Pertanika J. Soc. Sci. & Hum. 25 (S): 21 - 28 (2017)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Multiple Reference Point in Determining Zone-based Prayer Time in Selangor

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ABSTRACT

Salat is an Islamic obligation (prayer) that should be performed within a stipulated period. Based on the eccentricity of the Earth's orbit and its axis which affect the time for salat has led to JAKIM establishing the Time Zone Concept considering all zones. Scientifically, two types of techniques are used to specify the time of salat: the Western Most Point technique and the Multiple Reference Point technique. This study compared these techniques based on the calculation between the various setting points and their effects on the time for salat in 2013 for all zones within Selangor. Findings showed that the Multiple Point technique is the most suitable as it represents the entire zone.

Keywords: Multiple Reference Point, Prayer Time Zone Concept, Western Most Point

INTRODUCTION

"Tasyir" (facilitation)helps JAKIM (Department of Islamic Development Malaysia to come up with the Time Zone Concept for salat (prayers) while the precise time for salat in a zone is that agreed by the respective State Islamic Association to serve as a reference point in determining the exact and precise time for salat. This initiative was introduced to avoid any misconception or discrepancies when fixing the time for salat in all the states in Malaysia. Before the Time Zone concept was introduced, the time for salat was based on different places. However, such indicator cannot be used because of the existence of many villages in a city. Thus, the Time Zone concept was introduced to provide correct time for salat based on the residential zones.

Prayer time for each zone is based on various factors such as the position

ARTICLE INFO

Article history:
Received: 15 September 2016
Accepted: 30 January 2017

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ISSN: 0128-7702

of the Sun, as well as the size and shape of the surface of the areas involved in the prescribed zone so that they can be arranged in a uniform manner. Although State religious authorities are allowed to fix the time for salat, they still need to meet specific criteria set by JAKIM. Among these criteria are (BAHEIS):

(i) Each prescribed prayer time zone should not exceed 2 minutes.

(ii) A reference station zone must be within the west side of the zone.

(iii) Highland areas such as hills and mountains, or islands need to have a separate time zone (Mustafa & Mohamad Saupi, 2011).

Two (2) minutes zone means that the difference between East and West for a zone must be less than or equal to 2 minutes. A 2-minute resolution is a fix reference to prayer cycle. This period has been approved by the majority of *muftis* representing the states in Malaysia since it hardly affects the tahrim (the banned) prayer and considers the interests and virtues of prayer in the beginning of time (Mohamad Saupi, 2005). However, there are two methods used in Malaysia to determine the reference station serving as a guide for prayer time: Most Western Point and the Multiple Reference Point methods.

Prayer Time Zone Related Issues

Currently, there is no uniform time zone for solat and this needs to be addressed to avoid confusion. This could be due geographical factors. Basically, an area or zone is divided based on geographical factors. In the past, settlements were more focused in urban areas, towns and villages in the heart of a region while the border zones were uninhabited.

However, Malaysia's rapid development has witnessed the opening up of border zones which are being converted into residential areas. Thus, a relook of prayer times for all zones especially those newly occupied areas are in order. Residents living in the border area (between zones) experience confusion due to the difference in time of reference, In addition, the differences between the time in the east and west for a zone may vary. For example, the dawn on 22 December 2012 for Kuala Langat is 5.51 am, but the Muslims there have to wait until 5.55 am to pray as they refer to the reference station in Bagan Nakhoda Omar (Nurul Asikin & Mohamad Saupi, 2011).

The Practice of Prayer Time Zone in Selangor

The state of Selangor with a total land mass of 8104 km^2 comprises nine districts, namely Sabak Bernam, Kuala Selangor, Klang, Kuala Langat, Sepang, Hulu Langat, Petaling, Gombak and Hulu Langat. The Westernmost Point method was used for determining the prayer times here, which is based on a reference station located at the most western point of the zone.

The prayer time for the state of Selangor has been set according to two zones: Zone 1 (Eastern) comprising the District of Hulu Selangor, Rawang, Hulu Langat, Petaling

and Sepang, Shah Alam, which follows the coordinates of Gedangsa Village; Zone 2 (West) comprising Sabak Bernam, Kuala Selangor, Klang and Kuala Langat which follow the coordinate of Bagan Nakhoda Omar (BNO) town in Sabak Bernam (Wan Kamel, 2007).

METHODS

Westernmost Point Method

This method is used by many states including Selangor when the selected point or reference station is on the west side of the zone based on the earth's axial rotation. This means that people in the mid-east of the area have to wait until the western part reaches the time for obligatory prayers. This study uses the reference point set by the Selangor Mufti Department and Jabatan Kemajuan Islam Malaysia (JAKIM) to calculate the prayer time based on this method. For Zone 1, the coordinates of Gedangsa are at latitude 3° 44' N and longitude 101° 23' E, while the coordinates of BNO, which is a reference point for Zone 2 (JAKIM, 2012), are at latitude 3° 46' N and longitude 100° 53' E.

Multiple Reference Point Method

This method requires a few points or stations to be used as reference. This is because the westernmost station does not necessarily have the last period for Salat (Abdul Halim, 2011). The Earth, as we know, orbits around the Sun by leaning on its orbital plane. Based on the orbits, the sunset is to the North West and sometimes to the South West. This is a relative position of the earth around the Sun tilted at 23.5 ° in its axis (Baharrudin Zainal, 2004). Changes in the position of the Sun result in various points or references of check-in times for prayer according to the zone and season.

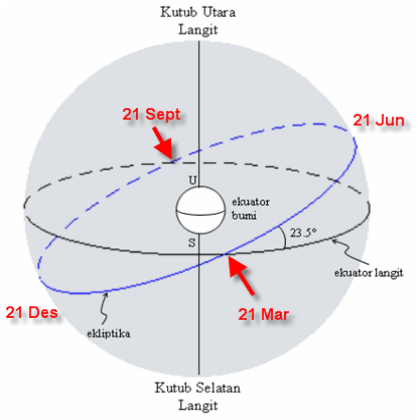

Figure 1. The movement path of the Sun

The study has selected some reference points around the circumference, representing the total districts in Zone 1 and Zone 2. The coordinates for every point earned from google earth were selected at random where the prayer times for every point are calculated. The point having the last prayer time was taken as a reference point for the zone it represents.

RESULTS

Zone 1

For Zone 1, it can be observed that there are certain districts that experienced delay in solat compared with kg. Gedangsa. The districts involved include Petaling, which experienced a delay for Maghrib and Isya' in January, November and December, as well

as dawn prayer in July and Asr in August and September. The district of Gombak district also experienced a delay for Isya' in January as well as dawn prayers in May and June. The district of Sepang experienced delays for Isya' in January and dawn in May and June.

Table 1
Zone 1 areas experiencing delay time compared with Kg. Gedangsa

Date	Kg. Gedangsa		Petaling		Gombak		Sepang	
	Maghrib	Isya	Maghrib	Isya	Maghrib	Isya	Maghrib	Isya
10 Jan	19:20	20:34	19:21	20:35	19:20	20:34	19:21	20:35
11 Jan	19:21	20:34	19:21	20:35	19:21	20:35	19:21	20:35
12 Jan	19:21	20:35	19:22	20:35	19:21	20:35	19:21	20:35
13 Jan	19:22	20:35	19:22	20:36	19:21	20:35	19:22	20:36
14 Jan	19:22	20:35	19:22	20:36	19:22	20:36	19:22	20:36
15 Jan	19:23	20:36	19:23	20:36	19:22	20:36	19:23	20:36
16 Jan	19:23	20:36	19:23	20:37	19:23	20:36	19:23	20:37
17 Jan	19:23	20:36	19:24	20:37	19:23	20:37	19:23	20:37
18 Jan	19:24	20:37	19:24	20:37	19:23	20:37	19:24	20:37
19 Jan	19:24	20:37	19:24	20:38	19:24	20:37	19:24	20:37
20 Jan	19:24	20:37	19:25	20:38	19:24	20:37	19:24	20:38

It can be seen that the districts involved have experienced a delay in of one minute in prayer time compared with Kg. Gedangsa and Hulu Selangor. This means that the residents in the affected districts are likely to perform prayers outside. This situation will become more serious if it includes the Maghrib prayer as seen in the district of Petaling, since it involves prayer and fasting during Ramadan (which affect breaking of fast).

It can be observed that the difference between the most western point and the most eastern point in Zone 1 is four minutes. Different prayer time can be seen in the prayer timetable calculated for May, June and July (the study referred to prayer subdivisions (2° 52' N, 101° 54' E) of the eastern area and Hulu Selangor (3° 47' N, 101° 19' E), which represents the western area of Zone 1). The difference between prayer time in Hulu Selangor and Hulu Langat was then calculated and the outcome showed it clearly inconsistent with the two minute criteria stipulated by JAKIM as agreed by the state mufti (Mohamad Saupi, 2005).

Meanwhile, in Zone 1, the difference between the maximum and minimum latitude and longitude is 55' and 40' (arc minutes) respectively. Thus, the difference in prayer time for the eastern and western points in a zone would be more than two minutes.

Table 2
Difference of latitude and longitude maximum and minimum for Zone 1

	Latitude	Longitude
Maximum	3.78333°	101.98333°
Minimum	2.86667°	101.31667°
Difference (arc minute)	55’	40’

To overcome this problem, the Multiple Reference Point method for Zone 1 was adopted. In order to avoid the problem of a relatively large Zone 1 from achieving four minute interval, the study proposes that Zone 1 is divided into three sub-zones: the district of Hulu Selangor representing Zone 1.1, the districts of Petaling and Gombak making up Zone 1.2 while Hulu Langat and Sepang placed in Zone 1.3.

Table 3
Division of Proposed Districts for Zone 1

Zone 1.1	Zone 1.2	Zone 1.3
Hulu Selangor	Petaling	Sepang
	Gombak	Hulu Langat

The difference in prayer time for Zone 1.2 and 1.3 can be minimised to 1 or 2 minutes and 1.1 minutes for Zone 3. The difference in maximum and minimum latitude and longitude for Zone 1.1 is 20’ and 31’ respectively. The difference in maximum and minimum latitude and longitude for Zone 1.2 was 11’ and 26’, while Zone 1.3 is 28’ (latitude) and 24’ (longitude).

Table 4
Difference in maximum and minimum latitude and longitude for Zone 1.1

	Latitude	Longitude
Maximum	3.78333°	101.83333°
Minimum	3.47000°	101.31667°
Difference (arc minute)	20’	31’

Table 5
Difference in maximum and minimum latitude and longitude for Zone 1.2

	Latitude	Longitude
Maximum	3.15000°	101.86667°
Minimum	2.96667°	101.43333°
Difference (arc minute)	11’	26’

Table 6
Difference in maximum and minimum latitude and longitude for Zone 1.3

	Latitude	Longitude
Maximum	3.05000°	101.98333°
Minimum	2.58333°	101.58333°
Difference (arc minute)	28’	24’

Zone 2

Zone 2 experienced delay in prayer time compared with the town of Bagan Nakhoda Omar (BNO). Prayer times for Sabak Bernam, which are determined using the method of Multiple Reference Point, experienced a delay time of 1 minute compared with BNO as observed on 11, 15 and 19 June 2013. The district of Klang was also affected between 25 May and 6 June, in which the time for Fajr was delayed by one minute.

Table 7
Zone 1 areas experiencing delay time compared with Kg. Gedangsa

Date	BNO			Klang			Kuala Langat		
	Subuh	Maghrib	Isya	Subuh	Maghrib	Isya	Subuh	Maghrib	Isya
1 Jun	5:41	19:25	20:39	5:42	19:22	20:37	5:41	19:21	20:36
2 Jun	5:41	19:25	20:40	5:42	19:22	20:37	5:41	19:22	20:36
3 Jun	5:41	19:25	20:40	5:42	19:22	20:37	5:42	19:22	20:37
4 Jun	5:41	19:26	20:40	5:42	19:22	20:37	5:42	19:22	20:37
5 Jun	5:41	19:26	20:41	5:42	19:23	20:38	5:42	19:22	20:37
6 Jun	5:42	19:26	20:41	5:42	19:23	20:38	5:42	19:22	20:37
7 Jun	5:42	19:26	20:41	5:42	19:23	20:38	5:42	19:23	20:38
8 Jun	5:42	19:26	20:41	5:42	19:23	20:38	5:42	19:23	20:38
9 Jun	5:42	19:27	20:42	5:42	19:23	20:39	5:42	19:23	20:38
10 Jun	5:42	19:27	20:42	5:42	19:24	20:39	5:42	19:23	20:39

In addition, the difference between both districts during dusk is 4 minutes as been observed over a few days in June and July. This means that the Muslim residents in Klang have to wait for 4 minutes before breaking their fast, which further contradicts the Prophet's advice to hasten the breaking of fast as soon as the sun sets. Apart from Klang, Kuala Langat has also faced similar problem for June and July where the difference of four minutes was observed for dusk in addition to one minute delay at dawn. Multiple Reference Point was seen useful in overcoming this problem.

The difference between the East and West areas were found to be too large for a zone with the value of up to six minutes. This can be observed for dusk between 22 and 23 June, Isya' between 10 and 14 July, and dawn in January. The value obtained is large enough for the people to have their prayers void when performed outside the actual time for prayers.

When comparing the value of difference between the maximum and minimum latitude and longitude, it was discovered that the value of difference obtained is relatively large with the value for latitude reaching 74' (arc minutes) or 1° 14', while the value of difference in longitude obtained is 52' (arc minutes). These values indicate that the size for Zone 2 is large.

Table 8
Difference of maximum and minimum latitude and longitude for Zone 2

	Latitude	Longitude
Maximum	3.86667°	101.68333°
Minimum	2.63333°	100.81667°
Difference (arc minute)	74'	52'

Multiple Reference Points Technique was adopted in this study to solve the problem of delay experienced by several areas. In order to address time difference that can reach up to six minutes, Zone 2 was divided into three

sub-zones to meet the two-minute criterion in which the difference in value of latitude does not exceed 1° with longitude of not more than 1/2 degree.

Table 9
Division suggested for Zone 2

Zone 2.1	Zone 2.2	Zone 2.3
Sabak Bernam	Kuala Selangor	Kuala Langat
	Gombak	Klang

The authors found that the differences in time for the eastern and western regions of Zone 2.2 and 2.3 can be minimised to 1 or 2 minutes with 3 minutes for Zone 2.1. The difference of maximum and minimum latitude and longitude for Zone 2.1 is 23' (latitude) and 33' (longitude). Furthermore, the difference of maximum and minimum latitude and longitude for Zone 2.2 is 26' (latitude) and 24' (longitude), while the Zone 2.3 is 34' (latitude) and 27' (longitude).

Table 10
Difference of maximum and minimum latitude and longitude for Zone 2.1

	Latitude	Longitude
Maximum	3.86667°	101.3667°
Minimum	2.48333°	100.8167°
Difference (arc minute)	23'	33'

Table 11
Difference of maximum and minimum latitude and longitude for Zone 2.2

	Latitude	Longitude
Maximum	3.2°	101.68333°
Minimum	2.633°	101.23333°
Difference (arc minute)	34'	27'

Table 12
Difference of maximum and minimum latitude and longitude for Zone 2.2

	Latitude	Longitude
Maximum	3.6°	101.5°
Minimum	3.1667°	101.1°
Difference (arc minute)	26'	24'

CONCLUSION

This study has shown that using Westernmost Point Technique to determine prayer times in Selangor is not suitable as it results in the delay of prayer times as observed in certain districts. The Multiple Reference Points Technique is therefore, ideal and provides accurate prayer time.

Zone size plays a crucial role in determining the prayer time. The difference in the latitudes between east and west in a zone of less than 1° with longitude difference of below ½° or 30' (arc minutes) for securing a two-minute difference is accurate. It was observed that areas that do not meet these requirements have a difference in prayer time of more than two minutes between east and west.

The size of zones 1 and 2 in Selangor has resulted in the difference of time exceeding two minutes between east and west, and in some cases between four to six minutes. As a result, the study proposes that each zone (Zones 1 and 2) has is divided into sub-zones; however, this cannot resolve the problems pertaining to time delay. To this end, the Multiple Reference Points method is adopted when zones are sub divided.

However, the criterion of two minute difference cannot be applied in several large

areas including Hulu Selangor and Sabak Bernam. This is because the difference in the coordinates for both districts does not meet the conditions set (resulting in the difference in prayer time to be around three minutes in these areas). Thus, it was proposed that the concept of 3-minute zone to be applied to large areas or districts. This concept is suitable considering the time taken to complete a single prayer.

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