

Compatible Design Approach for the Expansion of Sino-Eclectic Heritage Mosques in Melaka: A Multi Expert Sketch-Based Analysis

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Abstract

The expansion of heritage mosques presents a complex challenge, as it requires balancing the conservation of their cultural and architectural values with the need to accommodate contemporary functional demands. In this context, expert perspectives on compatible design characteristics for new extension structures are crucial, in line with their professional responsibilities in the field of heritage building conservation. This study aims to identify the principles and characteristics of compatible design for the expansion of Sino-Eclectic heritage mosques in Melaka through the analysis of expert sketches. The research adopts a qualitative approach based on content analysis of sketch outputs, alongside the interpretation of expert views in architecture and heritage conservation. The findings from the sketch analysis reveal seven key principles of compatible extension design: the adoption of character-defining elements of the heritage mosque, the use of modular construction systems, pitched roof forms, the separation of new additions, continuity of floor levels, height control, façade visibility and the retention of the minaret as a freestanding structure. These principles emphasize the importance of the original mosque as the primary contextual reference, ensuring visual and spatial continuity. This study has the potential to contribute to the development of a design framework for the compatible expansion of heritage mosques in Melaka while preserving their architectural identity.

Keywords: *Compatible design, conservation, expansion, expert sketch-based analysis, Sino-Eclectic heritage mosques.*

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Pendekatan Reka Bentuk Bersesuaian bagi Pembesaran Masjid Warisan Sino-Eklektik Di Melaka: Analisis Lakaran Beberapa Pakar

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Abstrak

Pembesaran masjid warisan merupakan satu cabaran yang kompleks kerana melibatkan keseimbangan di antara pemuliharaan nilai warisan masjid dengan memenuhi keperluan fungsi semasa. Dalam konteks ini pandangan pakar berkaitan ciri-ciri reka bentuk yang dianggap bersesuaian bagi struktur tambahan baharu adalah penting sejajar tanggungjawab professional yang digalas mereka di dalam bidang pemuliharaan bangunan warisan. Kajian ini bertujuan mengenal pasti prinsip dan ciri-ciri reka bentuk bersesuaian bagi pembesaran masjid warisan Sino-Eklektik, Melaka melalui analisis lakaran pakar. Kajian menggunakan pendekatan kualitatif berasaskan analisis kandungan hasil lakaran serta interpretasi pandangan pakar dalam bidang seni bina dan pemuliharaan bangunan warisan. Dapatan dari analisis lakaran telah mengenal pasti Tujuh (7) prinsip reka bentuk utama pembesaran bersesuaian iaitu pengambilan karektor menonjol masjid warisan, penggunaan struktur binaan modular, bumbung *pitch*, memisahkan binaan tambahan, penerusan aras lantai, kawalan ketinggian, kebolehlihatan fasad dan mengekalkan menara masjid sebagai struktur bebas. Prinsip-prinsip ini menekankan kepentingan masjid asal sebagai konteks utama kesesuaian dengan pembentukan kesinambungan visual dan spatial. Kajian ini berpotensi menyumbang di dalam pembentukan kerangka panduan reka bentuk pembesaran masjid warisan Melaka yang bersesuaian dengan mengekalkan identiti seni binanya.

Kata Kunci: Reka bentuk bersesuaian, pemuliharaan, pembesaran, analisis lakaran pakar, masjid warisan Sino-Eklektik

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1.0 Introduction

Melaka is widely recognised for its rich cultural heritage, encompassing both tangible and intangible forms. Its strategic location along the Straits of Melaka historically established the city as a significant entreport, linking traders from the East and the West, including China, India, the Middle East, and the Malay Archipelago (Husin, N., 2008). Its role as a thriving international trading centre since the 15th century has endowed present day Melaka with a distinctive heritage shaped by the confluence of diverse cultures, ultimately forming its unique identity (Mat, Z. et al., 2025). Among these heritage assets are Islamic religious buildings, namely mosques, which exhibit a unique architectural identity influenced by a combination of styles known as Sino-Eclectic mosques. These mosques not only function as places of worship for the local Muslim community but also serve as important symbols of communal identity and as significant manifestations of local architectural and cultural expression that have evolved since the 18th century (Aziz, S. H., & Ali, 2021). For these reasons, many Sino-Eclectic heritage mosques have been designated as heritage sites and are subject to conservation regulations at both state and national levels.

Despite their designation as heritage sites, these mosques continue to function actively, serving the religious needs of surrounding communities. Population growth in these areas has led to an increase in the number of mosque users, which has become a primary factor driving the expansion of many Sino-Eclectic heritage mosques, in some cases by up to 300% (Mohamed Som, S. et al., 2026). However, the expansion of heritage buildings has long been regarded as a sensitive issue in conservation practice, as the introduction of new structures may potentially compromise their cultural significance (Guzmán-Torres, 2009; Soosani, L., 2013). This situation creates a dilemma and tension between development needs and heritage conservation, highlighting the necessity for viable solutions, including the adoption of compatible design approaches (Shahraki, M. B., 2013).

The compatible design approach is highly important in the expansion of heritage mosques as it ensures that the cultural values, historical identity and architectural authenticity of the mosque are preserved despite the introduction of new addition to the building. In heritage conservation, incompatible extensions may result in the loss of the building's original character, disrupt visual harmony and diminish its authenticity and cultural significance (Khalaf, R. W., 2022). Nevertheless, the characteristics of a compatible design are inherently subjective as they depend on specific values and distinctive features of each heritage building, which may differ from one type of heritage building to another (Kuipers & De Jonge, 2025). Therefore, the compatibility of design approaches of Sino-Eclectic heritage mosques may vary from other heritage mosques due to differences in architectural style and contextual setting. Accordingly, the aim of this study is to identify expert perspectives regarding compatible design approach for the expansion of Sino-Eclectic mosques based on their design sketches. The use of expert sketch-based analysis is particularly important in this study because the interpretation of architectural design is more effectively communicated through visual sketches than through verbal explanations, which are often subject to varying interpretations.

Although the concept of compatible or contextual design has been widely discussed in heritage conservation literature, most previous studies have focused on theoretical principles, conservation policies, or evaluations of completed heritage interventions (Guzmán-Torres, 2009; Yung et al.,



2017; Gonzalez-Longo et al., 2024). Comparatively fewer studies have investigated how conservation professionals actually translate these principles into design decisions during the early conceptual stage, particularly for living religious heritage buildings such as Sino-Eclectic heritage mosques. Existing research also provides limited design specific guidance that can assist architects and conservation practitioners in proposing compatible extensions for this unique mosque typology. To address this gap, the present study adopts a multi-expert sketch-based analysis, allowing design knowledge to be captured directly through visual reasoning rather than relying solely on verbal explanation. By analysing expert sketches together with their design interpretations, this research reveals tacit professional knowledge and recurring design principles that are often difficult to articulate through conventional interview-based methods, thereby contributing new empirical evidence to the literature on compatible design.

2.0 Literature Review

2.1 Conservation of Heritage Mosques in Melaka

Melaka is home to a significant number of heritage mosques that are over a century old, commonly identified under the 'Sino-Eclectic' architectural typology. The term 'Sino' refers to Chinese influences, while 'eclectic' denotes the blending of various architectural styles that together form a distinctive and unique architectural expression. Some of these mosques were constructed during the Dutch colonial period in Melaka, such as Kampung Hulu Mosque and Tengkeria Mosque, both built in 1728.

Among the most prominent features of these mosques is their tiered pyramidal roof form, typically consisting of three levels, crowned with a decorative roof finial known as the mahkota atap. Unlike traditional Malay mosques, which are often elevated on stilts, Sino-Eclectic mosques are constructed using a ground-based slab system, where the floor sits directly on a slightly raised platform above ground level (Ahmad A. G., 1999; Raziq A. S., 2019). This construction method closely resembles that of many mosques in Indonesia, which also feature octagonal minaret structures and multi-tiered pyramidal roofs (N. Utaberta & Rasdi, M. T. M., 2010). Such architectural characteristics are likely influenced by the involvement of craftsmen from Java and Sumatra, who migrated to Melaka as early as the 20th century (A. H. Nasir, 1979).





Figure 1: Tengkerah Mosque features a typical Sino-Eclectic Mosque design characterized by a three-tiered pyramidal roof and octagonal shape minaret.

(Source: Authors, 2025)

In terms of spatial organization, heritage mosques in Melaka are typically designed with an open plan layout, often in a square configuration, and include a surrounding *serambi* (veranda) encircling the main prayer hall (M. Surat et al., 2011). Referring to Kampung Hulu Mosque and Tengkerah Mosque, A. H. Nasir (1976) notes that both structures share identical floor dimensions of 18.30 metres by 18.30 metres, with a height of approximately 14.6 metres from floor level to the roof apex. These mosques are also commonly enclosed by masonry perimeter walls and feature entrance gateways that signify the primary access point to the mosque compound, resembling those found in traditional Chinese temples (N. Utaberta & Rasdi, M. T. M., 2010).

In term of construction material, these heritage mosques are constructed using a combination of materials, including plastered brick walls, timber roof frame structures and clay roof tiles as roof finishing. In some cases, cast iron elements with ornamental detailing are incorporated, as seen in Kampung Kling Mosque. Decorative elements are also prevalent, particularly in the form of intricately carved timber panels with perforated motifs, applied to features such as door heads, windows, central columns and ceiling components. Additionally, ceramic tiles are widely used as wall finishes and decorative elements, especially along staircases, reflecting influences from Melaka traditional houses.

Today, nearly all Sino-Eclectic heritage mosques in Melaka continue to function actively as places of worship. Many have been officially gazetted as heritage sites under the Cultural Heritage Preservation and Conservation Enactment 1988 at the state level and the National Heritage Act 2005 (Act 645) at the national level. The primary objective of such designation is to ensure the continued preservation and safeguarding of these structures, given their significant heritage value. The hybrid architectural style embodied in these mosques not



only reflects cultural tolerance and adaptation but also serves as an important medium for historical and heritage education for future generations (Nawawi et al., 2018; Yun & Marzuki, 2025). Furthermore, the conservation of these heritage mosques is essential for maintaining their unique architectural character while contributing to the development of heritage tourism at the national level (Yan et al., 2024).

2.2 Compatible Design for the Expansion of Heritage Mosques

New development within heritage sites, including extensions and upgrading works, has consistently attracted significant attention in the field of conservation. The expansion of heritage buildings often creates a dilemma between ensuring the continued functionality of the buildings and preserving its authenticity and integrity (Agius et al., 2011; Hassan, A., 2015). Mosques are among the heritage building types that frequently face this challenge, particularly when additional space is required to accommodate increasing numbers of congregants or to provide improved facilities (Ahmad, M. A. et al., 2010). This is because expansion inevitably involves physical intervention in the heritage fabric, which may affect typological integrity, the use of traditional materials, and the historic urban skyline (Feilden, 2003; Jokilehto, J., 2017). Insensitive expansion of heritage mosques, especially when it disregards both tangible and intangible cultural values, has the potential to significantly diminish their heritage significance.

In the context of heritage building expansion, design serves as a mediating tool that balances the need for growth with the conservation of the building's character and authenticity (Gonzalez-Longo et al., 2024). Principles such as the clear distinction between new and old elements, and the reversibility of new additions are fundamental in ensuring the preservation of the original heritage identity while allowing contemporary interventions to meet present needs without resorting to imitation that may cause visual or historical ambiguity (ICOMOS, 2013). Approaches that emphasize visual continuity through the articulation of form and rhythm between the new extension and the existing mosque as well as respect for scale and proportion, can result in harmonious and compatible expansions.

Other influencing factors in the design of mosque expansions include the level of heritage significance, the condition of the building fabric, compliance with Islamic requirements, the surrounding urban and landscape context, as well as carbon footprint and sustainability considerations (Australia ICOMOS, 2013). The involvement of the local congregation and religious authorities is crucial in establishing a social mandate, while evidence based design methods such as Historic Urban Landscape (HUL) documentation, digital modelling and heritage impact assessments help ensure that interventions are carried out with precision and sensitivity. A transparent and effective governance framework further enables the expansion of heritage mosques to function as a model of adaptive conservation, meeting the needs of future generations while safeguarding their enduring heritage values.



2.3 Sketching as a Tool for Compatible Design

The translation of design ideas through architectural sketching has been widely acknowledged as a critical and effective approach in the field of heritage architectural conservation. According to Koliji (2016), sketching functions not merely as a tool for visual representation, but also as a medium for developing “imaginative knowledge” that connects abstract thinking with spatial reality. This perspective is further supported by Aeini et al. (2022), who emphasise the role of sketching in enhancing cognitive design capabilities, whereby repeated visual exploration facilitates the expansion and refinement of ideas. Advances in technology have broadened the range of sketching media, including the use of digital tools such as 3D modelling and virtual reality, which enable more precise visualisation of the integration between new and existing designs. Nevertheless, manual hand sketching remains highly effective and continues to be relevant as an exploratory tool in the early stages of design development (Giglietto, D., 2023).

In the development of compatible design for the expansion of heritage mosques, visualisation methods are recognised as essential, serving as a bridge between the documentation of heritage values and the design of new additions. Visualisation techniques whether manual sketches or digital representations have proven to enhance understanding of the original architectural design of the mosque. Consequently, any proposed intervention, including the design of additional structures, can be undertaken with greater sensitivity and careful consideration of its impact on the overall architectural composition (Imtiaz et al., 2024). As noted by Madandola et al. (2026), the expansion of heritage mosques typically involves a gradual process of architectural evolution, in which visualisation plays a crucial role in maintaining morphological and functional continuity. Therefore, it can be concluded that expert generated sketches serve not only as tools of visual communication, but also as important media for analysis, exploration and synthesis in producing compatible design solutions for the expansion of heritage mosques.

3.0 Research Methodology

This study adopts a multi expert sketch-based analysis approach as a qualitative method to explore expert design thinking through visual representation. This approach is grounded in the premise that sketching functions as a crucial cognitive tool in architectural practice, not only illustrating spatial ideas but also revealing underlying rationales and value considerations that are often difficult to articulate textually. A total of six experts were purposively selected, comprising five registered conservators and one architect with extensive experience in heritage building conservation. The selection criteria required participants to possess formal qualifications in architecture or heritage conservation, a minimum of ten years of professional experience, direct involvement in heritage conservation projects, and competency in architectural sketching. This number was considered appropriate for the qualitative nature of the study, as its purpose was to obtain in-depth professional insights rather than statistical representation, with thematic saturation achieved when no substantially new design concepts emerged after the sixth expert.

In the implementation phase, each expert was provided with plans of four heritage mosques that had undergone extensions and was asked to select one case for analysis. Based on the selected



plan, the experts were required to produce sketch proposing a more compatible extension design. The sketches were drawn directly onto the provided plans to allow sketch design interventions to be contextualized within the existing structure. Each sketch was accompanied by annotations to clarify design rationale. Subsequently, the sketches and annotations were analysed using qualitative content analysis through an iterative coding process involving open coding, axial coding, and thematic synthesis to identify recurring compatible design principles. To enhance the trustworthiness of the findings, methodological triangulation was achieved by analysing both visual sketches and written explanations, while peer discussions ensured coding consistency. All themes were derived from recurring patterns across multiple expert sketches, thereby strengthening the credibility, dependability, and confirmability of the findings.

4.0 Research Findings

The analysis of expert sketches related to the design of new addition for the expansion of Sino-Eclectic heritage mosques in Melaka has identified seven (7) design principles or characteristics that can be applied to ensure design compatibility between the new additions and the original mosque, as follows:

4.1 Adoption of the Dominant Character of the Heritage Mosque

The findings indicate that the adoption of the dominant architectural character of heritage mosques to establish visual continuity is the most frequently applied design approach among experts. Key architectural characteristics of Sino-Eclectic heritage mosques that are commonly interpreted include the *Meru* roof or pyramidal roof form, as well as the series of columns along the mosque veranda arranged in a repetitive spacing that forms its own structural grid.

However, this approach does not involve direct imitation of the original elements. Instead, it focuses on extracting and reinterpreting the fundamental design principles of these characteristics. This is consistent with the Burra Charter (1999), which emphasises that any new additions must respect the cultural significance of the place and avoid conjectural reconstruction that may lead to historical ambiguity or misinterpretation. Therefore, the adoption of dominant character is not a form of replication, but rather a contemporary interpretation of the form, proportion and spatial logic of the heritage mosque. This approach ensures that the new extension does not appear visually alien, instead integrates harmoniously within the historical architectural evolution of the mosque (Feilden, 2003).



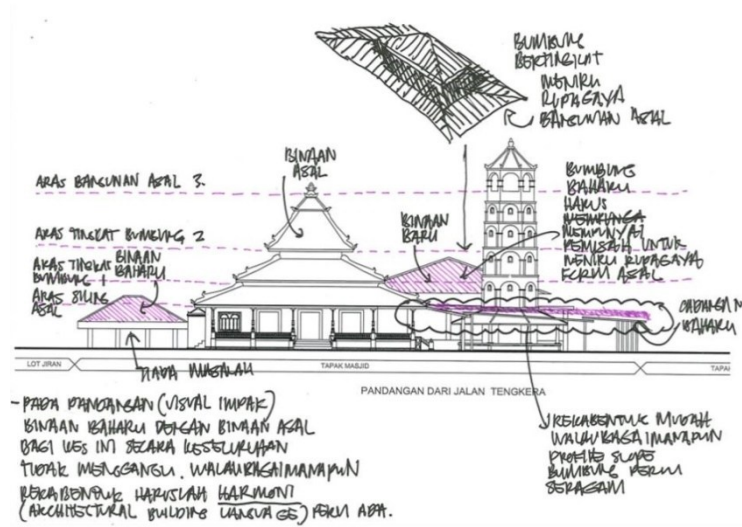


Figure 2: The expert sketch proposes the use of a hipped roof form to establish visual connectivity.

(Source: Authors, 2025)

4.2 Modular Construction System

The use of modular construction systems has been identified by experts as one of the compatible design approaches for the expansion of heritage mosques. Modular structures are seen as a practical strategy for providing additional prayer and functional spaces without requiring large scale construction that could visually overwhelm the original heritage mosque. In addition, modular systems offer greater flexibility, as they can be arranged in response to varying site conditions, while individual units can be incrementally added over time according to future needs.

Furthermore, modular construction typically involving lightweight and reversible components helps ensure minimal physical intervention on the existing site and heritage fabric. This approach is consistent with the principle of minimal intervention, which is strongly emphasised in heritage conservation guidelines such as the Venice Charter (1964) and the Burra Charter (2013), both of which advocate limiting physical impact on original structures. Modular systems also allow components to be prefabricated off site and assembled with minimal disturbance to the existing mosque structure and setting. According to experts, modular construction facilitates easier maintenance and allows for future reconfiguration without compromising the integrity of the heritage fabric. At the same time, it ensures that new additions remain visually distinguishable from the original structure, thereby supporting the principle of legibility in conservation practice.



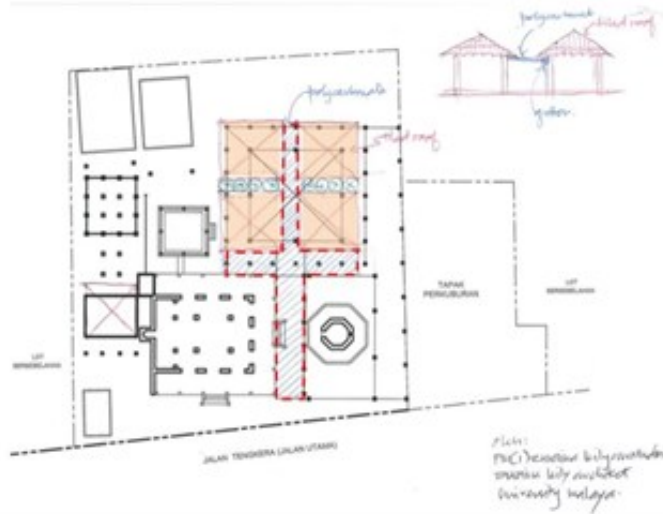


Figure 3: One of the expert sketches presents a modular construction system aimed at controlling the scale of the mosque extension.

(Source: Authors, 2025)

4.3 Separation of New Additions and the Heritage Mosque

The findings indicate that the separation of new extension structures from the heritage mosque is one of the approaches selected by experts in achieving compatible design for the expansion of heritage mosques in Melaka. This strategy is considered critical in preventing structural loads of new additions from being transferred to the existing walls or columns of the ageing heritage mosque.

The practice of spatially distancing or physically detaching the new structure from the original mosque also aligns with the principle of reversibility, whereby new interventions can be removed or dismantled in the future without causing damage to the original heritage fabric (Article 13, Venice Charter). This separation further facilitates a clearer understanding and appreciation of the architectural value of Sino-Eclectic heritage mosques, which possess distinct and well defined architectural characteristics. The resulting interstitial space functions as a visual transition zone, offering visitors an opportunity to perceive and appreciate the historical distinction between two different construction periods within the evolution of Melaka's heritage mosques.

4.4 Continuity of Floor Level

The continuity of floor levels between the existing prayer hall of the heritage mosque and the new extension is a functional approach that ensures accessibility and smooth



movement of congregants. However, from a conservation perspective, maintaining this level continuity also serves to respect the established spatial hierarchy inherent in the original mosque design. The alignment of floor levels between the new addition and the heritage mosque is primarily guided by the floor level of the mosque veranda. This is because the new extension is conceptually and functionally connected to the veranda space, which shares a closer spatial relationship with it compared to the main prayer hall. By continuing the veranda floor level into the new extension, a more holistic spatial integration can be achieved. This ensures a consistent spatial experience for users while maintaining the authenticity of the site's original topographical and architectural conditions, without compromising the integrity of the heritage fabric.

4.5 Height Control of New Extension Structures

The findings indicate that experts place strong emphasis on height as a key design consideration in achieving compatible expansion of heritage mosques in Melaka. The height of new extension structures is generally restricted so that it does not exceed the level of the second roof tier of the Sino-Eclectic heritage mosque, as illustrated in the **Figure 4**. This height control is intended to ensure that the new structure remains subservient to the heritage mosque, which is the principal building on the site. Sino-Eclectic mosques typically feature a three-tiered roof form, which is one of their most distinctive architectural characteristics and carries specific symbolic and spiritual meanings. In line with established conservation principles, most international heritage guidelines emphasise that new additions should not dominate or visually overshadow the primary heritage landmark. By limiting the height of the new structure, the highest roof profile of the Sino-Eclectic Mosque remains the visual focal point of the site and the surrounding urban landscape, thereby preserving the historic skyline and spatial identity of the area.

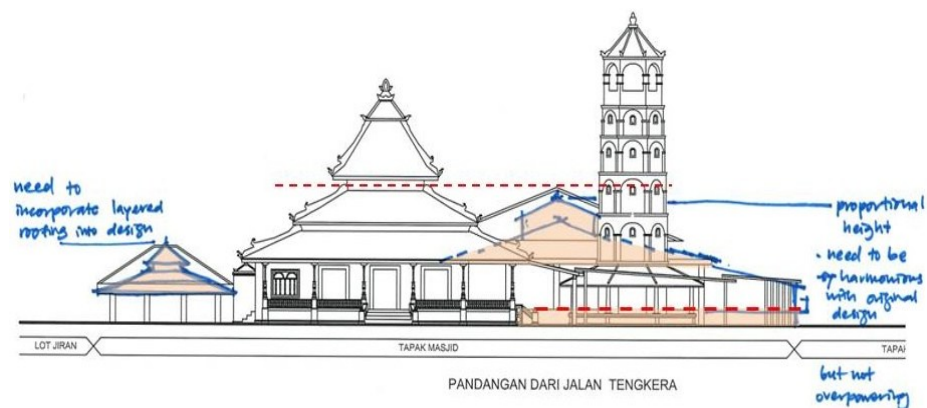


Figure 4: The expert sketch demonstrates the importance of establishing height limitations for the new addition in achieving harmonious mosque extension design.

(Source: Authors, 2025)



4.6 Visibility of the Mosque Façade

The design of new extension structures must ensure that the key facade of the heritage mosque remains visible from public viewpoints, particularly from main roads. Visibility is a crucial aspect in maintaining the sense of place of an area, as well as in ensuring that the architectural value of heritage buildings can be properly appreciated. If new extensions are constructed in a position that obstructs the visibility of the mosque's main facade, this may disrupt the narrative relationship between the heritage mosque and its surrounding social and urban context. In line with the heritage conservation guidelines issued by the National Heritage Department, any addition should not obscure important architectural features of a heritage building, such as decorative elements on walls or main entrances. To address this, the use of transparent materials or lightweight structural systems without solid walls as illustrated in the **Figure 5** can be adopted as part of the design approach. Such strategies help ensure that the authenticity and integrity of the heritage mosque facade are preserved, while still allowing for necessary spatial expansion.

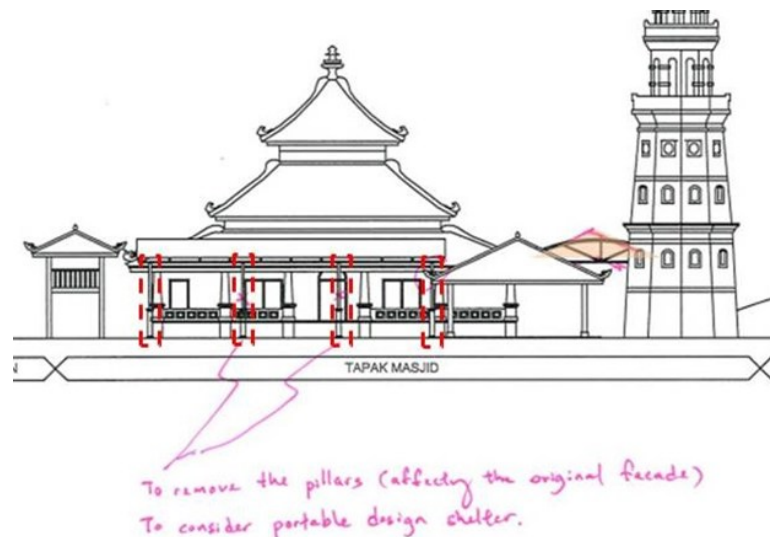


Figure 5: The use of lightweight and open-sided structure helps to preserve the visibility of the heritage mosque facade.

(Source: Authors, 2025)

4.7 Minaret as an Independent Structure

The single minaret structure, featuring a hybrid architectural style influenced by Chinese, European and Nusantara traditions, is one of the key character-defining elements of Sino-Eclectic heritage mosques in Melaka. The mosque minaret is typically constructed as a separate structure from the main prayer building, although positioned in close proximity to



it. As a result, poorly considered mosque expansions may lead to new extension structures physically merging with the minaret. Based on expert sketches, all respondents consistently demonstrate a clear tendency to avoid any new construction that connects directly to the minaret structure. This approach is crucial in emphasizing the fundamental characteristic of the minaret as a freestanding structure with its own distinctive architectural expression. Encroachment of new extensions into the spatial setting of the minaret can significantly reduce public appreciation of its architectural value and, in turn, weaken the understanding and interpretation of the mosque's overall design composition. Therefore, maintaining the separation and visual independence of the minaret is essential in preserving both its symbolic significance and its role within the broader heritage identity of the mosque.

The overall findings on the seven principles for the compatible expansion design of Melaka's Sino-Eclectic heritage mosques are summarized in the table below:

Table 1: Table shows seven (7) design principles highlighted by experts for the expansion of Melaka's Sino-Eclectic heritage mosques. (Source: Authors, 2025)

No	Principle	Description	Conservation Significance
1	Adoption of dominant character	Reinterpretation of Meru roof, veranda columns and architectural language	Maintains architectural identity without imitation
2	Modular construction	Lightweight and reversible modular system	Supports minimum intervention and reversibility
3	Separation of new addition	Detached extension from original mosque	Protects heritage fabric and structural integrity
4	Continuity of floor level	Maintain veranda floor connection	Preserves spatial continuity and accessibility
5	Height control	Extension lower than second roof tier	Maintains visual hierarchy
6	Façade visibility	Preserve main façade visibility	Protects landmark value and sense of place
7	Independent minaret	Preserve detached minaret	Retains symbolic and architectural



5.0 Discussion

The analysis of expert sketches reveals that compatible design for the expansion of Sino-Eclectic heritage mosques in Melaka is not based on direct imitation of architectural elements, but rather on a deep understanding of their architectural language. The use of sketching as a diagnostic tool enables experts to visually interpret the principles of the Burra Charter, particularly in balancing contemporary functional requirements with respect for the heritage significance of the mosque. The findings show that elements such as the *Meru* style roof and repetitive column arrangements are not merely aesthetic components, but critical parameters that define visual equilibrium. The ability of experts to reinterpret and reconfigure existing expansion concepts through sketching demonstrates the effectiveness of visual communication compared to verbal explanations, which are often more subjective in interpretation.

In addition, strategies that promote subservient design through height control and the use of modular construction systems are aligned with international conservation principles. By limiting the height of new extensions so that they do not exceed the second tier of the mosque roof, the prominent profile of the three-tiered roof one of the most significant architectural characteristics can be preserved as a visual landmark. The expert decision to physically separate new extensions from the heritage mosque helps protect the integrity of the original structure while creating a visual transition zone that enhances understanding of the mosque's historical context and architectural evolution. This approach maintains overall site harmony and is consistent with the principle of reversibility, which emphasizes that any new addition should be removable in the future without compromising the authenticity and integrity of the heritage mosque.

6.0 Conclusion

Overall, this study concludes that the expansion design of Sino-Eclectic heritage mosques in Melaka should be guided by seven design principles that priorities the interpretation of architectural language over direct imitation. The sketch-based expert approach has proven to be an effective cognitive instrument for conveying the notion of design compatibility, which is inherently subjective and abstract in nature. Through the application of modular construction systems, height control and the maintenance of façade visibility, mosque expansions can still be carried out to meet contemporary functional requirements without compromising their heritage values. Finally, this study reinforces the theory that successful conservation requires adaptive interventions that are responsive to both present day needs and the essential values of a heritage site.

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References

- Abdul Halim Nasir (1976) Panduan Tempat-Tempat Bersejarah Kelantan. Kuala Lumpur: Jabatan Muzium
- Abdul Halim Nasir (1979), "Seni Bina Masjid Lama" dalam Dewan Budaya, jil.1, bil 11, h. 49-50, November 1979
- Ahmad, A. G. (1999). *The architectural styles of mosques in Malaysia: From vernacular to modern structures*. In Proceedings of the Symposium on Mosque Architecture: The Historic and Urban Developments of Mosque Architecture (Vol. 2, pp. 147-163). King Saud University, Riyadh, Saudi Arabia.
- Agius, M., & Facy, B. (2011). Preserving heritage places under a new paradigm. *Journal of Cultural Heritage Management and Sustainable Development*, 1(1), 6–18.
- Ahmad, M. A., & Md. Daud, M. F. (2010). *Masalah dalam pemuliharaan bangunan warisan di Malaysia*. Prosiding Persidangan Kebangsaan Sains Sosial Universiti Malaysia Sarawak.
- Australia ICOMOS. (2013). The Burra Charter: The Australia ICOMOS Charter for places of cultural significance (2013). Australia ICOMOS.
- Aziz, S. H., & Ali @ Mat Zin, A. (2021). Mosque: A history of Islamic architectural writing in Malaysia. *Jurnal al-Muqaddimah*, 9(1), 53–71.
- Aeini, S., Afzalian, K., Etesam, I., & Shariatrad, F. (2022). Narrative design as a historical technique (case study: Grand Mosque of Fahraj). *Bagh-e Nazar Journal*.
- Feilden, B. M. (2003). *Conservation of historic buildings* (3rd ed.). Architectural Press.
- Giglitto, D. (2023). *Advanced Research and Design Tools for Architectural Heritage*. Routledge.
- Gonzalez-Longo, C., & Otto, T. (2024). Urban heritage conservation and design for sustainable development. In WHITR-AP Regional Conference Proceedings on Heritage Conservation and Design. International Council on Monuments and Sites (ICOMOS)
- Guzmán-Torres, Z. (2009). Historic buildings and contemporary additions: The elements of a cohesive design relationship.
- Hassan, A. A. (2015). Improving the development process of heritage sites. *Journal of Architectural and Engineering Sciences*, 2(1), 1–13.
- Hussin, N. (2008). Geografi dan perdagangan: Kepentingan Selat Melaka kepada perdagangan dunia, Asia dan dunia Melayu 1700-1800. *Akademika*, 73, 3–26.



- ICOMOS. (2013). *Principles for the conservation of heritage sites in China*. International Council on Monuments and Sites (ICOMOS).
- Jokilehto, J. (2017). *Questions of authenticity concerning different cultures and preservation*. In T. Lyngdoh (Ed.), *Postcolonial heritage and cultural responsibility* (pp. 1–16).
- Khalaf, R. W. (2022). Integrity: Enabling a future-oriented approach to cultural heritage. *The Historic Environment: Policy & Practice*, 13(1), 1–17.
- Koliji, H. (2016). *In-Between: Architectural Drawing and Imaginative Knowledge in Islamic and Western Traditions*. Routledge.
- Kuipers, M., & De Jonge, W. (2025). *Designing from heritage: Strategies for conservation and conversion*. Routledge.
- Madandola, M., Kahera, A. I., & Boussaa, D. (2026). *Evolution of Mosque Architecture*.
- M. Surat, N.A.G. Abdullah, I.M.S. Usman, N.M. Tawil, A.H Ismail (2011), *Kajian Dan Analisis Terhadap Asas Dan Akar Rekabentuk Masjid-Masjid Warisan Di Alam Melayu*, *Journal Design + Built*.
- Mat, Z., Che Husain, F., Halim, H., Akbar, W. M., & Abdullah, M. S. (2025). Governance, culture, and legacy of Melaka on shaping Malaysia's nation building. *International Journal of Research and Innovation in Social Science*, 9(11), 4151–4156.
- Mohamed Som, S., Mohd Nasir, M. R., Wan Mohamad, W. S. N., & Marzuki, I. N. (2026). The Pattern of Heritage Mosque Expansion in Melaka and Its Impact on Cultural Significance. *Malaysian Journal of Sustainable Environment*, 13(1), 251-270
- Nangkula Utaberta, & Rasdi, M. T. M. (2010). Deskripsi tipologi, klasifikasi dan analisis perancangan masjid di Malaysia. *El-Harakah Journal Budaya Islam*, 12(2), 85-100.
- Nawawi, N. M., Kassim, S. J., & Ibrahim, M. (2018). *The mosque in a multicultural context: Modernity, hybridity and eclecticism*. Springer.
- Raziq Abdul Samat, S., Shaari, S., Madon, D. L., Meor Hamzah, M. H., & Nor Fariza Baharuddin, N. (2019). Identifying a lotus motif transformation on the Melaka traditional mosque's roof crown in 1720–1950. *E-Journal of Islamic Thought and Understanding*, 1(1), 31–38.
- Shahraki, M. B. (2013). Pendekatan seni bina kontekstual dalam pembangunan kawasan warisan. *Jurnal Alam Bina*, 15(3), 1-20.
- Soosani, L. (2013). *Questioning the Compatibility of the Infill Architecture in Historic Environment, Case Study: Walled City of Nicosia*, Eastern Mediterranean University, Gazimağusa, North Cyprus.



- Yan, S., Geng, S., Chau, H. W., Wang, T., Jamei, E., & Vrcelj, Z. (2024). Adaptive reuse of religious architecture and heritage tourism. *Heritage*, 7(12), 329.
- Yun, O. H., & Marzuki, A. (2025). The impact of tangible heritage towards historic building usages in George Town UNESCO World Heritage Site. *Planning Malaysia*.

