

# Replacement of Fresh Water by Salt Water in making Concrete

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**Abstract** – Concrete is the second largest construction used material over the world. It is difficult to find out an alternative material as suitable as concrete in view of durability & economy point of view in construction. For making of concrete & curing purpose fresh water is widely used. This research basically aims at studying the scope for replacing fresh water with salt water for concreting purpose and studying its effects. Our study is restricted to Mechanical Properties of concrete prepared by using fresh water and salt water (Compressive strength, Split tensile strength & Flexural strength).

**Key words** – Concrete, Salt water.

## 1. INTRODUCTION –

### 1.1 Explanation –

Concrete is the highly heterogeneous material of the housing industry or construction industry. It is the combination of cement, sand, aggregate and water in specified proportion. Because of the properties of concrete, it is most generally used for the construction in the world. Materials used for making of concrete are not renewable. They are available in the nature in limited quantity. Over use of material can cause the scarcity. In order to avoid the scarcity of that material, we are need to discover the new material for making of concrete without affecting its properties. Here we are only discussing the mechanical properties after replacement of fresh water by salt water.

### 1.2 Problem Statement –

Construction industry requires a large amount of supply of water for making of concrete and its curing purposes water used for this purpose is fresh water.

This fresh water used is generally potable water. This is meant for the drinking purposes. In huge cities, authorities mark the use of water for specific purpose. This means that specific quantity of water can be used only for allotted work.

In coastal areas, like city of Mumbai, water allotted for drinking purpose is diverted and used for construction work. This is illegal offense. This is leading to the conflict between residents and industry creating disturbance to social harmony.

This problem of scarcity of water in coastline areas can be handled by reducing the requirements of construction industry. By using salt water, these requirements can be reduced.

Construction industry faces shortage of water now a days leading to time and cost over-runs. The project basically aims at studying the scope for replacing fresh water with salt water for concreting purpose and studying its effects.

## 2. MATERIALS AND METHODOLOGY –

### 2.1 Materials –

The detail of various materials used in the experimental investigation are following-

- **Coarse Aggregate** – Crushed angular aggregate of maximum size of 20 mm conforming to IS 383-1970 was used. The specific gravity of 10 mm size aggregate was found to be 2.926 and for 20 mm it is 2.931.
- **Fine Aggregate (Sand)** – The fine aggregate used in this investigation was river sand passing through 4.75 mm sieve with specific gravity of 2.716.
- **Cement** – OPC Ultra tech 53 grade cement was used.
- **Fresh Water** – Ordinary clean potable water free from suspended particles and chemical substances was used for both mixing and curing of concrete cubes, cylinder and beam.
- **Salt Water** – Seawater is water from a sea or ocean. We are using salt water has salinity of about 3.5% (35 g/l). This means that every kilogram (roughly one liter by volume) of seawater has approximately 35 grams of dissolved salts.

### 2.2 Methodology –

To investigate the effect of salt water on compressive strength, flexural strength and split tensile strength of concrete, concrete cubes, cylinder and beams were made, in which half of concrete cubes, cylinder and beams cast and cured with fresh water and remaining are cast and cured with salt water. The amount of salt (NaCl) used in water was kept as 35 g/l.

**2.2.1** The concrete cube size measuring 150×150×150 mm in dimension was used. The batching of concrete was

carried out by weight. Mixture was proportioned for a target cube strength of 30 N/mm<sup>2</sup> and had a cementitious material content of 340 Kg/m<sup>3</sup>, a fine aggregate content of 841 Kg/m<sup>3</sup>, a coarse aggregate content of 1249 kg/m<sup>3</sup> and a w/c ratio 0.49. When the concrete was properly mix using salt water and fresh water resp. the concrete cube mould were filled to one third of their height in three layer and compacted every layer 25 times. The concrete cubes cast and cured for 7, 14 and 28 days.

**2.2.2** The size of concrete cylinder is 15 cm diameter and 30 cm height were cast and cured for fresh water as well as salt water by using steel cylinder mould. Concrete are filled into mould in three layers.

**2.2.3** The size of beam mould (15×15×70) cm shall conforming to IS:10086-1982. Preparing the specimen by using steel mould by filling the concrete in three layer into the mould approximately equal thickness. Tamp each layer 35 times by using the tamping rod.

After 24 hours all the specimens are demoulded. Freshwater specimen is put in fresh water for curing and salt water specimen are put in salt water for curing. After the 7,14 and 28 days of curing specimens are remove from water and after wipe out water from the surface of specimens, the compressive, flexural and split tensile strength test are done on that specimen.

**3. TESTS -**

**3.1 Compressive Strength Test** -The Compressive strength test was done on cube (150×150×150) mm and cylinder (150 mm dia. and 300 mm height.).

**3.2 Split Tensile Strength Test** -The Split tensile strength test was done on cylinder (150 mm dia. and 300 mm height.).

**3.3 Flexural Strength Test** -The Flexural strength was done on beam (150×150×700) mm.

**4. OBSERVATION AND TABLES -**

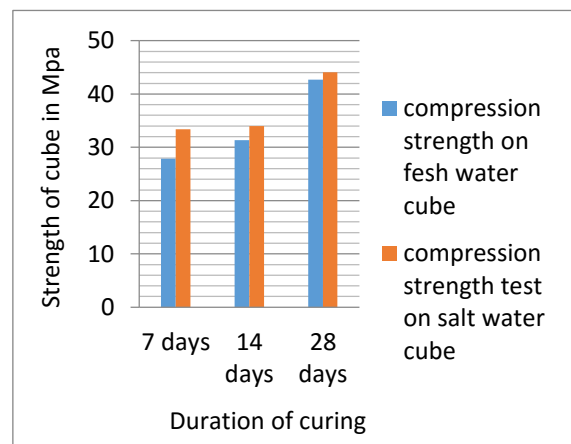
**4.1 Compressive Strength -**

Following table gives the respective values of compressive strength (N/mm<sup>2</sup>) of concrete cube and concrete cylinder after curing of 7th, 14th and 28th day.

Specimen	Size(m m)	7 days		14 days		28 days	
		FW	SW	FW	SW	FW	SW
Cube	150×150×150	27.84	33.40	31.33	33.96	42.71	44.10
Cylinder	150×300	18.48	19.97	20.65	29.07	31.10	33.59

Cube	150×						
	150×	27.84	33.40	31.33	33.96	42.71	44.10
	150						
Cylinder	150×						
	150×	18.48	19.97	20.65	29.07	31.10	33.59
	300						

Following graph shows the comparison between compressive strength of fresh water and salt water cubes.



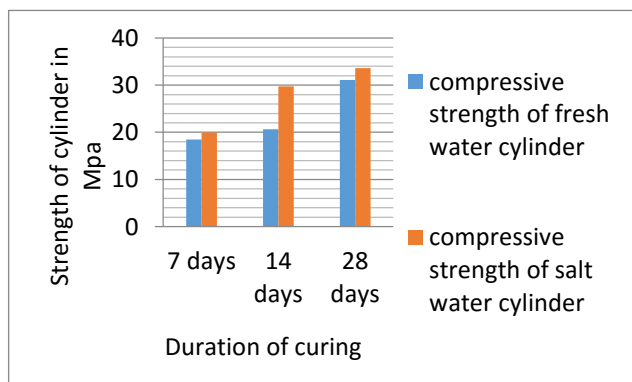
1. From the above graph the compressive strength of salt water cubes after 7 days increased by 19.99% as compare to fresh water cubes.

2. Similarly the compressive strength of salt water cubes after 14 days and 28 days increased by 11.91 % and 3.25% respectively as compared to fresh water cubes.



**Fig 1 :** Compression Strength test on cube

● Following graph shows the comparison between compressive strength of fresh water and salt water cylinder.



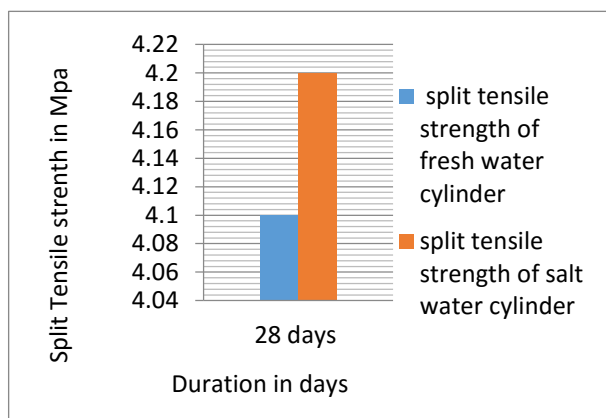
1. From the graph it is shown as the compressive strength of salt water cylinder is increased by 8.06%, 43.82% and 8.00% after the 7,14 and 28 days of curing as compared to fresh water concrete.

### 4.2 Split Tensile Strength -

Following table shows the values of split tensile strength of fresh water cylinder and salt water cylinder at the 28 days of curing.

Specimen	Size	28 days comp. strength	
		Fresh water	Salt water
Cylinder	150×300 mm	4.10 N/mm <sup>2</sup>	4.20 N/mm <sup>2</sup>

Following graph represent comparison of split tensile strength between fresh water cylinder and salt water cylinder.



1. From the above graph it is shown that the split tensile strength of salt water cylinder increased by 2.38% as compared to fresh water cylinder after 28 day



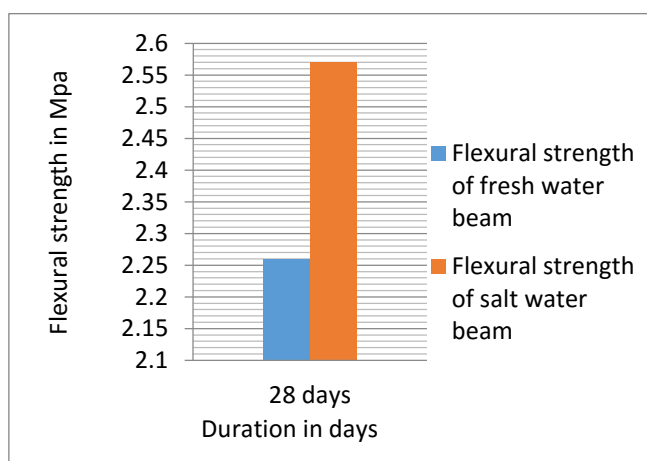
Fig 2 : Split tensile strength of cylinder

### 4.3 Flexural Strength -

Following table shows the Flexural strength values of fresh water beam and salt water beam after 28 days of curing.

Specimen	Size	28 days flexural strength	
		Fresh water	Salt water
Beam	150×150×750 mm	2.26 N/mm <sup>2</sup>	2.57 N/mm <sup>2</sup>

Following graph represents the comparison of flexural strength between fresh water beam and salt water beam.



1. From the above graph it is shown that the Flexural strength of salt water beam is increased by 13.71% as compared to fresh water beam after the 28 days of curing. Following fig. shows the salt water beam testing on UTM.



Fig 3 : Flexural strength of beam

## 5. DISCUSSION -

1. From the above results it is clear that, there is an marginal increase in the compressive strength, split tensile strength and flexural strength of concrete specimen casted and cured with salt water as compared to concrete specimen casted and cured with fresh water specimen.

2. Workability and Durability of salt water concrete is inferior to that of fresh water concrete. Our research limited to only PCC work.

## 6. CONCLUSION -

1. Series of experiments were conducted on M30 grade (1:2.47:3.67) of concrete. Concrete specimen casted and cured with fresh water and salt water as per the relevant IS code of practice. The specimens are tested at different ages 7, 14 and 28 days.

2. From the above finding the result we conclude that there is no reduction in the strength if we use salt water for casting and curing the concrete. There is increased the strength in some amount if salt water is used for casting and curing. This concrete can be used for mass concreting without any decreased in strength properties.

## 7. ACKNOWLEDGEMENT -

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