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Assessment of Water Consumption in Construction

Pawar Yogesh R[1], Shrikant R. Kate[2]

[1]Student M.E. Dept. of Civil Engineering, KJ's Educational Institute's, Trinity Academy of Engineering, Pune, India

[2]Assistant Professor, Dept. of Civil Engineering, KJ's Educational Institute's, Trinity Academy of Engineering, Pune, India

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 onstruction and compare with actual use of water on site.***

1. 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 CO2 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.

Objectives

- To study the capital water content or water foot print of a building in Maharashtra,India.
- To analysis the amount of water used during the actual construction process, both Direct and indirect.
- To develop a framework for efficient water consumption and improving water Efficiency in buildings.

2. Materials & Methodology

The methodology presented here involves two stages- one that assesses assessment of water consumption in construction as per standard ratio and the second assesses the amount of water used during the construction process. The project office of the building was approached to access the materials' purchase records and the assessment was carried out on the basis of the figures provided by them. However, it is important to note that a large amount of construction was made from Ready Mix Concrete, who's embodied water content needs specific study and has not been covered here. The major building materials having the highest stake in the constructed volume such as bricks, cement and steel were considered in the first stage of assessment as presented. The second stage had two optional methods- the first one involving theoretical calculation of the water requirement for concrete mixes and curing of brick masonry as well as concrete castings, while the other depends on data collection on water consumption directly from site sources to have an idea on the various indirect and otherwise unrecorded heads for which water is used during construction like watering for sub-grade stabilization, dust control, water line testing and cleaning, use by onsite resident construction labors.

a) Method for Actual Assessment of Water Consumption in Building 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. Study Area

Cool Homes Ravet

A G+4 proposed building of 24 flats and of 4 shops is taken for case study location is in Ravet, PUNE under PCMC for plot size 6800 sq. feet

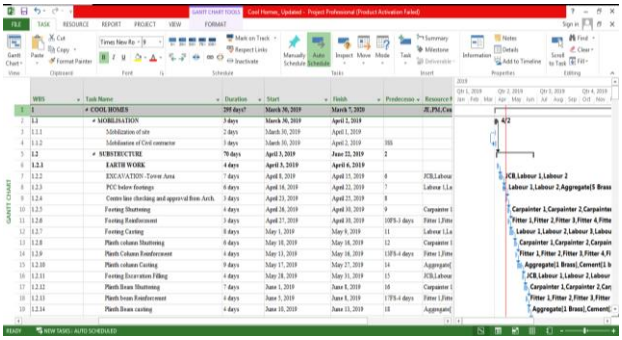
- Case study of a G+4 proposed building of 24 flats and of 4 shops in Ravet, PUNE
- Name of site : Cool homes
- Design Team : Apex consultant
- Owner and Developer :ShivajiPatil
- Architect :SnehaNichat
- Cost of project: 2.4 cr.
- Structural Engineer: NavneetPatil and PrashantPatil
- Builder: Praj Infra Solutions pvt.ltd.
- Area : 6400 sq.feet
- Residential building having 24 flats and 4 commercial road front shops.
- This roject is based on sustainable structure
- Present condition of the project: Excavation is done, now working on finishing level
- This project using heat resisting theme building project.
- Total 24 flats and 4 shops.
  i. 16 flats – 2bhk
  ii. 8 flats – 1 bhk
  iii. 4 shops – commercial road front shops.

4. Results and Observations

A. 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
Total water for required for cool homes		2605647.843

B. Scheduling In MSP



From the above total water required for project is 2605647 liter and total duration of project is 295 days, the approx. 2, 64,000 liter water per Month

C. Questionnaire Survey

S.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?	For Slab- Ponding For Brickwork, plaster column –Sprinkling of water 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

5. 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.

References

[1] S. Bardhan "Assessment of water resource consumption in building construction in India", ISSN 1743-3541 (on-line) WIT Transactions on Ecology and the Environment, Vol 144, April 2011
[2] Indraneel Roy Choudhuri "Assessment of Embodied Water of Construction: Case Study of a Four Star Rated Hotel in New Delhi, India" International Journal of Emerging Engineering Research and Technology Volume 3, Issue 8, August 2015, PP 195-199
[3] Suchandra Bardhan "Studies on Virtual Water Content of Urban Buildings in India"Indian Journal of Science and Technology, Vol 9(6), DOI: February 2016
[4] Robert H. Crawford and Graham J. Treloar "An assessment of the energy and water embodied in commercial building construction", The 4th Australian LCA conference, February 2005, Sydney
[5] Graham J. Treloar and Robert H. Crawford "Assessing direct and indirect water requirements of construction" The 38th International Conference of Architectural Science Association ANZAScA "Contexts of architecture", Launceston, Tasmania, November 2004
[6] Jamal Al-Qawasmi "Water Efficiency and Management in Sustainable Building Rating Systems: Examining Variation in Criteria Usage" Sustainability 2019, 11, 2416; doi:10.3390/su11082416.
[7] M. S. O. Ilha "Environmental assessment of residential buildings with emphasis in water conservation " CIB W062 Symposium 2006
[8] Cheng-Li Cheng "Evaluation of Water Efficiency in Green Building in Taiwan" Water 2016, 8, 236; doi:10.3390/w8060236
[9] Katarina Wärmark "Assessment of water footprint for civil construction projects" Examensarbete 30 hp Junig 2015
[10] Saveria Monosi "Used Foundry Sand in Cement Mortars and Concrete Production", The Open Waste Management, Journal 2010