

Water Conservation Technique on Construction Site

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ABSTRACT

This paper deals with the study of criteria for providing strategies to minimize water usage during construction projects, including utilizing water-efficient fixtures, recycling wastewater for concrete curing, implementing rainwater harvesting systems, employing dry-mix mortars, monitoring water consumption, and educating workers on responsible water practices to reduce environmental impact and promote sustainability. During construction, water is a resource that comprises several activities in a construction site. Its form of use varies according to the operations performed throughout along the construction stages. However, water is not seen or treated as a material of Civil Construction. Some of the activities that use water are compression of landfill, manufacture of concrete, mortar, curing of concrete, testing for waterproofing, cleaning.

Keywords: Concrete, mix design & aggregate

INTRODUCTION

1.1. General introduction

1.1.1 What Is Water?

Water is a chemical compound with the chemical formula H_2O .

1.1.2. Need of Save Water:

Water is one of the basic needs of human civilization and also prime national resource and most precious asset.

1.1.3 What Is Curing of Concrete? :

Curing may be defined as the process of maintaining satisfactory moisture and temperature conditions for freshly placed concrete for some specified time for proper hardening of concrete.

1.1.4 Types of Water Use In Construction Sites:

1. Human Use:

The use of water in construction sites for human needs is basically related to the essential demands of employees of the construction site and these are preserved in accordance with the labor laws.

2. Construction of the Building:

During construction, water is source that comprises several activities in a construction site. Its form of use varies according to the operations performed throughout along the construction stages.

3. Waste:

Waste is the consumption of resources in any activity that does not add value to the customer, any inefficiency in the use of labor, equipment and materials in quantities greater than those necessary for the production of the building.

1.2 problem statement:

The industry of civil construction contributes significantly to the exhaustion of the natural resources, especially water and has the power to influence the use of this resource through the implementation of conservation measures. Despite the studies about the rational use of water in buildings, little has been explored on the construction stage.

During construction, water is source that comprises several activities in a construction site. Its form of use varies according to the operations performed throughout along the construction stages. However, water is not seen or treated as a material of Civil Construction. Some of the activities that use water are compression of landfill, manufacture of concrete, mortar, uring of concrete, testing for water proofing, latex painting and cleaning.

1.3 objectives:

The objectives of proposed work are listed below:

1. Reduce excess amount of water use on construction site.
2. Apply various methods of curing.
3. Reduce cost of project by using some technique

1.3 scope of work:

Due to the lessamount of water present, construction sites faces problems. If we use proper technique on site, water definitely save in some amount. For curing purpose, if we use proper methods of curing then water as well as time can save. So it will help to reduce the problem about water on site. This can reduce cost of overall project.

LITERATURE REVIEW

1. M.Naderi, R. Sheibani, and M. A.Shayanfar :“ Comparison Of Different Curing Effects On Concrete Strength”.

In this paper author discuss the different curing conditions affect the attainable strength of concrete. To achieve this purpose, a laboratory test program was conducted. The laboratory program consisted of casting 150 mm by 150 mm concrete cubes using eight different mix designs and subjecting them to six different curing conditions. In order to investigate the influence of curing conditions, on the compressive strength of concrete cubes, for each mix design three cubes were chosen for every curing regime.

2. **Camilla PiresDos Santos, Simone Rosa Da SilvaAnd Cezar Augusto Cerqueira: “Water Consumption In Construction Sites In The City Of Recife / PE”** In this paper author discuss the water consumption in construction sites in the city of Recife/PE. For this, the chosen construction site, from a construction company that is concerned with environmental issues, was visited form on they data collection regarding water consumption, number of employees, the cost of labor and water and schedule of activities.

3. **Nirav R Kholia, Prof. Binita A Vyasand Prof. T. G. Tank: “Effect On Concrete By Different Curing Method And Efficiency Of Curing Compounds – A Review”.** The advancements in the construction and chemical industry have paved way for the development of the new curing techniques and construction chemicals such as membrane curing compounds, self-curing agents, wrapped curing, accelerators, water proofing compounds etc.. In this review paper effort has been made to understand the working and efficiency of curing methods which are generally adopted in the construction industry and compared with the conventional water curing method.

4. **Mohamed S. Affiand Teaching Assistant (2016): “Internal Curing Of High Performance Concrete Using Lightweight And Recycled Concrete Aggregates”.** Concrete curing is of paramount importance in order for concrete to meet performance requirements. Conventionally, curing has been conducted by means of water sparkling, wet burlap or a curing compound. For performance and environmental reasons, internal curing has been gaining increased attention. However, more data is needed for the effectiveness of this curing technique when used in various concrete mixtures.

5. **A. M. Neville: The Wet Curing System Of Concrete “Aqua Curtain”**, In this paper author discuss the principles of the major curing methods, categorizing as wet curing and membrane curing, respectively, those curing methods that actively supply water to the concrete and those that simply prevent water loss.

6. **Steven H. Gebler, Chairman and Cecil L. Jones: “Guide to Curing Concrete”.** In this paper author discuss the Current curing techniques are presented, commonly accepted methods, procedures and materials are described in this report. Methods are given for curing pavements and other slabs on ground, for structures and buildings, and for mass concrete.

7. Prof. Nanak J Pamnani, Dr. A.K. Verma, Dr. D.R. Bhatt(2013): “Comparison Of Compressive Strength Of Medium Strength Self Compacted Concrete By Different Curing Techniques” In this paper author discuss the In variation in compressive strength of medium strength, self-compacted concrete with three different curing techniques. Initially several trials were carried out for mix design of medium strength self compacting concrete. Once the mix design was achieved, three batches of concrete cubes were cast as per ASTM standard..

METHODOLOGY

3.1 Concept of Curing:

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. It may be either after it has been placed in position, thereby providing time for the hydration of the cement to occur. Since the hydration of cement does take time – days, and even weeks rather than hours – curing must be undertaken for a reasonable period of time if the concrete is to achieve its potential strength and durability. Curing may also encompass the control of temperature since this affects the rate at which cement hydrates.

3.2 Curing Methods and Materials:

3.2.1 Methods of Curing Concrete:

1. Water curing
 2. Membrane curing
 3. Application of heat
- Ponding and Immersion:
 - Fogging and Sprinkling:
 - Wet Coverings:
 - Impervious Paper:
 - Plastic Sheets:
 - Membrane-Forming Curing Compounds:
 - Internal Moist Curing:
 - Steam Curing:
 - Electrical, Oil, Microwave, and Infrared Curing:.
 - Sealing Compounds:

3.3 Methods:

3.3.1 Plastic Sheet:

Applications of plastics in civil engineering building construction are many. The prime reason for this is the property of plastics which makes it durable, non-corrosive, low cost and many others.

3.3.2Sponge Rubber Sheet:

3.3.2.1 PVA Sponge

3.3.2.2 Water Absorption Sponge:

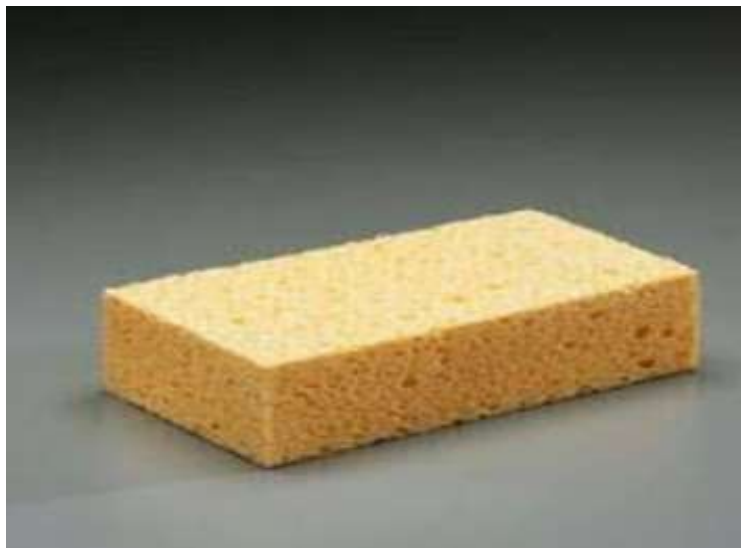




Fig.3.1 Water Absorption Sponge

3.3.3 Empty Paint Buckets:

A water bucket is used to carry water. Household and garden buckets are often used for carrying liquids and granular products.

3.4 Process:

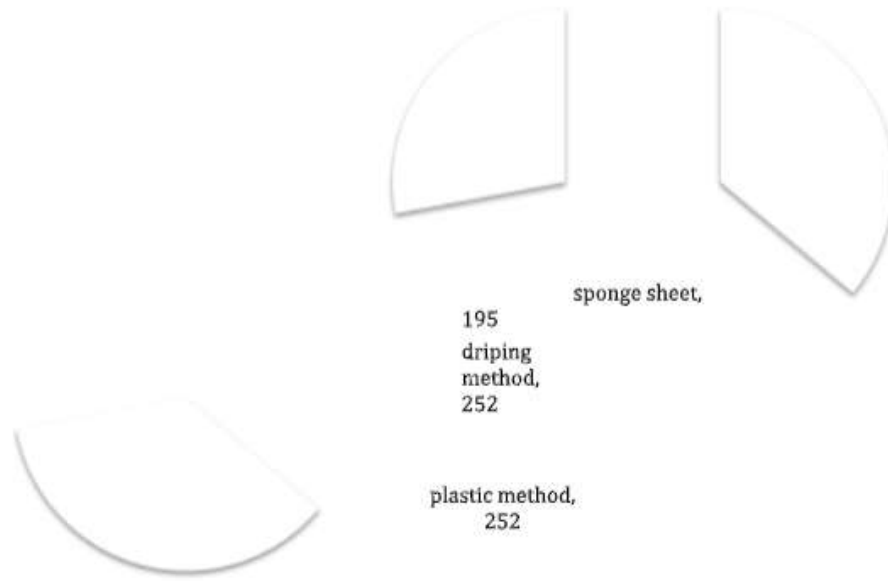
1. Plastic Sheet: First apply thick plastic sheet on the concrete member it should cover all the area. Then curing of water can apply over the structure. Then after curing the RCC and other member of structure the waste water are collected by using this plastic sheet. Also minimize loss of evaporation of water due to the sun.

2. Sponge Rubber Sheet plus plastic sheet: In this method first of all sponge sheet are cover whole area of concrete member as well as RCC member.

3. Empty Buckets System: This is the most common method used at all construction site in India.

3.4.1 Water quantity needed for each method:

Sr. no.	Methods	Water quantities in lit.
1	24 hr water	
2	Dripping Method	252 lit.
3	Plastic sheet	252 lit.
4	Sponge method	195lit.



Pie chart of water quantities in lit.

3.5 Concrete Mix Design

3.5.1. Introduction

The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required, strength, durability, and workability as economically as possible, is termed the concrete mix design. The proportioning of ingredient of concrete is governed by the required performance of concrete in 2 states, namely the plastic and the hardened states. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of workability, therefore, becomes of vital importance.

3.5.2. Requirements of concrete mix design

- The minimum compressive strength required from structural consideration.
- The adequate workability necessary for full compaction with the compacting equipment available.
- Maximum water-cement ratio and/or maximum cement content to give adequate durability for the particular site conditions.
- Maximum cement content to avoid shrinkage cracking due to temperature cycle in mass concrete.

3.5.3. Types of Mixes

1. Nominal Mixes
2. Standard mixes
3. Designed Mixes

3.5.4. Factors affecting the choice of mix proportions

The various factors affecting the mix design are:

1. Compressive strength
2. Workability
3. Durability
4. Maximum nominal size of aggregate
5. Grading and type of aggregate
6. Quality Control

3.5.5. Factors to be considered for mix design:

- The grade designation giving the characteristic strength requirement of concrete.
- The type of cement influences the rate of development of compressive strength of concrete.
- Maximum nominal size of aggregates to be used in concrete may be as large as possible within the limits prescribed by IS 456:2000.
- The cement content is to be limited from shrinkage, cracking and creep.
- The workability of concrete for satisfactory placing and compaction is related to the size and shape of section, quantity

and spacing of reinforcement and technique used for transportation, placing and compaction.

4. Results and Discussion

4.1. Results:

Result for m-25 concrete grade

4.1.1. Curing strength after 3 days. (40%)

3rd day (40%) strength

16
14
12
10
8
6
4
2
0

Dripping Method 24 hr water plastic sheet sponge method **4.1.2. Curing strength after 7 days. (65%)**

7th day (65%) strength

25
20
15
10
5
0

dripping method 24 hr water plastic sheet sponge method

cube 1
cube2
cube3
average
cube1
cube2
cube3
average

4.2.3. Curing strength after 14 days. (90%)

14 th day (90%) strength

40
30
20
10
0

dripping method 24 hr water plastic sheet sponge method **4.2.4. Curing strength after 28 days. (99%)**

24 th day (99%) strength

40
30
20
10
0

dripping method 24 hr water plastic sheet sponge method

For m-30 concrete grade

4.1.1. Curing strength after 3 days. (40%)

3rd day (40%) strength.

20
15
10
5
0
cube1
cube2
cube3
average
cube1
cube2
cube3
average

dripping method 24hr water plastic method sponge method cube1 cube2 cube3 average

4.1.2. Curing strength after 7 days. (65%)

7th day (65%) strength

30
25
20
15
10
5
0

dripping method 24h water plastic method sponge method cube1 cube2 cube3 average

4.2.3. Curing strength after 14 days. (90%)

14th day (90%) strength

40
30
20
10
0

dripping method 24hr water plastic method sponge method cube1 cube2 cube3 average

4.2.4. Curing strength after 28 days. (99%)

28th day (99%) strength.

50
40
30
20
10
0

dripping method 24hr water plastic method sponge method cube1 cube2 cube3 average

CONCLUSION

- The conclusion of this paper that we have introduced a new technique of water curing in construction industry. This is new technique in civil industry. This sponge plus plastic curing technique is efficient than other conventional method of curing.
- Using of this curing method wastage of water is reduced and it's also help to improving the compressive strength of concrete.
- This is easy to applied and easy to reuse for other curing member.
- This sponge plus plastic curing method is more economical. In this method less amount of water used for curing, so cost of construction is also minimizing.



- This method is more suitable where less amount of water is available such as Rajasthan, Latur, Usmanabad, etc.

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