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Domestic Water Consumption in Rural Areas: A Case Study

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Abstract: Having different patterns of life styles, water consumption facilities, culture and type of occupation of most of the people as well as different climate conditions in the villages of our country, have created various water requirements. So, performing separate regional studies throughout the country, it is necessary to take action to determine the design factors and elements, specially the consumed water per capita that is one of important and the most varying factors. With regard to this necessity, it has been taken action, through a studying plan, to determine the liter per capita per day (lpcd) in villages of Hamadan province and the outcome results showed that the extent of average lpcd on spring, summer, fall, winter and annual for total of statistical society were 100, 138, 110.2, 89.6 and 109.6 l per day, respectively. Also, the numerical value of seasonal fluctuation coefficient in different seasons were 0.91, 1.26, 1.01 and 0.82, respectively. One of these new effective factors that raised in villages of the country is the construction of private baths in the rural houses. According to this plan, it has been considered the effect of the this factor and its results shows increase in the average lpcd as much as 20.2 l per day for each individual and shall be considered in the further plans. Also, the results showed perceptible decrease in the average lpcd with increase on number of family's individuals.

Key words: Water supplying systems, per capita water consumption, Hamadan villages

INTRODUCTION

Community water supply is a capital intensive utility. The water supplying systems are designed and executed to meet two major objectives; providing sufficient water as well as healthy water needed by the society. It is obvious that if the water supplying systems, specially the rural systems, are not capable of supplying enough water, as a result of insufficient care in estimation and consideration of design principles or selection of water sources, people may try to provide for their water requirements through referring to other water sources that could be seriously polluted. This is something against the water supplying system policy and will impose heavy damages and expenses to the society. An important factor influencing the cost of water supply system is the intended level of service, which is, in turn, related to per capita consumption. Per capita domestic water consumption is influenced by a number of factors such as availability and conveniences of supply, socio-economic conditions of the community, cultural and hygienic habits and climatic conditions and whether water

charged for. These aspects have been receiving the attention of water supply system designers in several countries. water for domestic purpose in Iran is needed for: drinking 2-5, food preparation and cooking 5-10, bathing 25-50, ablution and flushing 20-30, washing clothes 10-20, washing dishes 5-15, house cleaning 3-10 and other uses 3-5 l/c/d or 75-150 l/c/d^[1]. In addition, in rural areas a small quantity of water is needed for animal's consumptions and irrigation the green-belts. Water use are expressed in liter per capita per day (lpcd) and it's data are useful for making estimates of community's water demand^[2]. Especially, in the rural areas that it's data is very variable and shall be determined by local studies. In Iran areas the rang of water consumption per capita per day is 60-150 L^[3] and the percent of rural population covered by rural water supply in year 2001 is 83%^[3] and it seems to be 84% in the year 2006^[4]. In the villages located in Hamadan province, there are 69 villages with a population of about 57000. Only 60 or 87% of villages with 13251 house hold have pipe water supply system and 13% of village with 865 house hold suffer the lake of distribution network system^[5]. One of new effective and

important factors that raised in villages of the country is construction of private baths in the rural houses, having received the serious consideration of the government and the Islamic consultative assembly in the state budget plan for rural families, have been posed as an important and essential factor in increasing the water consumption per capita and shall be considered in further plants.

MATERIALS AND METHODS

In the present investigation, in order to achieve the objectives of this study, which are determining the extent of seasonal and annual average water consumption per capita, the effect of private bath construction in rural buildings and number of families on average water consumption per capita, At fist within the limits of Hamadan province 20 villages that have domestic water meter in building's connection are selected. These villages population is about 24900. Then at each one of those, 10 building with a population of 1245 or 5% of total, are selected by random sampling method. Of course, in some of buildings are living more than one family. Therefore, calculate total number of building's residents in this study. Afterwards, a questionnaire completed for each one of buildings that had designed to collection necessary information consist: water meter cod, number of residents, use of private bath, use of domestic well, number of domestic animals, animals water source, area of buildings, area of greenbelt and situation of water supply system in order to continues or non-continues flow. Thereafter, the quantity of water consumed in each one of buildings during the period of (3/20/2002 to 3/21/2003) extracted from rural water and wastewater's company document's archive, for different season, separately. These data entered in especial tables and analysed by Excel and SPSS software. Because the construction of private baths in rural buildings could make a sensible rise in the water consumption per capita, the statistical society has separated to two groups: families that have private bath and families that haven't private bath in their houses. at this way, the effect's value of this factor on average water consumption per capita has surveyed at this investigation.

RESULTS AND DISCUSSION

The results showed that the maximum water consumption occurred on summer, about 138 l and minimum of this occurred on winter, whit 89.6 l. Also, the extent of average lpcd on fall is 110.2 l, So that according to annual average lpcd (Table 1 and 2).

Table 1: The extents of annual and seasonal average lpcd

Type of family	Spring	Summer	Fall	Winter	Annual
Without private bath	92.6	122.2	93.0	80.0	97.1
With private bath	104.6	147.3	121.0	96.0	117.3
Total of families	100.0	138.1	110.2	89.6	109.6

Table 2: The extents of seasonal coefficients (C*)

Type of family	Spring	Summer	Fall	Winter
Without private bath	0.95	1.26	0.96	0.82
With private bath	0.89	1.26	1.03	0.82
Total of families	0.91	1.26	1.01	0.82

Seasonal Average lpcd/Annual Average lpcd=C

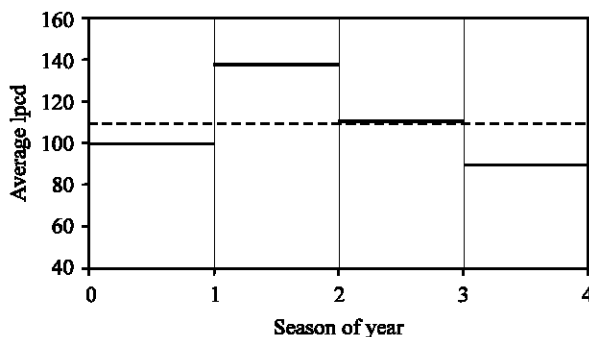


Fig. 1: The fluctuation curve on annual and seasonal of average lpcd

On the bases of investigation's of Fig. 1 results the value of yearly average lpcd is 109.6 l/c/d for total statistical society and 117.3 for families that use private bath in their houses. But even now rural water supply networks are planning on the bases of 80-100 l/c/d^[6] in our country. Of course this rang has been suggested on the bases on old investigations and on time water demands. Already, this perceptible different is arising of the people life's standard promotion at during the recently years and also using of modern furniture and facilities that having greater water consumption in villager buildings. For example, so that showed in results to construction private bath in the rural houses was causing an increase at the average lpcd as much as 20.2 litre for each individual. WHO recommends giving sign to 10-150 l/c/d^[7] in Iran's rural areas. Of course existing a much expansion at this spectrum are showing a great different in water demands in different rural areas and non-existence a exact and perfect information of this criteria in the villages. The extent of average lpcd that have suggested to rural areas in developed and industrially countries is 150-200 l/c/d^[6]. Of course, in looking at study's results we can see to come near the extent of average lpcd to mention above rang at nearly further. This subject is a strong reason to this recommendation that the actual extent of designing parameters must be determinate to different areas in the country by comprehensive studies. of course, the using of new technology and the improvement of water supply

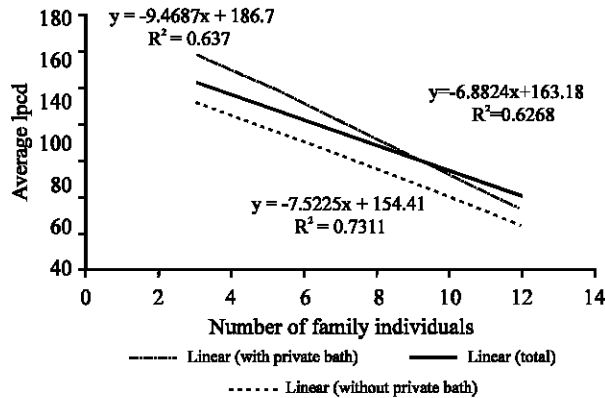


Fig. 2: The variation curve of average lpcd by number of family individuals

networks quality should be considered by engineers, because already the extent of water production per capita from water resources in Hamadan province villages about 160 L^[6] reported, in even that the extent of average lpcd is 109.6 L. Taintless a great part of excessive different between produced and consumed water could be raised to exist a great wastage of water in the rural water supply networks (about 30%). the other result that obtained to this study is to exist the significant reverse relation between average lpcd and number of villager families individuals. Results of Fig. 2 shows that the extent of average lpcd in a family by 12 individual about 60 L more than a family by 3 individual. Actually, this result are showing that the great part of consumed water in villager families has been consist essential consumptions and whenever the number of family individual decreased the extent of average lpcd has been increased rapidly. Existing this relation at the rural areas in Iran is very important because at recent years by the successfully execution of family planning the birth rate in villager families

decreased and the following in further years it will have decreased oftener. The effect of this factor in the increase of water consumption shall be considered in the further water supply plants.

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