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# Design standards for Muslim prayer facilities within public buildings

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**ABSTRACT:** The construction boom in the Arabian Gulf region has resulted in an inflow of consultants from around the world. Most have little or no experience of the particular requirements of the residents of the region, who are predominantly Muslim. One of these requirements is to have prayer facilities in public buildings to accommodate practicing Muslims who pray five times a day. The design requirements of such facilities are described only vaguely in commonly-used books on architecture design standards. The result is that inadequate design of such facilities in many projects causes discomfort to users. This paper describes an effort by an academic to support the profession with recommended standards for the design of prayer facilities. It covers not only the basic functional requirements of a prayer facility but also other issues such as fire protection and the relationship with supporting amenities such as ablution space. The research uses several methods to derive the recommended design standards. It draws from those few standards that already exist for the design standards of mosques and adapts them to prayer facilities within public buildings. It capitalizes on the author's experience as a space user who also has analytical capabilities in architecture design. Hence it studies well-designed spaces, identifies their strengths and incorporates them into the recommendations. It also studies poorly-designed spaces, identifies their weaknesses and recommends their avoidance. The purpose of the paper is to trigger more discussion on the design standards of such critical spaces in a region where there is a large population of users. The intention is to change the long-established practices of the many local and international consultants who design prayer facilities on an ad-hoc basis.

Conference theme: Human context: social, cultural, and economic studies

Keywords: architecture design standards, Muslim prayer halls, design of ablution spaces

## INTRODUCTION

Practicing Muslims pray five times a day (with Dawn, Midday, Afternoon, Sunset and Night prayer times). Each prayer has a time window for its performance and for this reason may occur when a practicing Muslim is at work, shopping, visiting a museum or using any other public building. In many Islamic countries, this translates architecturally into the provision of prayer facilities in public buildings. While there is no data available on the percentage of practicing Muslims - who regularly perform prayers - among the general Muslim population, anecdotal data obtained from observation at mosques and prayer spaces indicates that it is high, particularly in the Arabian Gulf region. Therefore, we can say that prayer facilities in public buildings in the region do serve a large number of people and consequently constitute an essential component of the design program of any public building.

Unfortunately, the architectural designs of prayer facilities are frequently deficient, which results in spaces being uncomfortable and unsafe. This is particularly true for international design offices that are

asked to design public buildings in cities such as Dubai, Abu Dhabi and Doha. Apparently, the reason for deficient design is the lack of adequate standards that guide designers' decision-making.

## 1. REVIEW OF RELATED WORK

Reference books on architectural design standards, such as *Architectural Graphic Standards* (American Institute of Architects 2007), *Neufert Architects' Data* (Neufert 2003) and *Metric Handbook* (Littlefield 2008), provide useful but basic data for some aspects of mosque design. *Architectural Graphic Standards* focuses on the space requirements for mosques in western countries. *Neufert Architects' Data* covers basic categories of mosque design as it has appeared historically in various regions of the Islamic world. The book also provides some description of the design of various mosque components, but more from the points of view of history and traditions. The *Metric Handbook* suggests basic elements for the design of a mosque, focusing on the symbolic value of the elements. It also covers aspects of ablution space design. The author of

this paper has reservations regarding the book's statements about ablution spaces and the dimensions recommended for ablution station. The three reference works do, however, provide useful Arabic terminology that is commonly used to describe mosque components.

More comprehensive reference works on mosque design standards exist (Directorate-General for Yanbu Project 1999, Ibraheem 1979, Nofel 1999). These provide detailed information on design standards at the urban planning scale and/or at the architecture scale. However, all appear only in the Arabic language, which presents a barrier to many international consultants. In addition, some design standards, such as the relationship between different spaces, do not receive sufficient attention.

Generally, all of the above-mentioned reference works focus on the design standards of purpose-built mosques and hence do not address the special issues related to prayer facilities within public buildings. In addition, none attempts to explain the reasons behind the design standards. In the case of international reference works this may be due to a lack of knowledge, or to text size limitations. In the case of the works in Arabic it could be due to an expectation that the reader already knows the reasons behind the design standards.

## 2. OBJECTIVE AND METHODOLOGY

The objective of this paper is to help architects design Muslim prayer facilities within public buildings through the recommendation of design standards for these facilities. These design standards occasionally differ from those of purpose-built mosques. The author has developed them using several methods. Existing design standards for mosques are looked at critically and are used where appropriate. The author's experience as an architect, a space user and an analytical observer of how people use prayer spaces are capitalized on so as to study well-designed spaces, identify their strengths, and incorporate them into the recommendations. These experiences are also used to study poorly-designed spaces, identify their weaknesses and recommend their avoidance. The author's discussions with some international architects have revealed their need to understand the functions performed in these spaces. This paper, therefore, sets out to address this need.

## 3. DESCRIPTION OF FACILITY FUNCTIONS

Each of the five daily prayer periods starts with the call for prayer (*Azan*). Depending on national culture and the building's function, some public buildings in some Islamic countries announce the *Azan* via loudspeakers. Building's designers may recommend the installation of an automated *Azan* system as part of the building's audio system. Upon hearing the *Azan*, people begin to go to the prayer facility (males and females have separate facilities); the first group prayer usually begins between five to 20 minutes after the *Azan* (with the

Sunset prayer starting the earliest because of the short window of time assigned to it). The location of the prayer facility within a building is therefore important. The architect needs to give provision for timely and convenient access to the facility, particularly if the building is large. A decision for having one central facility or several distributed ones needs careful study. Upon arriving at the prayer facility, and guided by religious rulings, a person will do one of the following:

- a. Take off shoes and go directly to the prayer hall
- b. Take off shoes and go to the ablution space to perform the ablution routine (taking approximately 1.5 – 2.0 minutes), then go into the prayer hall
- c. Visit the bathroom, which typically necessitates a subsequent visit to the ablution space, and then go to the prayer hall.

As will be shown, architecture design has implications for both comfort and hygiene for a person using prayer facilities.

Within the prayer hall, various activities are possible. Without going into any religious detail, these activities can be abstracted as follows:

- a. Start or join a group prayer
- b. Pray alone
- c. Sit on the floor reading the *Quran* or carry out a similar quiet activity.

The time required to perform a prayer varies, but it is in the range of five to 10 minutes. No furniture is required. Therefore, the space can be utilized for all the above activities simultaneously. However, as the prayer hall fills with users, this flexibility may create circulation problems while users leave the hall, as will be discussed. After leaving the prayer hall, the user puts on the shoes and returns to regular activities.

An understanding of the various functions in the facility helps recognize the design requirements for the spaces identified in the following section.

## 4. DESIGN OF FACILITY SPACES

### 4.1. Prayer hall

This is the main space in the prayer facility. It is simply an open space, empty of furniture, used for the performance of prayers. However, in designing this space, several issues need to be considered. Some of these issues reflect religious rulings for prayer performance.

- People perform the prayer facing the direction of Mecca (*Quibla*) in unbroken rows that are entirely filled one after the other. The rows must be parallel and carefully aligned. It is recommended, therefore, that the flooring material clearly indicates the lines where people place themselves while praying (see floor lines in Fig. 1). To allow for a comfortable prostration position (as shown in the group prayer in Fig. 1.), the distance between these lines is 120cm. Because of this dimension, it is recommended that the clear depth of the hall be measured in multiples of 120 cm.

- It is preferable that the rows of people at prayer should be long and uninterrupted. Therefore, it is recommended that the prayer hall be free of structural columns. It is also recommended that the hall be rectangular in shape, preferably having the long side of the rectangle facing the direction of Mecca (*Qibla*).
- In selecting the location of the prayer hall inside a public building, it is highly recommended to have the walls of the hall parallel and perpendicular to *Qibla* direction. Any other configuration will result in discomfort and waste of space, as is the case in Fig. 1.

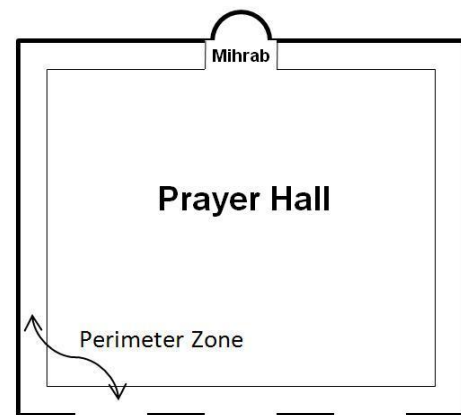


**Figure 1:** Sample of a prayer hall in a public building

- As mentioned in section 3, several activities can be performed simultaneously in the prayer hall. However, a religious ruling forbids a non-praying person to pass closely in front of a person who is praying. This creates a circulation problem during times of crowding. Those users who finish group prayer earlier than others are always in the front rows, with the result that they have difficulty in leaving the prayer hall without passing in front of those in the back rows who have not yet finished praying. One successful design solution to this problem is to have a perimeter zone in the prayer space of different – and usually cooler - flooring material (see Fig. 2). This different material gives users an indication that the zone is not part of the prayer area and should be kept free of people at prayer, thus allowing those in the front to leave via this zone.
- Because the front prayer lines must be filled first, and because people should not pass in front of those who are praying, it is better that entrances to the prayer hall are located at the back of the prayer hall (opposite *Qibla*). Side entries are acceptable, but are better located away from the *Qibla* wall. No entrances should be on the *Qibla* wall. Nevertheless, locations and distances between entrances should conform to fire regulations for high density assembly spaces.
- It is preferable that the prayer hall entrances be wide and without doors to ease simultaneous entry and exit during busy times. If doors are necessary for operational reasons, they naturally need to have sufficient operable width and open to the outside, as mandated by fire regulations.
- While the performance of prayer requires no furniture, some accessories may be provided in the hall

and can be used to enrich the hall's design. These accessories include:

- Cabinets or shelves to house copies of the *Quran*
- An indicator of the direction of Mecca. This usually takes the form of a curved wall or partition, and is called the *Mihrab* (see Fig. 1 and Fig. 2). The *Mihrab* is the place where the leader of the group prayer - who also faces Mecca – commonly stands. The curve provides better reflection of sound, particularly in large halls. However, there is no religious requirement for the design of the *Mihrab*, and the use of loudspeakers eliminates the need for a sound reflecting element.
- In the event that the public building is expected to host the weekly ceremonial group prayer on Friday, a piece of furniture at which a speaker stands facing the people may be installed. This is called a *Minbar* and there are generally no religious requirements for its design (some schools of thought make minor requirements). It would be, however, very unusual to host this Friday prayer within a public building as it typically takes place in purpose-built mosques.



**Figure 2:** Plan showing the perimeter zone that facilitates exiting the prayer hall without passing in front of others.

- A critical design decision is the prayer hall's floor area. A small area results in overcrowding, while a large area wastes space. Determining the floor area depends on two pieces of information:
  - The area needed for one person to comfortably perform prayer
  - The number of people who are expected to use the prayer hall simultaneously

The first piece of information can be easily acquired from a study of human dimensions. A person requires a rectangular area of floor with an average dimension of 60 cm wide by 120 cm deep. This results in an area of 0.72m<sup>2</sup> per user. It is important to note that some reference works suggest an area of 1m<sup>2</sup> per user. A larger area is more appropriate in a hall used for the Friday ceremonial prayer because users sit down when

the speech is being given. The average width of a sitting person is 80cm (as opposed to 60cm for a standing one). It is also important to consider that the leader of the group prayer uses one full line.

The second piece of information, regarding the number of people who are expected to use the prayer hall simultaneously, presents more of a challenge. Rules of thumb that help estimate the expected number of users in a purpose-built mosque serving a particular community are available in reference works (Ibraheem 1979). However, sizing a praying hall within a public building depends on factors other than those appropriate to purpose-built mosques. This matter requires investigation by the design team, but the following equation provides a basis:

*The number of people expected to use the prayer hall simultaneously = A x B x C x D*

Where:

(A) is the near peak number of the building's users. This number depends on the building's nature. The reason for using near peak and not peak is to avoid over sizing.

(B) is the ratio of Muslims among all users. This ratio depends on the location and nature of the building. A public school in Riyadh, Saudi Arabia, expects that 99% or so of its users are Muslim, while a shopping mall in Dubai, United Arab Emirates, may expect that 50% or so of its users are Muslim.

(C) is the ratio of practicing Muslims among the served Muslim population. This ratio depends on the building's location. For example, it might be expected that there will be fewer practicing people in an urban location than in a rural one.

(D) is the ratio of people who will pray at the prayer hall simultaneously. This ratio depends on the building's schedule. If the building operates at a time when the Sunset prayer is performed then this ratio is expected to be high because the window of time to perform the prayer is short. Similarly, an office tower where the lunch break is the same for all users will result in a high ratio.

Unfortunately, no research has been found that addresses the required ratios. For this reason, the recommended approach that will enable the designer to acquire these ratios is to observe buildings that are of a similar nature and in a similar location.

#### **4.2. Shoe removing and shoe rack space**

This is usually the most under-designed space in the prayer facility. Here, users take off their shoes, put them in shoe racks and enter the prayer space. Simultaneously, other users collect their shoes from the racks and put them on. The space also serves as the lobby of the prayer facility. Therefore, it needs to be of a size that can accommodate large numbers of users. It is recommended that the design provides sufficient space in front of each shoe rack to allow the simultaneous activity of one person taking off his/her shoes, one person putting on his/her shoes, and one person moving. This requirement translates to a space

width of around 200cm in front of each shoe rack. The provision of as many seats as the space allows (outside the 200cm) is also recommended.

As can be expected, shoes may present a source of air pollution. The shoe rack space, therefore, needs to be well-ventilated in the case of a naturally ventilated building. In an air-conditioned building, the space should have negative air pressure (suction), connected directly to an exhaust. Placing the suction grills near floor level is important so as to keep any odour below the level of users' faces.

#### **4.3. Bathrooms**

The design requirements of bathrooms that serve prayer facilities are no different from those elsewhere in Islamic countries. However, because of religious rulings, two additional issues need to be considered (Nofel 1999).

- a. Water closets - and urinals if they exist - should not be in line with the orientation towards Mecca and should preferably be perpendicular to that direction.
- b. Bathrooms should not be located behind the *Quibla* wall or above the prayer hall.

In general, bathrooms in Islamic countries require the following design considerations:

- a. Individual cubicle walls and doors should provide good visual - and preferably acoustic - privacy. However, there are no religious requirements as to how this should be achieved.
- b. In relation to international standards, more water closets and fewer urinals should be provided. This reflects the fact that several religious schools of thought discourage the use of urinals.
- c. Hygienic water sprays (douches) should be provided at the right side of each water closet to facilitate the religious cleansing requirement.
- d. The aspect of the easy cleaning of the bathroom needs to be sufficiently considered.

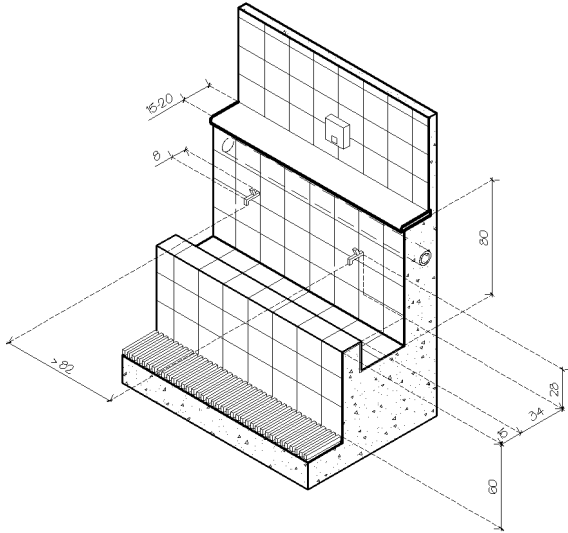
#### **4.4. Ablution space**

As described in section 3, the ablution space is used optionally (as determined by religious rulings). If carried out, the ablution activity includes - among other requirements - cleaning the feet with water. Therefore, if not well designed, the ablution space can become dangerous and messy. A variety of issues needs to be considered when the space is designed. These include the provision of comfortable dimensions for various models of ablution station (see example in Fig. 3), the selection of materials, and water conservation. (Mokhtar 2006) provides further information on design standards for ablution spaces; there is also a video covering the same topic (Mokhtar 2004).

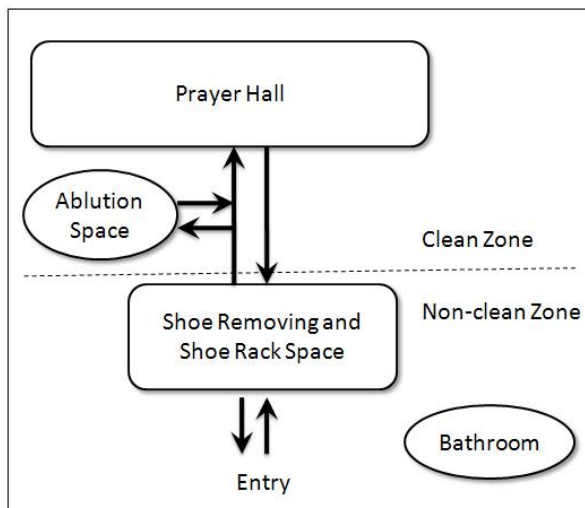
### **5. RELATIONSHIP BETWEEN SPACES**

A problematic relationship between the above-mentioned spaces is one of the main causes of uncomfortable and unsafe prayer facility design. The bubble diagram in Fig. 4 gives an example of the ideal relationship. The diagram indicates a clear separation

between two design zones - clean and non-clean. The clean zone includes the spaces in which the users are not wearing their shoes. Therefore, the shoe removing and shoe rack space is located just outside the line separating the two zones. This separation line is typically defined architecturally by a change in material (see Fig. 5) or a door. Occasionally, designers choose to use low fence for this separation. However, it is advisable to avoid the low fence solution on account of the needs of the physically challenged and the potential evacuation problems in the event of fire.



**Figure 3:** Proposed comfortable dimensions for an ablation station model (Mokhtar 2006).



**Figure 4:** Relationship between spaces in the prayer facility (Mokhtar 2008).

Fig. 4 shows the ablation space inside the clean zone. Unfortunately, many designers put this space outside the clean zone. As a consequence, users have to take

off their shoes, put on communal slippers to walk to the ablation space, perform their ablutions, and return to the line separating the clean and non-clean zones with wet feet. The wearing of the communal slippers, which become wet, not only makes the floor of the entry space wet and messy but also aids the spread of skin diseases (Raboobee et al., 1998).

Fig. 4 shows the location of the bathrooms outside the clean zone and not linked to the entrance or the shoe removal space. Unfortunately, many designers locate the bathrooms inside the entrance and very close to shoe removal space (see case study in Fig. 6), or even inside the clean zone. The expectation of these designers is that users who take off their shoes will put on communal slippers at the entrance of the bathroom space, and remove them before leaving it. As can be imagined, this results in the creation of unhygienic conditions. Inevitably, communal slippers used in the bathrooms become mixed with those used for ablutions, a situation which works against religious rulings regarding purity.



**Figure 5:** The change of material visually defines the separation between clean and non-clean zones.

Fig. 4 also shows that there is no direct access from the ablation space to the prayer hall. Rather, there is a lobby or a corridor that leads to the entrances of both spaces. This is important as it provides control over the transfer of water and humidity from the ablation space to the prayer hall. The floor of the lobby or the corridor needs to be finished with a material that helps dry peoples' feet as they move from the ablation space to the prayer hall.

## 6. CASE STUDY

The purpose of this case study is to review critically the design of a prayer facility and to identify issues that illustrate both good and problematic design decisions. This aids the better understanding of the design standards recommended in the paper. Fig. 6 shows the design of a prayer facility provided to the author for review by a major international consultant. The design is part of a project in the Emirate of Abu Dhabi in the United Arab Emirates. The prayer facility serves both genders and has the typical spaces mentioned in section 4.

- One of the advantages of this design is the clear separation between gender accesses to the facility. Yet, the facilities for both genders are close-by, which makes it convenient for couples and various family members to use the facilities. The provision of one or more waiting spaces close to the two entrances will help family members who are waiting for one another. However, the separation of genders inside the prayer hall itself is confusing for several reasons:

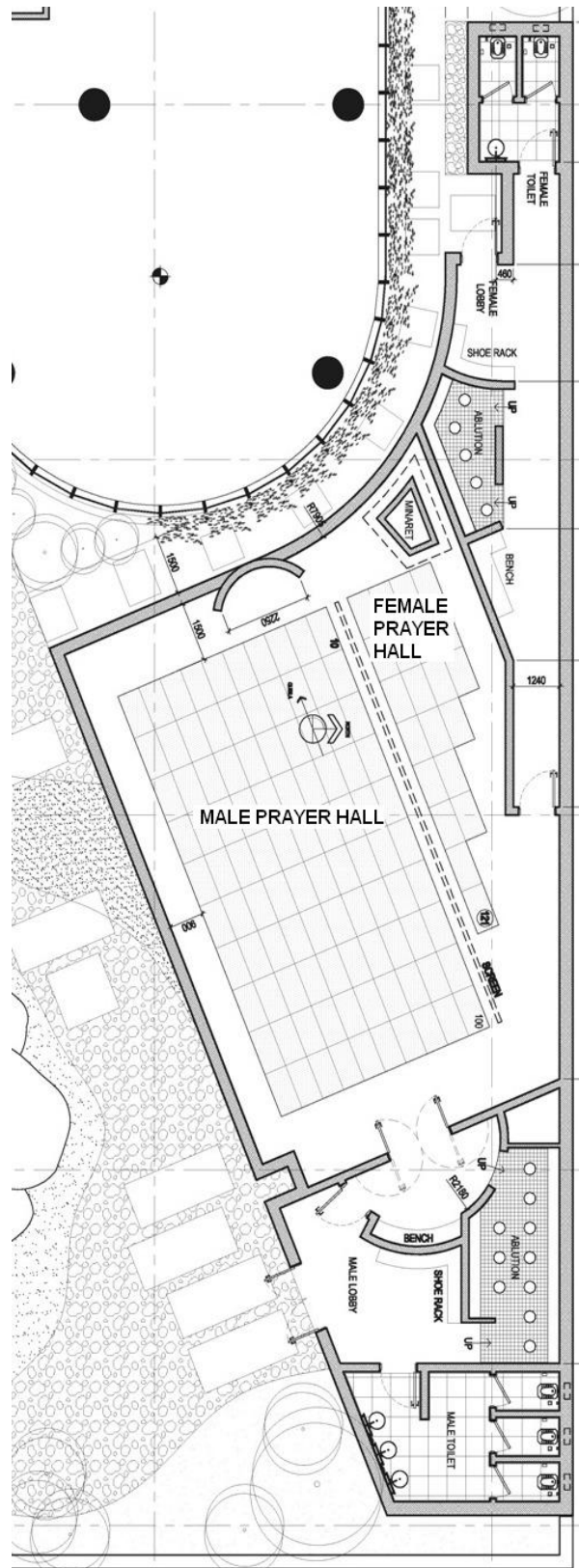
- a. The partition that separates males and females appears partial and allows people to pass between the two prayer places. While there is no religious ruling against this, in practice it makes users feel uncomfortable and it is therefore likely that the partition will be extended to reach the walls. However, in this case the designer's intention of having two prayer hall exits to accommodate fire regulations are defeated.

- b. The division of the prayer hall between the two genders creates a functional problem. In the event of a group prayer that involves males and females (in separate halls), a male leads the prayer in accordance to a religious ruling. However, another ruling prevents anyone from being situated in a line that is front of the group leader (in relation to Mecca). Yet, the design in Fig. 6 allows this to happen. A better design would be either to separate the two spaces acoustically - so that no group prayer involving males and females can occur - or to divide the space so that the female prayer hall is behind the male one.

- c. The relative area of the male prayer hall to that of the female one seems more appropriate to a mosque than to a prayer facility in a public building. Mosques are sized for the Friday ceremonial prayer which females – unlike males - are not required to attend. Consequently, the prayers halls of females in mosques are much smaller than those of males. However, this is not the case for prayer halls in public buildings (unless the number of males in the building is expected to be higher for some reason). Religious rulings make the expectation of the numbers of females attending daily prayer less than males, but only about 25% less. The design in Fig. 6 is expected to result in a female prayer hall that is relatively overcrowded.

- Another important advantage of the design is the orientation of the prayer hall so that its walls are perpendicular and parallel to the direction of Mecca (*Quibla*). However, a wall in the female prayer hall forms an angle with the *Quibla* direction, resulting in loss of space and the creation of confusion in the forming of prayer lines.

- One of the problems in the design is the lack of a defined clean zone. As Fig. 6 shows, the benches where users sit to take off and put on their shoes are in the walkway between the ablution space and the prayer hall. This results in the mixing of dirt from shoes with the water transported by users who have used the ablution facilities. The outcome is a dirty floor and ultimately the transfer of dirt to the prayer hall. A better solution would be to define a clear line separating the



**Figure 6:** A sample design for the prayer facility critically reviewed by the author.



clean zone (that includes both the prayer hall and the ablution space). In this case, the benches should be relocated to near the shoe racks outside the defined clean zone.

- Another problem in the design is the possibility of accessing the bathrooms from within the prayer facility. As discussed in section 5, such a design poses a health risk. A better design would have the bathroom doors opening outside the prayer facility. This makes the bathrooms accessible to other users of the building and at the same time forces users to use the bathrooms while wearing their shoes.
- One safety problem is the raising of the ablution space floor by one step. While a one step difference between two levels is generally dangerous, having that in a place where people's feet are wet can easily cause slipping and results in injuries (Mokhtar 2006).
- One advantage of this design is the clear indication of the direction of Mecca by a curved wall (the *Mihrab*). However, the female prayer hall seems to have no such indication – an omission which may cause users to pray facing the wrong direction.
- Another advantage of the design is the placing of a strip of different material around the perimeter of the prayer halls to facilitate exiting. However, this material should not continue in front of the curved *Mihrab*, as the prayer leader uses this area to prostrate. A better design solution is shown in Fig. 2.

## 7. SUMMARY

Existing works of reference for the architectural design of mosques lack a number of design standards that are required if architects are to provide safe and comfortable Muslim prayer facilities in public buildings. This paper covers several of the missing standards and also provides architects with a better understanding of the functional requirements. A case study is used to illustrate some of the recommended standards. More discussion on this subject is needed to help improve the design of these spaces.

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