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# Analysis of Realistic Water Requirement and Actual Water Usage in Construction

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**ABSTRACT:** Building construction is a highly resource intensive process, concerning use of materials, land, energy and water. In a building's entire life cycle, water and energy are considered to be the two major pillars that support human activities in it. While there are many studies on embodied energy and recurring energy consumption in buildings, such database appears scanty in the field of water. Similarly, embodied energy of building. Reducing water consumption and improving water efficiency in buildings is a major step towards sustainable water management. Unless the embodied water content of a building is known or measured, water management is not possible. In this thesis we calculate the exactly use/Requirement of water for the construction and compare with actual use of water on site.

**KEYWORDS:** Construction, Water, Wastage, E&C, water requirement.

## I. INTRODUCTION

Fresh Water is a very precious natural resource and it is widely reported that the world reserve of fresh water is fast depleting. Life on earth is not possible without water. Climate change concerns across the globe has predicted severe water scarcity due to degrading eco-system services and World Business Council for Sustainable development (WBCSD) in its Vision 2050 statement has estimated an additional load of more than 500 million people under water-stress conditions in the BRIC (Brazil-Russia-India-China) countries by 2030.

In India, with the National Action Plan for Climate Change (NAPCC) and its constituent National Water Mission, a target of 20% increase in water-use efficiency has been set to counter the challenge. The National Water Policy of Government of India recognizes the need of planning the economic activities like agriculture, industries and urban development in conformity with availability of this life-sustaining resource and has recommended water-zoning. From the point of view of urban development, building industry is known to be a major consumer of water resource, which in many cases, is the ground water extracted through bore-wells. There also had been reports of major subsidence threats due to over-exploitation of this important reserve in a particular segment of the city of Pune, India. In a building's entire life-cycle, water and energy are considered to be the two major pillars that support human activities in it. While there are many studies on embodied energy and recurring energy consumption in buildings, such database appears scanty in the field of water. Similarly, embodied energy of building constituent materials is also available along-with their embodied CO<sub>2</sub> emission factor, which is again not the case when water resource is concerned. Even industry related documents, in most cases, barely touches upon water use in their raw materials' inventory. Thus, there seems to be a big void when similar baseline research data availability with respect to water is looked for. Out of one of the few studies, United Nations Environment Program has indicated that over an entire life-cycle, the building industry consumes a global average of 30% of fresh water and generates 30% of world's effluents. In India, the manual on water supply and treatment has indicated water consumed per unit production of steel and it is, thus, one of the few building materials having a recorded water foot-print. Other major building materials like bricks, cement, aluminum, glass etc. use considerable quantity of water in their manufacturing process through extraction and processing, though data on their water-foot print is not readily available. In this backdrop, the present project seeks answers to the following research questions:

1. Is it possible to know the capital water content or water foot-print of a building in India? This is precisely its embodied water.

2. To know the above, it will also be important to know the water foot-print or embodied water of its constituent materials, at least the common ones. Is there any such data or reported research finding for Indian products in this area?
3. It will also be important to understand the amount of water used during the actual construction process, both direct and indirect. How can this construction water be estimated for Indian buildings?

The above key issues have been deliberated in the course of the project to the extent possible on the basis of available data, documentation and an actual case study

The scope of this project is to understand the amount of water used during the actual construction process, both direct and indirect. How can this construction water be estimated for Indian buildings and to reduce water consumption and improving water efficiency in buildings is a major step towards sustainable water management?

## II. PROBLEM STATEMENT

In Conventional approach with shrinking stock of natural resources and degrading eco-system services, the consumption process has to be wise, judicious and non-wasteful. Search for alternative and recycled materials, multiple floor spaces and use of renewable energy are some of the human responses against the perceived threat of materials, land and energy constraints respectively. Water resource management in building construction and operation, however, has still a long way to go, especially because the amount of water used per unit area of construction largely remains undocumented.

## III. CASE STUDY



Fig 1 Cool Homes Ravet

Case study of a G+4 proposed building of 24 flats and of 4 shops in Ravet, PUNE

- Name of site: Cool Homes
- Contractor: Anubandh Construction
- Area: 6400 sq. feet
- Residential building having 24 flats and 4 commercial road front shops.
- This project is based on sustainable structure
- Present condition of the project: now working on finishing level
- Total 24 flats and 4 shops.
  - i. 16 flats – 2bhk
  - ii. 8 flats – 1 bhk
  - iii. 4 shops – commercial road front shops



IV. RESULT AND DISCUSSION

1. Summary for Proposed Residential Building RCC Work

MATERIAL SUMMARY FOR PROPOSED RESIDENTIAL BUILDING, AT COOL HOMES						
Sr.No.	Description	Qty.(In Cum)	Cement ( In Bag)	Cement In Kg	Water/Cement (W/C)	Water In Liter
I.	PCC (M10)	20	89	4429	0.5	2215
	1:03:06					
II.	FOOTING (M20)	122	996	49781	0.5	24891
	1:01:05					
III	PLINTH BEAM	18	150	7488	0.5	3744
IV	COLUMNS					
1	FOOTING TO PLINTH COLUMN	10	83	4163	0.5	2081
2	PLINTH TO FIRST COLUMN	17	192	9581	0.5	4790
3	FIRST TO SECOND COLUMN	11	91	4550	0.5	2275
4	SECOUND TO THIRD COLUMN	13	109	5450	0.5	2725
5	THIRD TO FOURTH COLUMN	13	104	5200	0.5	2600
6	FOURTH TO TERRACE COLUMN	12	98	4900	0.5	2450
7	TERRACE TO O.H.W.T	10	83	4150	0.5	2075
V.	BEAM					
1	FIRST FLOOR	18	150	7488	0.5	3744
2	SECOUND FLOOR	16	131	6550	0.5	3275
3	THIRD FLOOR	14	114	5700	0.5	2850
4	FOURTH FLOOR	12	98	4900	0.5	2450
5	TERRACE FLOOR	10	82	4100	0.5	2050
VI	SLAB					
1	FIRST FLOOR	51	420	21000	0.5	10500
2	SECOUND FLOOR	48.45	396	19800	0.5	9900
3	THIRD FLOOR	46.02	376	18800	0.5	9400
4	FOURTH FLOOR	43.72	357	17850	0.5	8925
5	TERRACE FLOOR	41.53	339	16950	0.5	8475
Total Water in Liter						111415



2. Summary For Proposed Residential Building Brick Work

MATERIAL SUMMARY FOR PROPOSED RESIDENTIAL BUILDING, AT COOL HOMES						
SR.NO.	DESCRIPTION	QTY.(IN CUM)	CEMENT ( IN BAG)	Cement in kg	Water/Cement (w/c)	Water in liter
I.	BRICK WORK FOR ONE FLAT	20.99	31	1550		
II.	BRICK WORK FOR ONE FLOOR	83.96	124	6200		
III.	BRICK WORK FOR 4 FLOOR	335.84	496	24800	0.55	13640

3. Total Water Required For Project

Total water		
Sr. no	Activity	Water
1	RCC WORK	111415
2	BRICK WORK	13640
3	TILE Work	4592
4	INTERNAL PLASTER	3752
5	EXTERNAL	6428
Total Water		139827
Wastage 30%		181775.1
Curing 45% of total Water		263573.895
Final Water (factor 1.5)		395360.8425
Total Water For Labour for 295 days		2210287
<b>TOTAL WATER FOR REQUIRED FOR COOL HOMES</b>		<b>2605647.843</b>

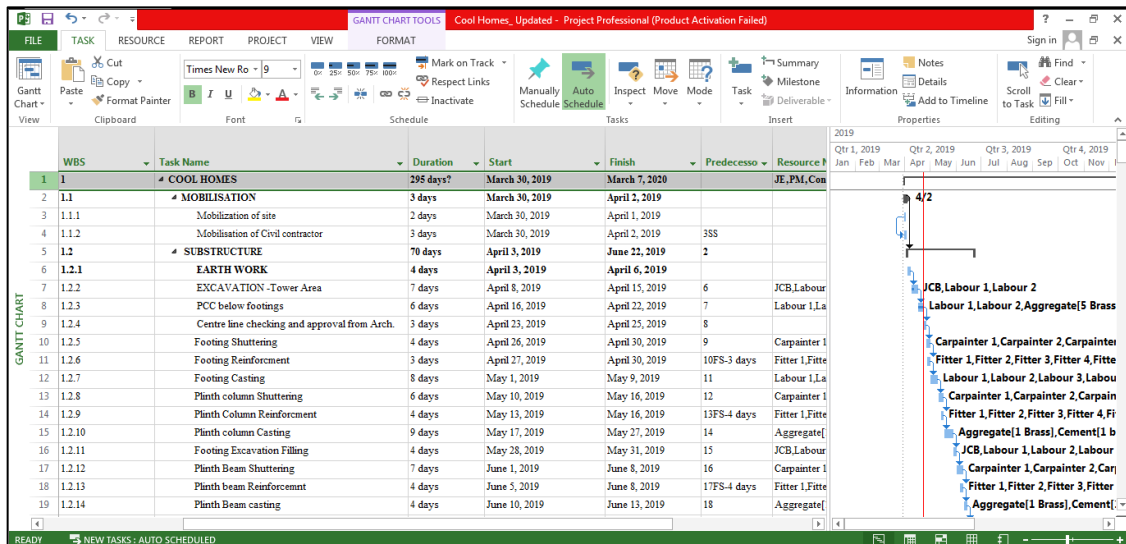
4. Questionnaire Survey

SR. NO	QUESTION	ANSWER
1	Is there water management followed by the workers?	Yes , Sometimes
2	Is there boring on site?	Yes, But water is not sufficient for site
3	How Much Wastage of water on site?	20-25% Because of curing
4	Which methods follow for curing?	<ul style="list-style-type: none"> <li>• For Slab- Sprinkling of water</li> <li>• For Brickwork, plaster And column –Sprinkling of water</li> </ul> In Sunny days we use wet gunny bags for column
5	How Many water tankers order per Week of the site?	5-6 No of Tankers
6	Is their Labour camp Available on site	Yes
7	How many Carpenters are there	10-12



8	How many Fitter are there	10-12
9	How many Skilled Labors are there	5-7
10	How many Unskilled Labors are there	12-15

**4. Final Duration required for Project (295 Days)**



From the above total water required for project is 2,60,5647 liter and total duration of project is 295 days, the approx. 2, 64,000 liter water per Month

**V. CONCLUSION**

- In this study, it was found that water consumption in the construction site studied is influenced by the amount of activities performed, because as observed in the period of initiation, the foundation stage, the volume of water consumed is significantly lower in comparison to the months in which there are several service fronts performing activities simultaneously, such as coating, waterproofing, masonry, structure, and installations.
- It was observed that the stages identified as major consumers of water were coating and masonry. However, with this research it was found that the amount of water used by these stages together represent less than 3.0% of the total. The activities evaluated as largest consumers of water in construction sites were the curing of concrete and the testing of waterproofing, representing 14.56% on average of the total water consumption.
- From the above total water required for project is 26, 05,647 liter and total duration of project is 295 days, the approx. 2, 64,000 liter water per Month and as Questionnaire survey its 5-6 tankers required for the site per Week including boring water.

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