

EFFECT ON CONCRETE TENSILE STRENGTH OF DIFFERENT DISTRICT OF GROUND WATER

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Abstract

The quality of mixing water may affect the setting, hardening and strength of the concrete. Concrete is the most durable material and cement provides the large amount of energy to structural materials in concrete. Here the principal consideration is to mixing the quality and quantity of water into the concrete preparation. For the preparation of concrete quality of water always plays an major role. Quality of water may vary according to places; hence it may change the behaviour of concrete. It is seen that the water may affect strength, workability, setting time, tensile strength. According to IS3025 (PartII):1983, pH value of water should be potable between the range of 6.0 to 8.0 pH, it is favourable for construction work. The works aim is to provide a new approach of concrete tensile strength and also check the alkalinity, total suspended solids, sulphate, hardness etc. Samples are collected by different district (Durg, Rajnandgaon, Kawardha, Balod) of Chhattisgarh. Here we get different types of Minerals in every district. So This is done to determine the Split Tensile Strength Test of Concrete by making concrete cylinders. The samples of concrete (cylinder) were made for two different Grade i.e.mix design of M20 and M25.

Keywords- Strength, Setting time, Water test, Impurity, pH value, Tensile Strength, Sieve analysis, W/C ratio, PPC cement, Workability test.

1. INTRODUCTION

Water is an important ingredient of concrete. The quality and quantity of water is to be looked into very careful. The capacity to resist cracking, breaking under tension is term as tensile strength of concrete. Tensile strength properties are included in material specification to check the quality. Nowadays, there are a number of methods for determining strength of concrete. Split cylinder test of concrete is one the method to analyse the tensile strength of concrete. For making road and runways tensile strength is major property of concrete. Water quality take an important role in concrete mixture, it may vary the result of test. To know the quality of water it is compulsory the take knowledge about water chemical composition. To improve the workability more water is add, if the fine content of sand is in excessive amount. In concrete there are some fine particle like clay and cement particle when this interact with water in physiochemical state it leads to more absorption of water than coarse and fine aggregate. Here collection of water have been done of 100 litres from every districts for the

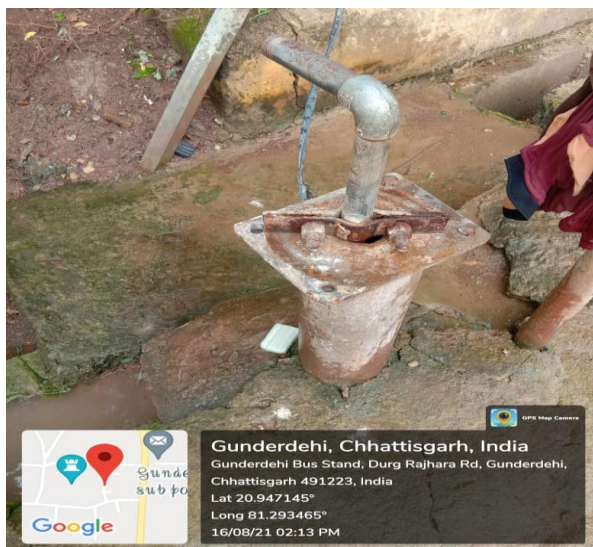
testing of water , for mixing the concrete and for curing it for 7 and 28 days. Almost in Chhattisgarh there are 29 minerals have been reported in the state. Some important are as- Coal, Iron ore, Limestone, Dolomite, Bauxite, and Tin ore.

Durg is one of the most densely populated district in state and it is situated in a southern part of “Chhattisgarh Plain”. Survey of India Degree N Latitude $20^{\circ}54'$ to $21^{\circ}32'$ and E Longitude $81^{\circ}10'$ to $81^{\circ}36'$. It consists of deposits of limestone with low grade, iron, lead, fluoride and chromium.

Rajnandgaon district was split up by Durg in 26 January 1973 and as per survey of India it exists from N Latitude $20^{\circ}70'$ to $21^{\circ}50'$ and E Longitude $81^{\circ}29'$ to $82^{\circ}23'$. Minerals of economic importance are mainly found in Rajnandgaon Iron ore, Quartz, Flag stone and Quartzite.

Kawardha district is situated in western of Chhattisgarh state. The district is bounded from N Latitude $21^{\circ}42'$ to $22^{\circ}32'$ and E Longitude $80^{\circ}49'$ to $81^{\circ}34'$. In kawardha district Minerals were found as Limestone, Iron ore etc.

Balod is one of the dense populated area and situated in the central part of the Chhattisgarh. The N Latitude $20^{\circ}23'$ to $21^{\circ}03'$ and E Longitude $80^{\circ}48'$ to $81^{\circ}30'$. Balod District is covered by Durg districts in the north and Rajnandgaon district in west. The minor Minerals which found is low grade Limestone, flagstone, laterite, sandstone, quartzite and quartz. The ground water movement in gunderdahi shale occurs under the zone of saturation, it caused by the heating and expansion of groundwater.



2. SIGNIFICANCE OF WORK

Here aim of the work is to check the quality of water behaviour in concrete for tensile strength, so for this some analysis and tests are conducted which helps to know the underground water quality in different district of Chhattisgarh geological. The role of water is very important because the water to cement ratio is the most critical factor in the production of perfect concrete. Too much water reduces concrete strength, while too little will make the concrete unworkable. It is the least expensive ingredient of concrete. It plays an important role in mixing, laying, and compaction, setting and hardening of concrete. The pH of water shall be generally between 6 to 8

Water act as a lubricant for the fine and coarse aggregate and makes the mixture workable. The water causes the hardening of concrete through a process is called hydration. According to studies we check the chemical qualities of four districts of water and see the split tensile strength of concrete by making concrete cylinder.

The split tensile strength is to resist the tensile force applied to it. In this test the concrete cylinder is placed horizontally between loading surfaces and loaded along its diameter. This loading results in producing lateral tensile stress in the cylinder and its splits in tension along its diameter. The tensile strength of concrete is measured by the units of force per cross sectional area (N/Sq.mm or Mpa).



Figure 1: Samples of Water for Testing.

3. EXPERIMENTAL WORK

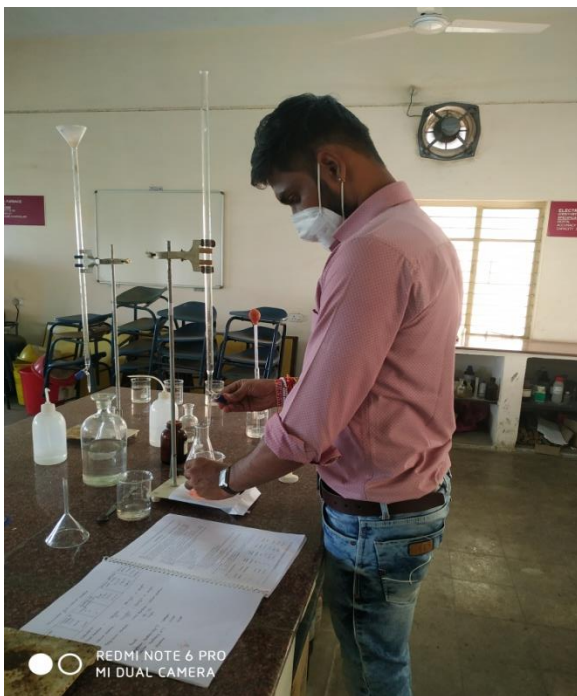
In this study, the construction process, fresh or portable water is generally utilized by for the development of concrete materials. Here the effect of quality of groundwater on the split tensile strength is analysing, we have taken four districts of underground water of Chhattisgarh where different types of minerals are found and check the different properties of water. This research gap can be studied under different mix design parameters and underground water resources to understand the utilization of developed concrete with the help of testing of tensile strength. To probable utilization of various district underground water

resources collected for the development of concrete. The construction materials with different ratios and mix design grade of M-20 and M-25 were prepared. For every different four districts of underground water for M-20 grade and M-25 grade 32 samples were tested for split tensile strength test for 7 days and 28 days.

3.1 Materials-

3.1.1 Water analysis:-

Water quality kept an important role in concrete mixing; a potable water gives good property and chemical composition to concrete. To check the purity of water several types of test process is used.



S No.	Name of District	pH	TDS (ppm)	Alkalinity (ppm)	Acidity (ppm)	Total Hardness (ppm)	Chlorides (ppm)	TSS
1.	Durg	7.39	344	225	95	245	169.99	0.148
2.	Rajnandgaon	7.45	485	170	50	345	114.99	0.016
3.	Kawardha	7.33	413	185	45	405	164.99	0.01
4.	Balod	6.93	533	170	75	375	214.99	0.016

Table: 3.1 Water Analysis Test.

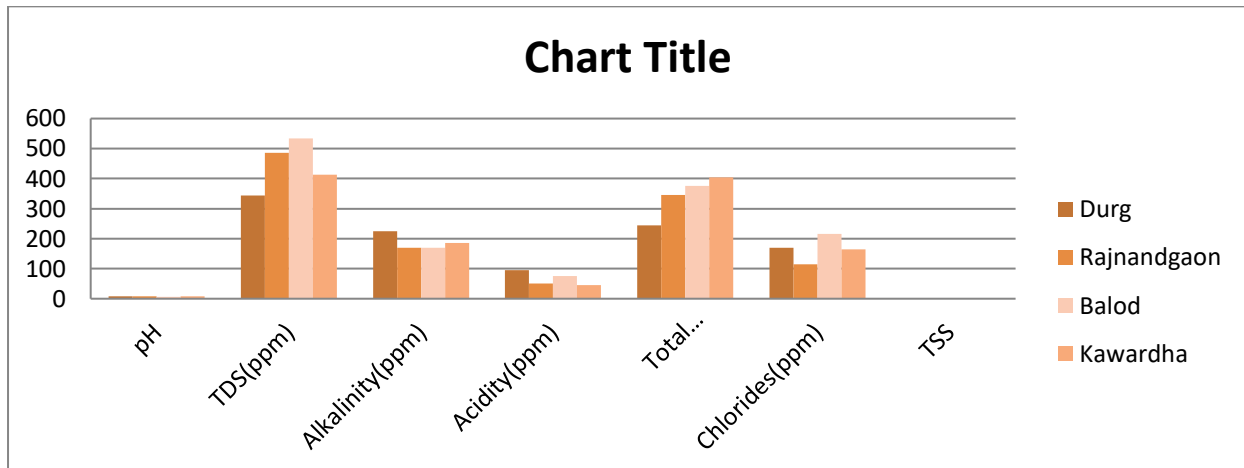


Figure No.3.1 Graph representation of water test analysis

3.1.2 Cement:-

The expected and actual results are analyzed by the testing of any material. For any construction work it is necessary to ensure that the material product can withstand at certain condition, variation at weather condition and at load condition which can resist the structure from future risk. In concrete mix, we have taken PPC ULTRATECH cement plays the vital role for the analysis of cement quality this test will performed.

- Normal consistency
- Fineness of cement
- Soundness of cement
- Initial and final setting time of cement
- Specific gravity

3.1.3 Aggregate:-

To provide strength, thermal and elastic properties of concrete aggregate plays essential role. Here size of aggregate varies greater than 4.75mm and passes through 20mm sieve is taken, this is termed as coarse aggregate. In any concrete mixture 70 to 85% of mass have taken by coarse aggregate. To check the quality and property of these aggregate following tests are done.

- Water absorption
- Fineness of coarse aggregate
- Moisture content
- Specific gravity

3.1.4 Sand:-

In concrete mix sand from natural gravel deposits or from crushed rocks provides strength, sand is taken 4.75mm passing sieve, it's also called as fine aggregate, and for check the quality of sand following basic test are conduct.

- Fineness of sand
- Moisture content
- Specific gravity



3.2 Methodology-

The Cylinder were casted for M20 and M25 grade of Concrete for which Mix Designs were done and the ratio for M20 is (1:2.01:3.49) and for M25 it is (1:1.81:3.29). Then after calculating the weight of materials

1. Take the weighted materials i.e. Fine Aggregate and Coarse Aggregate along with PPC Cement.
2. Dry mix the materials thoroughly.
3. Mix all the materials side by side and by turning it over each other and then make a hollow at the centre.
4. Add Appropriate quantity of different district of water by measuring and mixing mixture thoroughly.
5. Now put the mixture in oil polished cylinder Moulds 1/3 of mould.
6. Now after temping 25 times fill the 2/3 of the mould and repeat the process
7. Now completely fill the mould and level it then put on Table Vibrator then keep for 24 hours.
8. After 24 hours take the specimen out of the mould and keep for Curing in curing tanks.
9. After 7 & 28 Days the specimens will be taken out of curing tanks and after waiting for few hours the Split Tensile Strength tests will be performed.

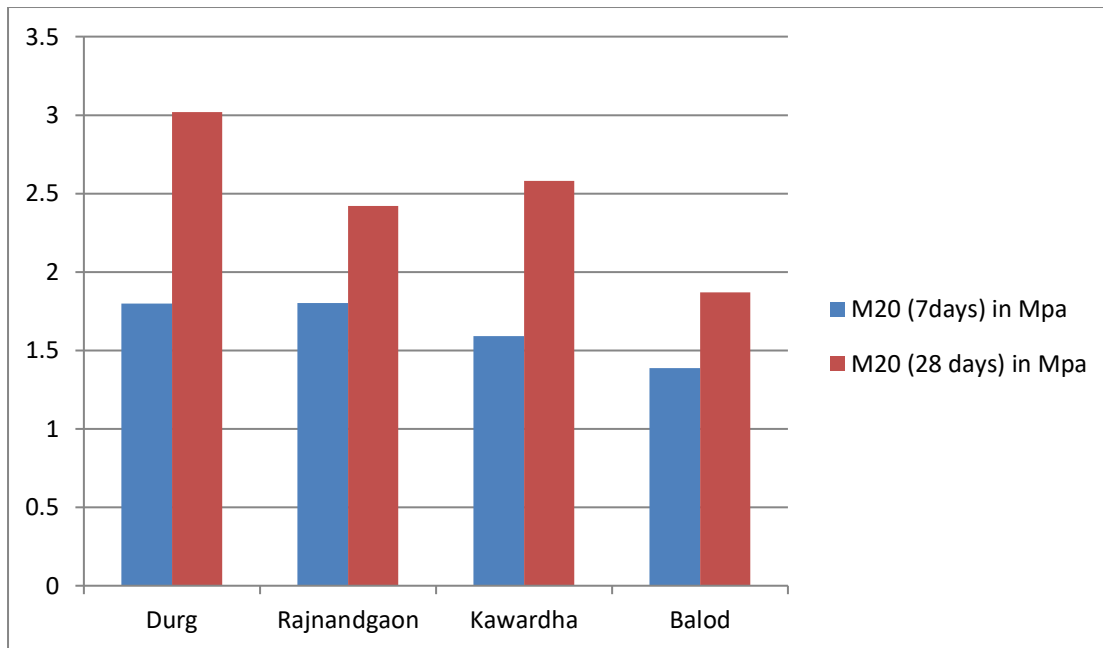
4. Results and Discussions

Ground water gives the requirements of water to be used for construction activity results in increase of Split tensile strength. Chloride attack on concrete structure is one of the most important phenomena we consider when we deal with the durability of concrete. Among all sources of failures of concrete structure, the chloride attack accounts 40% contribution. The main effect of chloride attack is the corrosion of reinforcement that induces the strength of the structure drastically.

M20 Grade-

Table No. 4.1 M20 grade of concrete

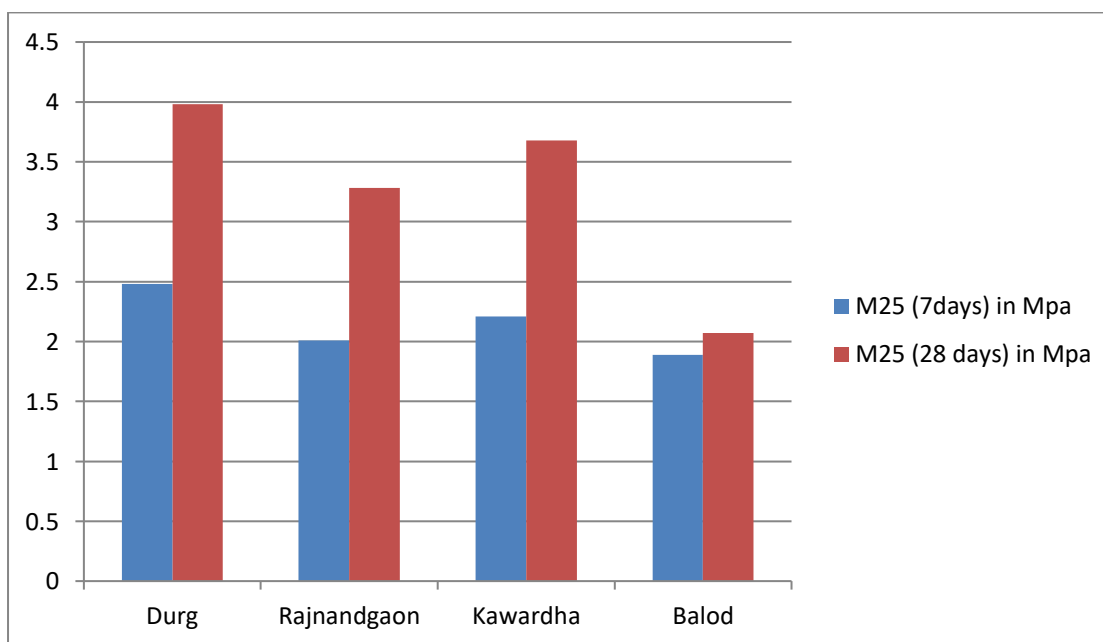
Water Samples	7 Days	28 Days
Durg	1.8 N/mm ²	3.02 N/mm ²
Rajnandgaon	1.80 N/mm ²	2.42 N/mm ²
Kawardha	1.59 N/mm ²	2.58 N/mm ²
Balod	1.38 N/mm ²	2.02 N/mm ²



M25 Grade-

Table No. 4.1 M20 grade of concrete

Water Samples	7 Days	28 Days
Durg	2.48 N/mm ²	3.98 N/mm ²
Rajnandgaon	2.01 N/mm ²	3.28 N/mm ²
Kawardha	2.21 N/mm ²	3.68 N/mm ²
Balod	1.89 N/mm ²	3.01 N/mm ²





5. CONCLUSION

Water samples collected from different district and chemical examination performed of ground water and elaborated the quality of water. The result display that the target objectives have been achieved, such as:

- The result shows that the concrete made with different district of water samples such as underground water of different types of minerals. (Limestone, Iron ore, Bauxite, Quartzite, etc.)
- The initial and final setting time of cement is utterly affected by the quality of water in mixing concrete. The high level of impurities in Balod water contributes to the higher setting time of the cement which in return reduces the strength.
- The tensile strength obtained for concrete made with Durg ground water have more strength as compare to Kawardha, Rajnandgaon, Balod.

- The tensile strength of concrete in 28 days for M-20 developed using Durg water is (3.02 N/mm²) and M-25 Durg (3.98 N/mm²) as compare to other district.
- Water contributes an active part in imparting strength and durability to concrete. The role of water is not only important at the mixing stage but also during curing. Impurities in water, which may be either in the dissolved or suspended form, may interfere with the hydration of cement, thus affecting the setting, hardening and strength development. It may also cause efflorescence and leaching effects in set cement mortar/concrete
- It is observed that there is an increase of 30% in compressive strength of Durg water sample concrete when compared to concrete prepared with Balod water sample.
- As compared with all water sample minor difference lead where as Balod district water concern to be variation in results.

6. REFERENCES

- [1]. ATA Olugbenga In “Effects of Different Sources of Water on Concrete Strength Case Study of ILE-IFE”, @2014
- [2]. Mr. K.J. Kucche, Dr. S.S. Jamkar, Dr. P.A. Sadgir In “Quality of Water for Making Concrete” A Review of Literature, @2015
- [3]. Tarun Kumar, Amar Kant Gautam, D.C Jhariya In “Multi Criteria Decision Analysis for Planning and Management of Groundwater Resources in Balod District, India”, @2016
- [4]. Rahmat Madandoust Mostofa Kazomi, Sedighe Yousefi Moghadam In “Analytical Study on Tensile Strength of Concrete”, @2017
- [5]. Mutiu A, Akinpelu, Samson O. Odeyemi, Oladipupo S. Olafusi, Fatimah Z. Muhammed In “Evaluation of Splitting Tensile and Compressive Strength Relationship of Self Compacting Concrete” , @2017
- [6]. Hamad Farid et al. In “Impact analysis of water Quality on the Development of Construction Materials”, @2019
- [7]. Yalley PP and Sam A In “Effect of Sand Fines and Water Cement Ratio on Cement Properties”, @2018
- [8]. Wen-Cheng Liao et.al In “An Innovative Test for Method for Tensile Strength of Concrete by Applying the Strut and Tie Methodology”, @2020
- [9]. Saad Fahad Resan et.al. In “New Approach of Concrete Tensile Strength Test”, @2020
- [10]. Nishigandha Rameshwar Chandne, Anil Vasant Shirgire In “Effect of Different Sources of Water on Strength of Concrete”-A Case Study, @2021