Capacity of Masjid and Ablution area

Muhammad Irshad

Research Scholar Department of Civil Engineering, University of Engineering and Technology Peshawar, Pakistan.

Abstract — *Islam is the religion of the majority in about 40 countries and almost every other country in the world has a minority that follows Islam [1]. Comparatively a pretty percentage of Muslims perform their religious duties on a regular basis, including the five mandatory prayers a day in the Masjid. For Muslims ablution is must before praying. This is a state for which a person is required to do certain actions in certain order, referred to as ablution process. Ablution function involves cleaning of certain parts of the body in a certain sequence with clean water. There is always a portion of the Masjid users who needs to perform ablution before offering prayers. Therefore all over the world, there is always a need to build Masajid along with their necessities, like ablution spaces. During planning and design stage, the capacity of a Masjid and its ablution area is generally overlooked. In some cases a fixed ratio is being followed to plan the capacity of the ablution area. This study is an attempt to prove that such fixed ratios are not applicable on all types of localities, In fact it vary between urban, rural, commercial, residential and industrial localities. The methodology of planning the ablution area capacity of a newly planned Masjid has been covered in this study by comparing case studies of urban residential area and rural residential area.*

Keywords- Planning Capacity of Masjid, Number of Ablution Units in a Masjid

I. INTRODUCTION

Muslims are required to pray five times a day. These five prayers are mandatory and are supposed to be offered in a Masjid. Once a male or female reaches the age of adolescence, the five daily prayers and fasting etc., will become obligatory for them. Also it is obligatory for all adult Muslims to learn the Farz rules of Shariat. The existence of Masjid in any Muslim community is unavoidable. Daily the Muslims offers the five mandatory prayers as well as other kinds of prayers like wajib, sunnat, and nafal prayers during different or specific times of the day. Ablution before any prayer is must for Muslims. Ablution is a state for which one is supposed to do certain actions in a particular order, stated as ablution process. Ablution function involves cleaning of certain parts of the body in a certain sequence with clean water. Ablution starts with rinsing the palms, rinsing the mouth, washing the nose by sniffing, washing the face, washing each arm up to the elbow, wiping the hair with wet hands and finally washing the feet up to the ankle [2]. Some portion of the Masjid users always need to perform ablution at the Masjid before offering prayers. Therefore, the designer of the Masjid building should plan appropriate number of ablution units with the Masjid. Each ablution unit generally consist of a faucet with a drain and seat in its front. By and large, the number of ablution units for a particular Masjid is decided without considering the number of users during rush interval. Such a planning not only leads to user's discomfort but also affects the main functions of the building. In this study the methodology for finding out the minimum capacity of the ablution area has been worked out. The factors, on which the capacity of Masjid and ablution area is based, are also identified. To have a much more clear idea about the methodologies, some sample field surveys conducted by the author are also discussed. The methodology of this study is wished-for to act as guidelines for working out the minimum capacity of a Masjid and its ablution area.

II. PRAYING CAPACITY OF A MASJID

In an urban area the design of a Masjid is most often commanded by the size and the orientation of the plot available. The expected needed capacity of the masjid for the locality, if considered as well, at the initial planning stages, can result in an impeccable functional design. The national building standards (Pakistan) has set the maximum limits for an area to be served by a single masjid in terms of walking distance. It states that in an urban area the farthest distance a resident has to travel to a *mohalla Masjid* must not exceed 500 meters [3]. This restriction implies that a single Masjid should at most serve a cordon of 250 meters radius and hence the users are facilitated in terms of walking distances. However in case of densely populated areas the number of masajid to be provided may increase. In both the cases the capacity of the masjid becomes dependent on the population within the cordon to be served.

To understand the methodology of working out the capacity of a *Masjid* in a residential area, a case study of an imaginary *Masjid* to be built in *Regilalma township*, was undertaken. *Regilalma town ship* is in developing stages. therefore to find the capacity of a *Masjid* to be built in *Regilalma*, a survey was carried out in an area of the similar characteristics and having users of the similar life style. *Hayatabad* was found to be the most matching area with *Regilalma* in almost all the aspects. The locations as well as, the property prices are the same, and mainly the planning, development and maintenance of both the towns is the responsibility of the same authority. Keeping in view the local trends, it was decided to base the capacity of the *Masjid* on the number of male members in the locality. In order to find

out the percentage of males in the locality, a survey was conducted by distributing questionnaires in a selected representative sample of *Hayatabad*. The number of people in a dwelling, varies with the size of the dwelling, therefore the questionnaires were distributed randomly in dwellings of different sizes consisting of 3 *marla*, *5marla*, 7 *marla*, 10 *marla*, 1 *kanal*, and 2 *kanals*, in a stratified manner. A total of hundred questionnaires were distributed in hundred dwellings and the following information of the residents was acquired through the questionnaire:

a)   Total number of persons in the family
b)   Total number of male members
c)   Total number of female members
d)   Total number of male members having age greater than 12 years.

The total population of the survey sample was found to be 637. The total number of male having age greater than twelve years, among this population was found to be 273. The percentage of males having age more than 12 years, in the population from this data was calculated as shown in table 3-1. This ratio was considered to be the representative ratio of the whole area. This factor if multiplied with the expected population of the area or sector, for which the *Masjid* has to be built, will give us the number of expected users of the *Masjid*. The expected population can be estimated by the number of dwellings planned in that sector.

Table 1: Percentage of Masjid Users in the Locality

Total number of persons in the dwellings (A)	number of male with age greater than 12 years (B)	percentage of males with age greater than 12 years (B÷A)
637	273	0.4285

To consider the future capacity required, the annual growth rate of the locality is required. It can be taken from the local public registration database authority.

Let us assume the population of a locality in 2010 was 25000 and population of the same locality in 2011 was 27000. By dividing 27000 with 25000, the annual growth rate comes to be 1.08. This annual growth rate factor if multiplied with the present needed capacity of the *Masjid*, one can get the projected required capacity after 1 year. Similarly by multiplying (10×1.08) with the present needed capacity, one can get the projected required capacity for the next 10 years.

The step by step methodology of estimating the required capacity of a *Masjid*, worked out in this research is given below;

- Determine the percentage of *Masjid* users in the locality by distributing questionnaires in a representative sample area
- Determine the total population of the area to be served by the *Masjid*
- To get the number of *Masjid* users, multiply the percentage of *Masjid* users with the total population of the area.
- To consider the needed capacity in the future, multiply the annual growth rate of the locality with the estimated number of *Masjid* users

III.   Observing the trend of performing ablution within the masjid

The number of ablution units to be provided in a *Masjid* depends on the trend within the locality that how much percentage of that locality prefers to perform ablution at *Masjid*. Trend of performing ablution within the *Masjid* varies from case to case. Mainly it depends on the nature of the locality of the *Masjid* i-e urban and rural. Also, in residential areas this percentage will be less than that of a *Masjid* located in an industrial area or in a commercial area, because there are very rare chances, that the employees and workers in the industries and commercial areas, will have sufficient ablution necessities at their work spaces. Similarly with in residential areas, this trend again varies with place to place. In residential areas it is dependent on the lifestyles of the people of that locality. In many cases it is also dependent on the functionality and quality of the ablution facilities provided. To verify whether this trend vary from place to place, two pilot studies were conducted. One in an urban area and other in a rural area. This research covers *Masajid* for residential areas only, therefore in the urban area it was asked from the residents through questionnaire, whether they use to perform ablution at their homes or they prefer to perform it in the *Masjid*. Seventy five dwellings responded positively to the questionnaire. According to the response of the residents, a total of 74.33% male having age greater than twelve years prefer to perform ablution at their homes, while 25.67% of this lot normally prefer to perform ablution at *Masjid*. Through questionnaires only the residents of the houses were covered. There were other users of the *Masjid* also, e.g. shopkeepers of the nearby market etc. Therefore in order to determine a realistic and representative percentage, it was decided to study this trend on site also. The mean value of the questionnaires and onsite study was considered as the final representative value. Therefore another study was carried out to know that how much of the people coming to *Masjid* use the ablution facilities of the *Masjid* before going to the praying area. Tuesday was selected as a typical day for the survey, as almost all the residents of the locality were expected to be back from weekend trips etc. The survey team was divided in to two groups. Group-A was assigned the task to count the number of people entering the *Masjid*, while Group-B was given the task to note the number of people using the ablution facilities of the *Masjid*. Two separate counting forms, A and B as shown in the appendices, were prepared to minimize the chances of mistakes. In the survey the trend of people entering the *Masjid* and using the ablution facilities was observed for all the five mandatory prayers. Normally there is sufficient gap between the *azan* and the group prayer, but this gap is very little at *maghrib* prayer. So except for the

maghrib prayer, the survey for each prayer was started with the start of *azan* and the number of people entering the *Masjid* was noted separately for every minute, from the start of the *azan* till the end of the group prayers. For *maghrib* prayer the survey was started five minutes before the time of *azan*. Table 2 shows the data of percentage of people using the ablution area.

Table 2: Percentage of People using the Ablution Facilities (Urban Area)

Onsite Survey				
Prayer	Number of people coming to *Masjid*	Number of people using the ablution facilities	Percentage of people using the ablution facilities	Average Percentage of people using the ablution facilities
Fajar	176	45	25.56	32.45
Zuhar	507	266	52.46	
Asar	270	113	41.85	
Maghrib	409	80	19.55	
Isha	315	72	22.85	

64 people entered the *Masjid* in the 10th minute of the survey which was the maximum among all the intervals of the survey, thus this time interval was declared as the peak minute.

Table 3: Maximum number of people entering the Masjid (Urban Area)

Prayer	Peak minute	Number of people entering the *Masjid* during Peak minute	Peak minute with maximum number of people
Fajar	5:55am	18	64
Zuhar	13:08pm	30	
Asar	04:45pm	24	
Maghrib	6:19pm	64	
Isha	07:46pm	37	

Table 3: Mean percentage of people using the Ablution Facilities (Urban Area)

Percentage of people using ablution facilities, from Onsite Survey	Percentage of people using ablution facilities, from Questionnaires	Mean value
32.45	25.67	29

For rural area Saturday was selected as a typical day, as most of the people working at urban areas comes to their villages on weekends. Again except for the *maghrib* prayer, the survey for each prayer was started with the start of *azan* and the number of people entering the *Masjid* was noted separately for every minute, from the start of the *azan* till the end of the group prayers. For *maghrib* prayer the survey was started five minutes before the time of *azan*. Table 5 shows the data of percentage of people using the ablution area.

Table 4: Percentage of People using the Ablution Facilities (Rural Area)

Prayer	Number of people coming to *Masjid*	Number of people using the ablution facilities	Percentage of people using the ablution facilities	Average Percentage of people using the ablution facilities
Fajar	46	30	65.22	65.86
Zuhar	45	33	73.33	
Asar	46	33	71.74	
Maghrib	72	53	73.61	
Isha	66	30	45.45	

Table 6 shows the number of people observed during the peak minutes in the rural area.

Table 5: Maximum number of people Entering the Masjid (Rural Area)

Prayer	Peak minute	Number of people entering the *Masjid* during Peak minute	Peak minute with maximum number of people
Fajar	6:08am	4	
Zuhar	1:27pm	5	
Asar	4:59pm	4	9
Maghrib	6:14pm	9	
Isha	08:01pm	8	

1. Working out the peak minute

Once the peak minute was identified, then the total number of people entering the *Masjid* in the peak minute was multiplied with the percentage of usage of ablution area worked out from the survey, to get the answer for the number of people using the ablution area in the peak minute.

2. Number of ablution units required

The number of ablution units of a *Masjid* must at least accommodate the people coming to the ablution area in the peak minute. Thus the number of ablution units in the *Masjid* must be at least equal to the number of people using the ablution area in the peak minute, as worked out in table 7.

Table 6: Minimum Number of Ablution Units required

Area	Peak Minute with Maximum Number of People (A)	No of people using the ablution area in the peak minute = Column (A) × Percentage of people in the locality using ablution facilities of the Masjid (B)	Minimum Number of ablution units Required =Column (B)
Urban	64	64×0.28 = 17.92	18
Rural	9	9×0.6586 = 5.93	6

3. Time taken on a single ablution

To determine the water consumed on a single ablution, one must know the time taken on a single ablution. The time taken on a single ablution, by people of different ages having different health levels, is normally not exactly the same. Therefore the people were classified into the following categories based on their ages:

- Category-I; 12 to 35 years age
- Category-II; 40 to 65 years age
- Category-III; Aged above 65 years

Three persons from each group were observed and their time taken on the ablution was noted. The average of the three readings for each group was considered as the "time taken on a single ablution" for that group. Once the time taken on a single ablution for each group was worked out, then by taking the average of all the groups, a single value of almost one and a half minute, for the "time taken on a single ablution" was calculated as shown in table 8.

Table 7: Time Taken on a single Ablution

Category	Age (years)	Persons	Time taken on ablution (seconds)	Value of time taken on a single ablution for each group (seconds)	Average value of time taken on a single ablution (seconds)
I	12-35	A-I	68	71.67	
		B-I	71		
		C-I	76		
II	40-65	A-II	93	88.67	91.67
		B-II	74		
		C-II	99		
III	Above 65	A-III	122	114.67	
		B-III	116		
		C-III	106		

4. Water consumed per ablution

Once the general value for the "time taken on a single ablution" was known, then the water consumed per ablution was calculated by using the equation Q=V/t, as follow:

$$V=Q \times T$$

Where V is the volume of water, Q is the discharge and T is the "time taken on a single ablution."

For the above equation discharge Q of the faucet (with outer diameter equal to 0.69 inches or 17.5 millimetres) was found out by filling a vessel of known volume 1.5 litres, from the faucet. Three attempts were made to fill the vessel with three different flow velocities i-e slow, normal and high. The time taken to fill up the vessel was noted as 24 seconds, 19 seconds and 13 seconds, respectively. Then again the equation Q=v/t, was used. The discharge from the Faucet was considered as Q, the volume of the vessel filled was considered as V and the time taken to fill up the vessel was considered as t.

By putting this value of Q in the Equation V=Q×T, the total volume of water consumed on a single ablution was calculated as shown in table 9.

Table 8: Amount of water consumed on single Ablution

Flow velocity	Time Taken to fill the vessel of 1.5 litres volume (seconds)	Total Discharge from the faucet to fill the vessel of 1.5 litres volume (litres per second)	Time taken on single ablution (seconds)	Volume of water consumed on single ablution (litres)	Mean value of Volume of water consumed on single ablution (litres)
Slow	24	0.0625		5.625	
Normal	19	0.0789	90	7.10	7.7
High	13	0.1154		10.386	

It must be noted that the amount of water used for a single ablution as per the *sunnat* of the Prophet Muhammad (PBUH) is 1.25 litres [4]. This means we are using almost six times more water than the recommended value of Islam. So it is the duty of every Muslim not to waste the water during ablution. And it is the responsibility of the planner of the *Masjid* to select the type faucets very carefully. A better option to use less water on ablution is the infra red controlled faucets, but unfortunately their cost is very high. So if the project budget allows, such water saving faucets must be installed.

5. Capacity of overhead water tank and septic tank

The quantity and nature of the use of water is different than the domestic usage of water. So the capacity of the septic tank should not be based on the standard values of the domestic daily water consumption per person. But it should be mainly based on the value of water consumed in ablution area.

III. CONCLUSIONS

The conclusions are purely based on the results worked out as per the recommendations of the religion and functional design of the different elements and spaces of the *Masjid*.

- The number of *Masajid* to be built in a locality does not depend on the distance fixed between them but it depends on the population of a locality. A locality with denser population will need *Masajid* with less distance between them.
- According to Islam it is mandatory for all the male Muslims to offer their daily five prayers in the form of *group prayer* within *Masjid*.
- The trend of performing ablution within the *Masjid* changes from place to place, i-e from urban to rural or from residential to commercial areas, etc. This trend also changes with the life style of the people, e.g. in rural areas studied under this research, about 65 percent of the *Masjid* users ablution at *Masjid*, while in urban areas studied under this research, only 25 percent of the *Masjid* users prefer to perform ablution at *Masjid*.
- The number of people using the ablution facilities in the peak minute can be estimated by multiplying the number of people entering the *Masjid* in the peak minute with the worked out percentage of people who prefers to perform ablution at *Masjid*.
- It is important to know the time taken on a single ablution. People of different age levels take different time on ablution, so while working out the time taken on a single ablution people from every age group were considered. The average time taken on a single ablution was worked out to be 90 seconds.
- According to Islam the recommended amount of water to be consumed on single ablution is 1.25 liters. But the average amount of water consumed on ablution was calculated to be 7.7 liters, which is almost six times more than the recommended value of Islam.

IV. RECOMMENDATIONS

- The number of *Masajid* in a locality should be decided on the basis of *Masjid* users in the population of the locality.
- The capacity of a *Masjid* should be estimated based on the total number of males (having age greater than twelve years) in the population of that area. Future needs should be considered by multiplying the annual growth rate factor of that area with the present needed capacity of *Masjid*.
- The minimum number of the ablution units to be installed in a *Masjid* should be based on the percentage of people who prefers to perform ablution within the *Masjid*. In a pure residential area this percentage may be worked out either by onsite study in the *Masjid*, or by distributing questionnaires through a representative sample of the residential area. In case of residential area having some commercial space like markets etc, this percentage should be worked out by taking percentage of both the methods.
- The number of ablution units within the *Masjid* should accommodate the number of people using the ablution facilities of the *Masjid* during the peak minute.
- The design of the overhead water tank and the septic tank of a *Masjid* should not be based on the daily domestic water consumption.

Terms and Definitions

(PBUH) stands for peace be upon him. Muslims say this phrase after hearing or saying the name of the Prophet (PBUH).

Asar the third mandatory prayer of the day, offered by Muslims, in the late afternoon

Azan a call given before every prayer to apprise people with the time of the prayer and to call them to the Masjid.

Fajr the first mandatory prayer of the day offered by Muslims before the sunrise

Farz obligatory duty

Group prayer prayer offered as congregation in the leadership of imam

Hayatabad name of a developed town situated in peshawar (pakistan)

Imam the person, in the leadership of whom, the group prayers are offered.

Isha the fifth and the last mandatory prayer of the day, offered by Muslims, when about an hour and a half have passed after the sunset.

Kanal a unit used for indicating the size of a plot equivalent to 5445 square feet

Maghrib the fourth mandatory prayer of the day, offered by Muslims just after the sunset

Marla a local unit used for indicating the size of a plot equivalent to 272 square feet

Masajid plural of Masjid.

Masjid` the sacred place allocated for worshiping of muslims

Mohalla local word used for a group of houses, either situated on the same street or in the nearby vicinity.

Nafals procedures by doing which one would get reward and to miss carries no penalty

Regi lalma township Name of an under developing town situated in peshawar (pakistan)

Shariat Islamic law

Sunnats the procedures of the Prophet (PBUH)

Wajib anything obligatory

Zohr the second mandatory prayer of the day offered by Muslims, shortly after the noon

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