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A Study of Reduce Water Consumption in Building Construction

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***Abstract*: The aim of this research paper is that so much precious water is being generated every day at a construction site is also big issue to save water apart from other building construction strategies. Reducing water consumption and improving water efficiency in building is a major step towards sustainable water management. Further, this is integrally linked with sustainable development issues. Water conservation technologies and strategies are often the most overlooked aspect of a whole building design strategies.**

***Keywords*: Save water, construction strategies, methods of curing.**

1. Introduction

Building construction is a highly resource intensive process, concerning use of materials, land, energy and water. Since buildings are required to fulfill our need for shelter, consumption of these resources is simply unavoidable. However, with shrinking stock of natural resources and degrading eco-system service, the consumption process has to be wise, judicious and non-wasteful.

Fresh, clean water is a limited resource. While most of the planet is covered in water, it is salt water that can only be consumed by humans and other species after undergoing desalination, which is an expensive process. Occurrence such as drought further limit access to clean and fresh water, meaning people need to take steps to reduce water use and save as much water as possible. There are many strategies and system that building owner can use to reduce their water consumption and become more sustainable building.

2. Related work

A. Literature review

1) Curing of concrete with wastewater

The objective of the study has been to analyze the efficacy of curing schemes which may serve as alternative to the use of fresh water conventionally used for the purpose. It compares the influence of four different surface curing agents, (i) Treated wastewater, (ii) Tap water and commercially available, (iii) water based and (iv) resin based curing compounds on the compressive strength and water absorption characteristics of ordinary concrete. The observation establishes the suitability of wastewater curing in achieving better strength and water tightness at 28 days.

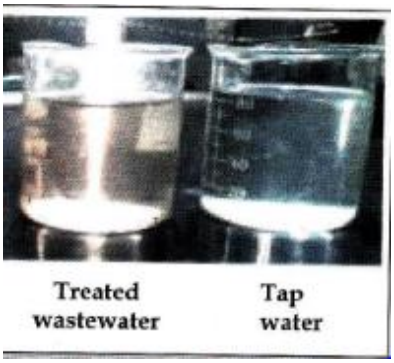

Table 1. Characteristics of tap water and treated effluent

Parameter	Concentration (mg/l except for pH)			
	TW	TE	Limit	Reference
Total solids	150	1000	50000	ASTM C1602 [27]
Suspended matter	-	69.50	2000	IS 456 [28]
Inorganic solids	100	800	3000	IS 456
Organic solids	50	200	200	IS 456
pH	7.5	8.1	≥ 6	IS 456
Total alkalinity*	288	361	250	IS 456
Total acidity*	-	10	50	IS 456
Chloride	175	189	500	IS 456, BS EN 1008 [29], ASTM C1602
Sulphate	45	65	400	IS 456
			2000	BS EN 1008
			3000	ASTM C1602
Pb	0	0	500	Mindess 1981 [30]
			100	BS EN 1008
Zn	0.48	0	500	Mindess 1981
			100	BS EN 1008
Mn	0	0	500	Mindess 1981

* expressed as $CaCO_3$ equivalent

2) Assessment of water resource consumption in India

This paper presented a study that intended to assess the possible range of water amount locked in the building fabric as its embodied water. The result indicates the embodied water to be about 27.6 Kl per sq m of built up area of a multi-storied

apartment building of steel and RC construction. Thus the water consumption for 68 months comes to around 521350.83 Kl for the building construction.

This shows that water consumption at material production stage i.e. the industries have to be more conscious about usage of fresh water and look for ways to bring this down through reuse and recycling.

B. Case study

1) A case study of different method of curing of concrete with water

Water curing is considered as the best method of curing of concrete as it satisfies all the requirements of curing namely absorption of the heat of hydration, promotion of hydration and elimination of shrinkage. But to save water, we can use these curing ways water curing can be done in the following ways,

a) Ponding and Immersion: On flat surface, such as pavements and floors, concrete can be cured by ponding. Ponding is an ideal method for preventing loss of moisture from the concrete; it is also effective for maintaining a uniform temperature in the concrete. The curing water should not be more than about 11°C (20°F) cooler than the concrete to prevent thermal stresses that could result in cracking. Since ponding required considerable labour and supervision, the method is generally used only for small jobs.

b) Fogging and spraying: Fogging and sprinkling with water are excellent method of curing when the ambient temperature is well above freezing and the humidity is low. Fogging is applied to minimize plastic shrinkage cracking until finishing operations are complete. Vertical retaining wall or plastered surfaces or concrete columns etc. are cured by spraying water.

c) wet covering: Fabric covering saturated with water, such as burlap, cotton mats, rugs, or other moisture-retaining fabrics, are commonly used for curing. In some case, wet covering such as wet gunny bags, hessian cloth, jute matting, straw etc., are wrapped to vertical surface for keeping the concrete wet. For horizontal surface saw dust, earth or sand are used as wet covering to keep the concrete in wet condition for a longer time the concrete is not unduly dried to prevent hydration.

2) A study of usage of water for construction

Water consumption during actual construction The data of electrical expenses on account of on-site water pumping during construction period was available for some 68 months. This monetary value was converted into energy consumed in Kilo-Watt-Hour (kWh) by dividing it with the unit energy rate, considered here to be 3.91 INR as per available contemporary data and the energy consumed by the water pumps was calculated. Total energy equivalent for water resource use was found to be 972319.44 kWh for these 68 months. As mentioned earlier, the construction water was supplied by the six on-site bore wells. The capacities of on-site water-pumps, as obtained from site sources, were 7.5 H.P. and 10.0 H.P. The quantity of water consumed during the process of construction was, thus, calculated based on the known discharge capacity or the yield of the pumps. This Water foot-print calculation for rest of the construction period i.e. 81 months was extrapolated from the results obtained. The running of water-pumps for approximately 12 hrs a day also validated the total number of pump operation hours obtained from this assessment. Thus the water consumption for 68 months comes to around 521350.83 Kl for the building construction. Assuming uniform rate of pump operation throughout the construction period, the total Water Consumption (WC) for the 81 months of construction works out to be 621020.84 Kl. The total built-up area of the building group being 310173.22 Sq m, embodied water (WA) per unit area constructed is WA = WC / Built-up area = 2 Kl/ Sq m. A previous study had estimated the construction water use of a three storied 1150 Sq m building of RC construction to be 1 Kl per Sq m in the same region and therefore, the present finding appears reasonably acceptable.

3. Water conservation strategies

There are a number of strategies that can be employed to reduce the amount of water consumed at construction site.

A. Steel structure vs. RCC structure buildings

In comparison with rcc structure steel structure saves 18.66% of water so we can also construct steel structure and composite steel structure it saves 32.02% of water in comparison with rcc structure. but the cost of construction of composite steel structure is 41.28% higher than rcc structure. the cost of steel structure is 38.19% higher than rcc structure.

B. Reduce the amount of water consumed at a facility

In general terms, these methods include:

- System optimization (i.e., efficient water systems design, leak detection, and repair);
- Water conservation measures; and
- Water reuse/recycling systems.

More specifically, a wide range of technologies and measures can be employed within each of these strategies to save water and associated energy consumption. These include:

- Water-efficient plumbing fixtures (ultralow-flow toilets and urinals, waterless urinals, low-flow and sensored sinks, low-flow showerheads, and water-efficient dishwashers and washing machines)
- Irrigation and landscaping measures (water-efficient irrigation systems, irrigation control systems, low-flow sprinkler heads, water-efficient scheduling practices, and Xeriscape)
- Water recycling or reuse measures (Gray water and process recycling systems), and
- Methods to reduce water use in HVAC systems.

4. Benefits of water reduction in the building process

While there are many strategies and systems that building owners can use to reduce their water consumption and become more sustainable buildings, it is best to have water conservation engrained right into the facility from the beginning. This type of green building construction will help buildings be more efficient while cutting down on utility costs.

5. Conclusion

As we study above strategies to reduce water consumption in building construction, it is concluded that Fresh, clean water is a limited resource and it is wasted at construction site and building consumption but the same water is also needed for human consumption and agriculture. We can use some strategies and reduce water consumption and take a major step towards sustainable water management.

References

[1] https://www.masterbuilder.co.in/the-need-of-water-conservation-for-construction/
[2] Prerna Tighare, and R. C. Singh, “Study of Different Methods of Curing of Concrete & Curing Periods,” in International Journal for Research in Applied Science & Engineering Technology, vol. 5, no. 5, pp. 444-447, May 2017.
[3] Bardhan, Suchandra, “Assessment of water resource consumption in building construction in India,” ECOSUD 2011 Conference, vol. 144, pp. 93-101, 2011.
[4] Sarkar Kaustav, Miretu Tadesse and Bhattacharjee Bishwajit, “Curing of concrete with wastewater and curing compounds: Effect on strength and water absorption,” Indian Concrete Journal, vol. 88, 2014.
[5] https://www.performanceservices.com/benefits-of-water-reduction-in-the-building-process