analysis of Flexural Strength at 28 days**

**Flexural Strength**

The Flexural strength test of Prism specimen is checked after 7 & 28days. The result of Flexural strength is shown in Table.3

Table No.3.Flexural strength of Prism

| Days | % of adding admixture | Flexural Strength(MPa) |
|---|---|---|
| 7 days | cc | 3.32 |
| | 2% | 3.36 |
| | 6% | 3.78 |
| | 10% | 3.45 |
| 28 days | cc | 4.57 |
| | 2% | 4.5 |
| | 6% | 4.65 |
| | 10% | 4.6 |

**Split tensile Strength**

The Split tensile strength test of cylinder specimen is checked after 7 & 28days. The result of Split tensile strength is shown in Table.4

Table No.4.Split tensile strength of cylinder

| Days | % of adding admixture | Split Tensile Strength(MPa) |
|---|---|---|
| 7 days | cc | 1.32 |
| | 2% | 1.03 |
| | 6% | 1.56 |
| | 10% | 1.37 |
| 28 days | cc | 2.5 |
| | 2% | 2.45 |
| | 6% | 2.75 |
| | 10% | 2.63 |

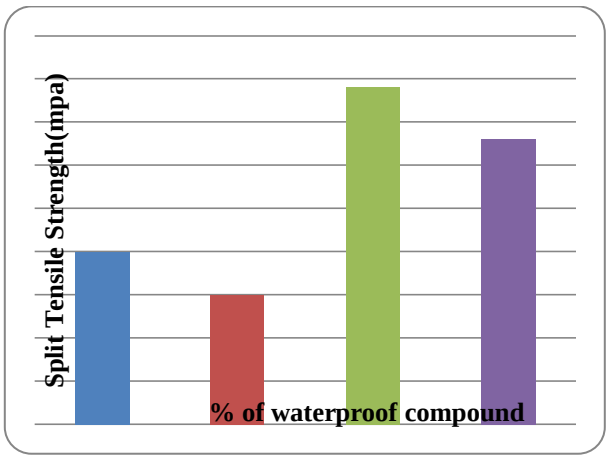


**Chart-3 Analysis of Split Tensile Strength at 28 days**

**Water Absorption Test**

For concrete, the test procedure involves drying a specimen to a constant weight, weighting it, immersing it in water for specified amount of time, and weighting it again. The increase in weight as a percentage of the original weight is expressed as its absorption (in percent). The average absorption of the test samples shall not be greater than 5% with no individual unit greater than 7%.The 150 x 150 mm size cube after casting were immersed in water for 90 days curing.These specimens were then oven dried for 24 hours at the temperature110°C until the mass became constant and again weighed. This weight was noted as the dry weight (W1) of the cylinder. After that the specimen was kept in hot water at 85°c for 3.5 hours. Then this weight was noted as the wet weight (W2) of the cylinder. % water absorption = [(W2– W1) / W1] x 100

## V. CONCLUSION

The optimum percentage of Water proofing compound is obtained as 6%.As compared with normal concrete, concrete with 6% waterproofing compound showed higher slump &compressive strength. Waterproofing compound improves the pores structure of concrete and made the concrete denser than the normal concrete and showed better result than normal concrete. As Compared with normal concrete, concrete with 6% water proofing compound showed decrease in water absorption, porosity andincrease strength. Results of conventional concrete are comparable with waterproofing concrete. Concrete structures are often exposed on influence of environmental impacts. The significant issue is to protect properly concrete structures against the damaging effect of dampness. For correct operating, an essential condition is to effectively protect the structure. The defective protection against water in an object generates destructive processes, which significantly reduce its permanence. It causes the necessity of carrying out the expensive repairs, in order to determine the predicted period of using the object. The protection of the concrete structure against the harmful action of dampness is a major economical and technical problem.We can also conclude that the construction process needs proper supervision, better workmanship, use of chemicals in required amount, qualitative materials and importantly maintenance of structural components. Water damage can be a serious issue in a structure. With water come moulds and a host of other oblems which can undermine foundations, make conditions in the building unsafe, and damage property inside the building. Wooden buildings can suffer rapiddecay from water exposure, but water penetration can also damage concrete and other building materials, especially in cold climates where water may freeze and cause cracks.Insufficient waterproofing can be a problem year round, not just during the rainy season. Somepermeability in a building is desired, not least because building occupants generate humidity which must be safely vented. The goal of building waterproofing is to prevent as much water as possible from entering the building

**REFERENCES**

[1] Craig, S. (2010). “Understanding Integral Waterproofing”, waterproof magazine http://www.hycrete.com/wp-content/uploads/WaterproofMagazine-Integral-Waterproofing-April2010.pdf.

[2] Foster, B. E. (1950). Use of Admixtures as Integral Water proofing and Damp proofing Materials. ACI Journal, 22(1), 46-52.

[3] Geetha A. and Perumal P., Effect of Waterproofing Admixtures on the Flexural Strength and Corrosion Resistance of Concrete, Journal of The Institution of Engineers (India): Series A, Vol. 93, pp. 73-78, 2012

[4] Ghafari N., Corrosion control in underground concrete structures using double waterproofing shield system (DWS), International Journal of Mining Science and Technology, Vol. 23, pp. 603611, 2013

[5] Hariharan, G., Jain, S.P.S. (1998), Water Proofing of Building &Structures,CE’sCircular No.193, http://www.ser.indianrailways.gov.in/uploads/files/1303281777301-CEC193.pdf,.

[6] Dr. K.P. Jaya (2011), “Retrofitting and Rehabilitation of Structures”, Paper presented in one day conference on Repair, Restoration and Rehabilitation of Concrete Structures.

[7] Kaushal.K. (2000). “Waterproofing of Buildings”, NBM & CR, pp. 50-55. ix. Kubal, M. T. (2000). “Construction waterproofing handbook”,McGraw-Hill Professional Publishing.

[8] Perkins, P. (2002). “Repair, protection and waterproofing of concrete structures”.CRC Press.

[9] Prajapati and Arora (2011), ―A study on oxygen permeability of concrete containing different water proofing admixtures and cementations 54 materials ,International journal of advanced engineering research and studies, Vol. 1

[10] Renwick Lynn D’souza, Bridge waterproofing details, university of pittsbursh 2014.