

EVALUATION OF MOSQUE QIBLA DIRECTION DEVIATIONS BASED ON ASTRONOMICAL ACCURACY AND ISLAMIC JURISPRUDENTIAL TOLERANCE LIMITS

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Abstract

Accurate qibla direction is essential because it serves as a permanent reference for congregational prayers in mosques. However, the orientation of several mosques is still determined using an approximate westward direction or simple methods, potentially causing deviations from the astronomical qibla azimuth. This study aims to evaluate the actual orientation of five mosques in Bone Regency based on astronomical accuracy and Islamic jurisprudential tolerance limits. This field study employed a descriptive quantitative approach combined with normative Islamic jurisprudential analysis. Data were collected through observation, direct measurement, documentation, interviews, and a literature review. The analysis compared the actual orientation of each mosque with the qibla azimuth calculated from its geographical coordinates and evaluated the difference using an operational tolerance limit of 2°. The results showed deviations of 8°19'00" at Nurut Tijarah Mosque, 10°00'36" at Al-Munawwarah Mosque, 0°51'36" at Al-Hijriah Mosque, 9°26'24" at Nurul Aeni Mosque, and 8°38'24" at Al-Muhajirin BTN Pepabri Mosque. Only Al-Hijriah Mosque remained within the tolerance limit, while the other four exceeded it and required prayer-row realignment. This study concludes that the concept of jihat al-Ka'bah must be applied alongside astronomical calculations so that Islamic jurisprudential tolerance does not justify significant deviations. These findings can guide mosque administrators and the Ministry of Religious Affairs in verifying and correcting prayer-row directions without altering mosque structures.

Keywords: Qibla Direction; Qibla Azimuth; Astronomical Accuracy; Islamic Jurisprudential Tolerance.

INTRODUCTION

Facing the qibla is one of the validity requirements of prayer that every Muslim must fulfil when able to determine its direction. This obligation originates from the command of Allah in Surah al-Baqarah verse 144, which instructs Muslims to turn their faces toward the Sacred Mosque. In the context of a mosque, the accuracy of the qibla direction is particularly important because the building orientation and prayer rows serve as long-term references for congregational prayer. An error at the initial stage of determining the qibla can cause every prayer row to follow an inaccurate direction continuously. Therefore, determining a mosque's qibla direction concerns not only ritual practice but also requires scientific precision and certainty under Islamic jurisprudence.¹

¹ Rahma Amir and Muh. Taufiq Amin, "Calibration of Mosque Qibla Directions in Makassar District, Makassar City," *Elfalaky: Jurnal Ilmu Falak* 4, no. 2 (2020): 233–59, <https://journal.uin-alauddin.ac.id/index.php/elfalaky/article/view/20747>.

Astronomically, the qibla direction is understood as the shortest direction from a particular location to the Ka'bah, determined from the geographical position of the observation site and the coordinates of the Ka'bah. It can be established by calculating the qibla azimuth through spherical trigonometry. The calculation is then applied in the field using instruments such as a theodolite, mizwala, qibla tracker, corrected compass, or rashdul qibla method. Developments in Islamic astronomy and geospatial technology allow the qibla direction to be calculated and measured with increasingly high precision. Consequently, contemporary qibla determination should not rely solely on an estimated westward direction, road orientation, surrounding buildings, or local custom.²

Despite advances in measurement methods, qibla direction deviations are still found in several mosques. A study of nine mosques in Bontomarannu District, Gowa Regency, for example, showed that some mosques still deviated from the qibla, whereas others were accurate. Other research also indicates that human error can affect qibla determination, particularly when measurements are conducted without precise coordinate data, without correcting magnetic declination, or with instruments that are not operated according to procedure. These findings reveal a gap between available technical capabilities and qibla determination practices at the mosque level.³

Qibla direction deviations may arise from several factors. Mosque founders or administrators sometimes use only a simple compass, follow the setting Sun, adjust the building to available land, or imitate an existing mosque. A magnetic compass is also easily affected by metal objects, electrical installations, local magnetic fields, and changes in magnetic declination. In addition, floor renovation, changes to prayer-row arrangements, relocation of the mihrab, and inadequate measurement records may create differences between the calculated qibla direction and the prayer rows in use. Measurement and calibration services provided by the Ministry of Religious Affairs demonstrate that qibla verification remains a practical need for mosques and prayer rooms in Indonesia.⁴

The issue becomes more complex when astronomical accuracy is connected with Islamic jurisprudential provisions. Astronomy assesses deviation through the angular difference between the theoretical qibla azimuth and the actual mosque orientation. The smaller the angular difference, the greater the accuracy. Islamic jurisprudence, by contrast, distinguishes between facing the physical structure of the Ka'bah, or 'ain al-Ka'bah, and facing the direction of the Ka'bah, or jihat al-Ka'bah. This distinction mainly applies to people who are far from Mecca and cannot see the Ka'bah directly.

² Zainul Arifin, "Tolerance of Qibla Direction Measurement Deviations," *Elfalaky: Jurnal Ilmu Falak* 2, no. 1 (2018): 62–75, <https://journal.uin-alauddin.ac.id/index.php/elfalaky/article/view/14159>.

³ Nur Adni Ramadhani, Nur Aisyah, and Rahma Amir, "Accuracy Test of Mosque Qibla Direction Measurements in Bontomarannu District, Gowa Regency," *HISABUNA: Jurnal Ilmu Falak* 5, no. 1 (2024): 80–100, <https://doi.org/10.24252/hisabuna.v5i1.40707>.

⁴ Directorate General of Islamic Community Guidance, Ministry of Religious Affairs of the Republic of Indonesia, "Ministry of Religious Affairs Provides Free Qibla Direction Measurement Services," 2016, <https://kemenag.go.id/nasional/kemenag-beri-layanan-gratis-pengukuran-arah-kiblat-6yz3r7>.

Indonesian Council of Ulama Fatwa Number 5 of 2010 states that a person who can see the Ka'bah must face its structure, while a person who cannot see it must face its direction. In Indonesia, that direction is northwest, with a different angle for each geographical location.⁵

The concept of jihat al-Ka'bah does not mean that every generally westward orientation is acceptable as the qibla. Indonesia's geographical position gives each region a specific qibla azimuth that cannot be standardised merely by using the term "northwest." Even a small angular difference at the observation point can produce a large lateral displacement when the directional line is extended toward Mecca. Therefore, the application of Islamic jurisprudential flexibility still requires a rational and measurable limit suited to human capability and the available instruments. Without such a limit, jihat al-Ka'bah may be used to justify deviations that can still be corrected.⁶

Previous studies have proposed several tolerance limits for qibla deviation, but no single angular limit has been uniformly accepted. Zainul Arifin explains that tolerance is needed to bridge the demand for measurement precision with mosque-building conditions and human technical capability.⁷ Meanwhile, Nur Amalia, Muh. Rasywan Syarif, and Subehan Khalik show that tolerance can be calculated by determining whether the projected mosque orientation still points toward the city of Mecca or falls outside it. These different bases indicate that the terms "accurate," "deviated," and "within tolerance" have not always been applied using the same indicators.⁸

Most previous studies tend to follow two separate lines of inquiry. The first focuses on field measurements and reports the magnitude of deviation in particular mosques. The second discusses the legal obligation to face the qibla and the concept of tolerance from the perspective of Islamic jurisprudence or Islamic astronomy. Field research often ends with a classification of accurate or inaccurate based on angular difference without adequately explaining its legal implications. Conversely, jurisprudential studies frequently discuss 'ain al-Ka'bah, jihat al-Ka'bah, and normative tolerance without consistently applying them to actual mosque measurements. This separation leaves a gap between astronomical facts and Islamic jurisprudential assessment.⁹

The principal research gap lies in the limited use of an integrated evaluation framework comparing the actual mosque orientation, astronomical qibla azimuth, angular deviation, projected lateral displacement, and tolerance limits derived from Islamic jurisprudence. Consequently, a mosque with a directional difference may be declared incorrect without considering a defensible tolerance limit.

⁵Indonesian Council of Ulama, "Fatwa Number 5 of 2010 concerning Qibla Direction" (2010), <https://mui.or.id/baca/fatwa/arrah-kiblat>.

⁶ Nur Amalia, Muh. Rasywan Syarif, and Subehan Khalik, "Tolerance of Qibla Direction Deviation," *HISABUNA: Jurnal Ilmu Falak* 4, no. 1 (2023): 109–22, <https://doi.org/10.24252/hisabuna.v4i1.35802>.

⁷ Arifin, "Tolerance of Qibla Direction Measurement Deviations," 62-75.

⁸ Amalia, Syarif, and Khalik, "Tolerance of Qibla Direction Deviation," 109-122.

⁹Ramadhani, Aisyah, and Amir, "Accuracy Test of Mosque Qibla Direction Measurements in Bontomarannu District, Gowa Regency," 80-100.

Conversely, some deviations may be regarded as acceptable solely on the basis of *jihat al-Ka'bah* without measurable astronomical examination. This situation creates uncertainty in deciding whether the existing qibla may continue to be used, requires only prayer-row adjustment, or needs comprehensive recalibration. A study integrating both perspectives is therefore required so that the evaluation is neither excessively mathematical nor limited to normative flexibility.

Based on these issues, the study entitled “Evaluation of Mosque Qibla Direction Deviations Based on Astronomical Accuracy and Islamic Jurisprudential Tolerance Limits” is necessary to establish an objective and accountable assessment. It aims to measure the actual mosque orientation, calculate the correct qibla azimuth, determine the magnitude of deviation, and assess that deviation using relevant Islamic jurisprudential tolerance limits. Integrating astronomical and jurisprudential analyses is expected to produce a clear classification of accurate qibla orientations, deviations that remain within tolerance, and deviations that exceed tolerance. The findings can provide a scientific basis for mosque administrators, communities, Islamic astronomy experts, the Indonesian Council of Ulama, and the Ministry of Religious Affairs in determining appropriate and proportionate corrections without generating social conflict.¹⁰

METHOD

This study is field research employing a descriptive quantitative approach combined with normative Islamic jurisprudential analysis. The method measures qibla deviations astronomically and evaluates the results according to Islamic jurisprudential tolerance limits. The research objects are mosque qibla directions in Bone Regency. Mosques were selected through purposive sampling based on clearly identifiable prayer rows, active use, and indications of qibla misalignment. Informants comprised mosque administrators, imams, and community figures familiar with the history of the original qibla determination.

Data were collected through observation, direct measurement, semi-structured interviews, documentation, and a literature review. Measurements covered geographical coordinates, true north, astronomical qibla azimuth, and the actual azimuth of mosque prayer rows. Each mosque was measured at least three times to reduce reading errors. Interviews gathered information concerning the original qibla determination method, instruments used, renovation history, and administrator responses to possible correction. The literature review covered the Qur'an, hadith, Islamic jurisprudence texts, Indonesian Council of Ulama Fatwa Number 5 of 2010, Islamic astronomy books, and scholarly articles on qibla deviation tolerance.

¹⁰ Ministry of Religious Affairs of the Republic of Indonesia, “Qibla Direction Verification Conducted at 725,669 Locations,” 2026, <https://kemenag.go.id/nasional/verifikasi-arrah-kiblat-berlangsung-di-725669-titik-lokasi-YKflh>.

The data were analysed descriptively, quantitatively, and normatively. Quantitative analysis calculated the difference between the actual azimuth of the mosque prayer rows and the astronomical qibla azimuth based on the geographical coordinates of the mosque and the Ka'bah. Results are presented in degrees, minutes, and seconds of arc. The deviations were then compared with tolerance limits based on the concepts of 'ain al-Ka'bah and jihat al-Ka'bah, Indonesian Council of Ulama Fatwa Number 5 of 2010, and the views of Islamic astronomy experts. Results were classified into three categories: astronomically accurate, deviated but within Islamic jurisprudential tolerance, and deviated and requiring prayer-row correction.

RESULTS AND DISCUSSION

1. Legal Basis for Facing the Qibla

Facing the qibla is a validity requirement of prayer for anyone capable of doing so. The obligation is established in the word of Allah in Q.S. al-Baqarah [2]: 144.

فَقَدْ نَرَىٰ تَقَلُّبَ وَجْهِكَ فِي السَّمَاءِ فَلَنُوَلِّيَنَّكَ قِبْلَةً تَرْضَاهَا فَوَلِّ وَجْهَكَ شَطْرَ الْمَسْجِدِ الْحَرَامِ وَحَيْثُ مَا كُنْتُمْ فَوَلُّوا وُجُوهَكُمْ شَطْرَهُ وَإِنَّ الَّذِينَ أُوتُوا الْكِتَابَ لَيَعْلَمُونَ أَنَّهُ الْحَقُّ مِنْ رَبِّهِمْ وَمَا اللَّهُ بِغَفِلٍ عَمَّا يَعْمَلُونَ

Meaning:

Indeed, We see you turning your face toward the sky. We shall therefore turn you toward a qibla that pleases you. So turn your face toward the Sacred Mosque. Wherever you may be, turn your faces toward it. Those who were given the Scripture certainly know that it is the truth from their Lord, and Allah is not unaware of what they do.¹¹

This verse commands the Prophet Muhammad and Muslims to turn their faces toward the Sacred Mosque wherever they are. The same command is reaffirmed in Q.S. al-Baqarah [2]: 149–150.

وَمِنْ حَيْثُ خَرَجْتَ فَوَلِّ وَجْهَكَ شَطْرَ الْمَسْجِدِ الْحَرَامِ وَإِنَّهُ لَلْحَقُّ مِنْ رَبِّكَ وَمَا اللَّهُ بِغَفِلٍ عَمَّا تَعْمَلُونَ ١٤٩ وَمَنْ حَيْثُ خَرَجْتَ فَوَلِّ وَجْهَكَ شَطْرَ الْمَسْجِدِ الْحَرَامِ وَحَيْثُ مَا كُنْتُمْ فَوَلُّوا وُجُوهَكُمْ شَطْرَهُ لِنَلَا يَكُونَ لِلنَّاسِ عَلَيْكُمْ حُجَّةٌ إِلَّا الَّذِينَ ظَلَمُوا مِنْهُمْ فَلَا تَحْشَوْهُمْ وَاخْشَوْنِي وَلَا تَمْنَعِي عَيْنُكُمْ وَلَعَلَّكُمْ تَهْتَدُونَ ١٥٠

Meaning:

149. From wherever you depart, turn your face toward the Sacred Mosque. Indeed, it is the truth from your Lord, and Allah is not unaware of what you do.

150. From wherever you depart, turn your face toward the Sacred Mosque, and wherever you may be, turn your faces toward it, so that people may have no argument against you except those among them who commit injustice. Do not fear them, but fear Me, so that I may complete My favour upon you and so that you may be guided.¹²

The repetition of this command demonstrates the importance of qibla orientation in prayer and its role as a symbol of Muslim unity. The obligation is also affirmed in the hadith concerning the change

¹¹ Ministry of Religious Affairs of the Republic of Indonesia, Al-Qur'ān al-Karīm: Terjemah Perkata Transliterasi Latin (Jakarta: Cahaya Qur'an, 2017), 22.

¹² Ministry of Religious Affairs of the Republic of Indonesia, Al-Qur'ān al-Karīm: Terjemah Perkata Transliterasi Latin (Jakarta: Cahaya Qur'an, 2017), 23.

of qibla from Jerusalem to the Ka'bah. When news of the change reached the people of Quba, they turned toward the Ka'bah while performing prayer. The hadith indicates that a Muslim must follow the correct qibla after receiving reliable information. New knowledge of the qibla may therefore provide grounds for correcting an orientation previously established through estimation.¹³

In Islamic jurisprudence, scholars distinguish the obligation to face the qibla according to the worshipper's location. A person near the Sacred Mosque who can see the Ka'bah must face the physical structure, or 'ain al-Ka'bah. A person far from Mecca who cannot see it must face its direction, or jihat al-Ka'bah. This distinction arises because a distant worshipper cannot directly sight the Ka'bah and must determine its direction through natural signs, calculation, or available instruments.¹⁴

Jihat al-Ka'bah does not mean that every westward direction is acceptable as the qibla. The direction toward the Ka'bah from each region has a distinct azimuth according to the site's latitude and longitude. Thus, a mosque in Indonesia cannot determine the qibla merely by facing generally west or northwest. The direction must be calculated from the geographical coordinates of the mosque and the Ka'bah to obtain the correct qibla azimuth.¹⁵

This provision is reinforced by Indonesian Council of Ulama Fatwa Number 5 of 2010 concerning Qibla Direction. It contains three provisions. First, the qibla for a person who can see the Ka'bah is the physical structure of the Ka'bah. Second, the qibla for a person who cannot see the Ka'bah is its direction. Third, Muslims in Indonesia face northwest, with a position that varies according to the geographical location of each region. The phrase "a position that varies" demonstrates that the term northwest must be converted into a specific azimuth through astronomical calculation.¹⁶

Under present conditions, using Islamic astronomical calculations constitutes an effort to fulfill the obligation of facing the qibla as accurately as possible. Such calculations determine the great-circle direction connecting a location with the Ka'bah through the shortest path on the Earth's surface. The ability of modern technology to determine coordinates, true north, and qibla azimuth reduces the grounds for retaining a demonstrably significant deviation. Islamic jurisprudence therefore provides the legal foundation, while astronomy supplies a measurable method of fulfilling the obligation.

2. Tolerance Limits for Qibla Direction Deviations from an Islamic Jurisprudential Perspective

Qibla tolerance is the maximum deviation considered acceptable when a worshipper or mosque building does not precisely follow the astronomical qibla azimuth. Tolerance is necessary because applying a calculation to a building and maintaining bodily orientation to the exact arcsecond are

¹³ Muhammad ibn Ismail al-Bukhari, Sahih al-Bukhari, *Book of Prayer*, *hadith* no. 403; Wahbah al-Zuhayli, *Al-Fiqh al-Islami wa Adillatuhu*, vol. 1 (Damascus: Dar al-Fikr, n.d.), discussion of istiqbal al-qiblah.

¹⁴ Ismail, "Qibla Direction from the Perspectives of Islamic Jurisprudence and Geometry," *Mahkamah: Jurnal Kajian Hukum Islam* 7, no. 1 (2022), <https://doi.org/10.24235/mahkamah.v7i1.10127>.

¹⁵ Amir and Amin, "Calibration of Mosque Qibla Directions in Makassar District, Makassar City," 233–259.

¹⁶ Indonesian Council of Ulama, Fatwa Number 5 of 2010 concerning Qibla Direction.

difficult. Instrument installation errors, instrument limitations, building conditions, prayer-row thickness, and bodily movement during prayer can generate small differences from the calculated direction.

The jurisprudential basis of tolerance relates to the distinction between 'ain al-Ka'bah and jihat al-Ka'bah. A distant worshipper fulfils the obligation by directing the body toward the Ka'bah according to the best available determination. However, this flexibility applies only to reasonable deviations that do not eliminate the orientation toward the Ka'bah. It cannot justify retaining a major deviation after a more accurate direction has become known and can be implemented without substantial difficulty.¹⁷

Islamic astronomy literature has not established a single numerical tolerance universally accepted by all scholars and researchers. Several studies use 2° as a practical limit for evaluating mosque orientation. A deviation below 2° is considered minor, whereas a deviation above 2° is regarded as requiring correction. Other studies distinguish mathematical tolerance from sociological tolerance. Mathematical tolerance is based on projecting the direction toward the Ka'bah, the Sacred Mosque, or the territory of Mecca. Sociological tolerance considers a worshipper's ability to maintain bodily orientation during prayer and may reach approximately 6° to either side.¹⁸¹⁹

These differences show that tolerance cannot be treated as an absolute Islamic jurisprudential rule. The 6° limit is more relevant to changes in a worshipper's bodily position during prayer. This study, however, evaluates the fixed orientation of mosque buildings and prayer rows. A building orientation is permanent, used by many worshippers, and can be corrected by rearranging the prayer rows. Accordingly, this study applies 2° as an operational tolerance limit, reflecting caution, modern measurement capabilities, and the obligation to face jihat al-Ka'bah as accurately as possible.

Under this limit, mosque orientations are classified into two categories. First, deviations of $\leq 2^\circ$ remain within Islamic jurisprudential tolerance, although refinement is still recommended. Second, deviations of $> 2^\circ$ exceed tolerance and require correction. This classification is an analytical tool and does not, by itself, invalidate prayers already performed. The assessment of past prayers must consider the knowledge, capability, and efforts available when the qibla was initially determined.

3. Mosque Qibla Direction Measurement Results

Measurements were conducted at five mosques in Bone Regency. The actual direction is the azimuth of the building orientation or mosque prayer rows. The qibla azimuth is the directional angle

¹⁷ Ismail, "Qibla Direction from the Perspectives of Islamic Jurisprudence and Geometry."

¹⁸ Khalifatus Shalihah, "Religious Leaders' Views on the Accuracy of Mosque Qibla Directions in Batu Layar District, West Lombok Regency, Using Istiwaaini," *Al-Afaq: Journal of Islamic Astronomy and Astronomy* 2, no. 2 (2020): 35–56, <https://journal.uinmataram.ac.id/index.php/afaq/article/view/2919>.

¹⁹ Ismail, Dikson T Yasin, and Zulfiah, "Tolerance of Qibla Direction Deviation in Indonesia from Islamic Astronomy and Islamic Law Perspectives," *Al-Mizan* 17, no. 1 (2021): 115–38, <https://doi.org/10.30603/am.v17i1.2070>.

toward the Ka'bah, measured clockwise from true north at 0° through 360°. The magnitude of deviation is the absolute difference between the actual mosque orientation and the astronomical qibla azimuth:

$$\Delta K = |A_m - A_k|$$

Where:

- ΔK = magnitude of qibla direction deviation
- A_m = actual mosque azimuth
- A_k = astronomical qibla azimuth

Table 1. Measurement and evaluation results for mosque qibla directions in Bone Regency

No.	Mosque Name	Coordinates	Building Orientation	Qibla Azimuth	Deviation	Direction of Deviation	Status
1.	Nurut Tijarah Mosque	4°32'43" S; 120°19'16" E	283°58'24"	292°17'24"	8°19'00"	South	Exceeds tolerance
2.	Al-Munawwarah Mosque	4°32'50" S; 120°18'43" E	282°16'48"	292°17'24"	10°00'36"	South	Exceeds tolerance
3.	Al-Hijriah Mosque	4°33'24" S; 120°20'04" E	291°25'48"	292°17'24"	0°51'36"	South	Within tolerance
4.	Nurul Aeni Mosque	5°05'00,55" S; 120°16'35,31" E	282°54'36"	292°21'00"	9°26'24"	South	Exceeds tolerance
5.	Al-Muhajirin BTN Pepabri Mosque	4°33'19,77" S; 120°19'31,74" E	300°55'48"	292°17'24"	8°38'24"	North	Exceeds tolerance

Source: Measurement data processed by the researcher.

An actual azimuth smaller than the qibla azimuth indicates a deviation south of the line toward the Ka'bah. A larger actual azimuth indicates a deviation to the north. The results show that four mosques deviate southward and one deviates northward. Thus, the deviations in the study area do not follow a single direction.

a. Qibla Direction Analysis of Nurut Tijarah Mosque

Nurut Tijarah Mosque is located on KH. Agus Salim Street, Macege Urban Village, West Tanete Riattang District, Bone Regency, at coordinates 4°32'43" S and 120°19'16" E. Based on these coordinates, the correct qibla azimuth is 292°17'24". The actual mosque orientation was recorded at 283°58'24".



Figure 1. Nurut Tijarah Mosque²⁰

The magnitude of deviation was calculated as follows:

$$292^{\circ}17'24'' - 283^{\circ}58'24'' = 8^{\circ}19'00''$$

The result shows that the actual orientation of Nurut Tijarah Mosque deviates $8^{\circ}19'00''$ south of the qibla. This deviation exceeds the 2° tolerance limit. Therefore, the mosque orientation is classified as exceeding the Islamic jurisprudential tolerance applied in this study.

Correction can be made by rotating the prayer-row lines approximately $8^{\circ}19'$ northward, or to the right of the existing orientation. The building does not need to be demolished. Mosque administrators can install new prayer-row lines directed toward the azimuth of $292^{\circ}17'24''$. This approach retains the mosque structure while improving directional accuracy.

b. Qibla Direction Analysis of Al-Munawwarah Mosque

Al-Munawwarah Mosque on Majang Street, Macege Urban Village, West Tanete Riattang District, Bone Regency, is located at coordinates $4^{\circ}32'50''$ S and $120^{\circ}18'43''$ E. Its qibla azimuth is $292^{\circ}17'24''$, while the actual building orientation is $282^{\circ}16'48''$.



Figure 2. Al-Munawwarah Mosque²¹

²⁰Google. (2026). *Google Earth Pro* (Versi 7.3.6) [Software]. Retrieved from <https://www.google.com/earth/>.

²¹Google. (2026). *Google Earth Pro* (Versi 7.3.6) [Software]. Retrieved from <https://www.google.com/earth/>.

The magnitude of deviation was:

$$292^{\circ}17'24'' - 282^{\circ}16'48'' = 10^{\circ}00'36''$$

The deviation of $10^{\circ}00'36''$ is south of the qibla. It is the largest deviation among the five mosques and exceeds five times the operational tolerance of 2° . The orientation of Al-Munawwarah Mosque should therefore be corrected approximately $10^{\circ}00'36''$ northward, or to the right of its current orientation.

The result suggests that the initial mosque orientation may have relied on an estimated westward direction, road alignment, or a simple method that did not refer to true north. Earlier research in Bone Regency similarly found that several mosque qibla directions were inaccurate because they had initially been determined through traditional methods and varied community interpretations. This finding confirms the importance of remeasurement by a person competent in Islamic astronomy.²²

c. Qibla Direction Analysis of Al-Hijriah Mosque

Al-Hijriah Mosque on Colonel Police Andi Dadi Street, Biru Urban Village, Tanete Riattang District, Bone Regency, is located at coordinates $4^{\circ}33'24''$ S and $120^{\circ}20'04''$ E. The qibla azimuth at this location is $292^{\circ}17'24''$, while the actual mosque orientation is $291^{\circ}25'48''$.



Figure 3. Al-Hijriah Mosque²³

The deviation was calculated as follows:

$$292^{\circ}17'24'' - 291^{\circ}25'48'' = 0^{\circ}51'36''$$

The actual orientation of Al-Hijriah Mosque deviates $0^{\circ}51'36''$ southward. This value is below the 2° tolerance limit. Therefore, its qibla direction is sufficiently accurate and remains within Islamic jurisprudential tolerance.

Although acceptable, mosque administrators may further refine the prayer rows by shifting them approximately $0^{\circ}51'36''$ northward. This adjustment reflects a precautionary approach. The

²² Andi Jusran, "Analysis of Mosque Qibla Direction Accuracy in West Tanete Riattang District, Bone Regency," *Al-Bayyinah* 3, no. 1 (2019): 93–107, <https://doi.org/10.35673/al-bayyinah.v3i1.319>.

²³Google. (2026). *Google Earth Pro* (Versi 7.3.6) [Software]. Retrieved from <https://www.google.com/earth/>.

difference does not create an urgent need to alter the structure, and the prayer-row markings may simply be adjusted when spatial conditions permit.

d. Qibla Direction Analysis of Nurul Aeni Mosque

Nurul Aeni Mosque in Barakkao, Polewali Village, Kajuara District, Bone Regency, is located at coordinates $5^{\circ}05'00.55''$ S and $120^{\circ}16'35.31''$ E. Based on this geographical position, its qibla azimuth is $292^{\circ}21'00''$. This differs by $3'36''$ from that of the other four mosques because Nurul Aeni Mosque lies farther south. Its actual orientation is $282^{\circ}54'36''$.



Figure 4. Nurul Aeni Mosque²⁴

The magnitude of deviation was:

$$292^{\circ}21'00'' - 282^{\circ}54'36'' = 9^{\circ}26'24''$$

The result indicates a deviation of $9^{\circ}26'24''$ southward, far exceeding the 2° tolerance limit. The orientation of Nurul Aeni Mosque therefore requires a correction of approximately $9^{\circ}26'24''$ northward, or to the right of its current orientation.

The different azimuth of Nurul Aeni Mosque also demonstrates that qibla direction cannot be standardised solely according to administrative boundaries. Even within the same regency, different coordinates produce different azimuths. This accords with Indonesian Council of Ulama Fatwa Number 5 of 2010, which states that the qibla position in Indonesia varies according to geographical location.²⁵

e. Qibla Direction Analysis of Al-Muhajirin BTN Pepabri Mosque

Al-Muhajirin BTN Pepabri Mosque on Lapawawoi Karaeng Sigeri Street, Masumpu Urban Village, Tanete Riattang District, Bone Regency, is located at coordinates $4^{\circ}33'19.77''$ S and $120^{\circ}19'31.74''$ E. The correct qibla azimuth is $292^{\circ}17'24''$, while the measured actual orientation is $300^{\circ}55'48''$.

²⁴Google. (2026). *Google Earth Pro* (Versi 7.3.6) [Software]. Retrieved from <https://www.google.com/earth/>.

²⁵ Indonesian Council of Ulama, Fatwa Number 5 of 2010 concerning Qibla Direction.



Figure 5. Al-Muhajirin BTN Pepabri Mosque²⁶

The magnitude of deviation was:

$$292^{\circ}17'24'' - 300^{\circ}55'48'' = 8^{\circ}38'24''$$

The actual mosque azimuth is greater than the qibla azimuth. Al-Muhajirin BTN Pepabri Mosque therefore deviates $8^{\circ}38'24''$ north of the line toward the Ka'bah. This exceeds the 2° tolerance limit. Its prayer rows should be rotated approximately $8^{\circ}38'24''$ southward, or to the left of the existing orientation.

This finding differs from the other four mosques, whose actual azimuths are smaller than their qibla azimuths. It shows that the correction must be based on the measurement of each mosque. Administrators cannot apply the same correction to every mosque because both the direction and magnitude of deviation differ.

4. Overall Evaluation of Measurement Results

Using the 2° tolerance limit, only one of the five mosques remains within tolerance. The other four exceed it.

Table 2. Classification of qibla direction deviation levels

Category	Number	Percentage
Within tolerance $\leq 2^{\circ}$	1 mosque	20%
Exceeds tolerance $> 2^{\circ}$	4 mosques	80%
Total	5 mosques	100%

Al-Hijriah Mosque has the smallest deviation at $0^{\circ}51'36''$, while Al-Munawwarah Mosque has the largest at $10^{\circ}00'36''$. The mean absolute deviation of the five mosques is $7^{\circ}27'12''$, substantially exceeding the operational tolerance used in this study.

The predominance of mosques exceeding the tolerance limit demonstrates a gap between building orientation and astronomical qibla direction. This finding is consistent with previous research in Bone Regency, which found that several mosques did not accurately face the qibla. Possible causes

²⁶Google. (2026). *Google Earth Pro* (Versi 7.3.6) [Software]. Retrieved from <https://www.google.com/earth/>.

include older determination methods, alignment with roads, use of a compass without magnetic-declination correction, and the absence of remeasurement after renovation.²⁷

The measurements cannot directly be used to declare past prayers invalid. The community may have faced the qibla according to the knowledge and capability available when the mosques were constructed. However, once a more accurate direction becomes known, prayer rows should be corrected as an effort to fulfil the obligation. Jihat al-Ka‘bah accommodates genuine limitations but does not justify retaining a major deviation that can be corrected.²⁸

The recommended follow-up is verification with an Islamic astronomy expert or an officer of the Ministry of Religious Affairs. The verification should be recorded formally and communicated to administrators and worshippers. The four mosques exceeding tolerance can correct their qibla through prayer-row realignment without demolishing the buildings. This approach safeguards astronomical accuracy while considering public benefit and local social conditions.

CONCLUSION

This study shows that the actual directions of five mosques in Bone Regency have different levels of accuracy. Nurut Tijarah Mosque deviates 8°19'00" southward, Al-Munawwarah Mosque 10°00'36" southward, Al-Hijriah Mosque 0°51'36" southward, Nurul Aeni Mosque 9°26'24" southward, and Al-Muhajirin BTN Pepabri Mosque 8°38'24" northward. The mean deviation is 7°27'12". Based on the operational tolerance of 2°, only Al-Hijriah Mosque remains within tolerance. The other four exceed it. Thus, 20% of the mosques fall within tolerance, while 80% require prayer-row correction.

The findings answer the research objectives and questions by showing that actual mosque orientations do not always correspond to their astronomical qibla azimuths. The qibla azimuth for four mosques is 292°17'24", while Nurul Aeni Mosque has an azimuth of 292°21'00" because of its different coordinates. This proves that the qibla must be calculated from the latitude and longitude of each site. A general reference to northwest is insufficient. Integrating astronomical calculations and Islamic jurisprudential provisions also shows that jihat al-Ka‘bah cannot justify every deviation. Flexibility must be applied measurably according to human capability, instrument precision, and deviation magnitude.

This study is limited to five mosques and therefore does not represent every mosque in Bone Regency. It focuses on building or prayer-row orientation and does not examine in depth the original determination history, instruments used during construction, renovation-related changes, or worshipper

²⁷ Andi Jusran Kasim, Supriadi, and Aswar Anas, "Public Perspectives on Qibla Direction Accuracy Using Modern Instruments," *Qisthosia: Journal of Islamic Law* 2, no. 1 (2021): 1–14, <https://jurnal.stainmajene.ac.id/index.php/qisthosia/article/view/122>.

²⁸ Ismail, Yasin, and Zulfiah, "Tolerance of Qibla Direction Deviation in Indonesia from Islamic Astronomy and Islamic Law Perspectives.", 115–138.

responses to correction. The 2° limit is also an operational threshold selected from one view in Islamic astronomy and is not a single rule accepted by every school of Islamic jurisprudence.

Future research should involve more mosques across a broader area and apply sampling methods that represent the characteristics of mosques in Bone Regency. Measurements should also compare several methods, including theodolite, qibla tracker, rashdul qibla, and geodetic calculations. Further studies may test several tolerance limits based on projections toward the Ka'bah, the Sacred Mosque, and Mecca. Social dimensions should also be examined to understand public acceptance of prayer-row correction and to formulate an accurate, communicative, and conflict-sensitive calibration model.

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