

The Application of Digital Reconstruction in the Documentation and Interpretation of Candi Kampung Baru, Kota Kuala Muda, Kedah

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Abstract

The site of Candi Kampung Baru was discovered in 2015, making it one of the most recent archaeological discoveries in the Bujang Valley. 2 phases of excavation had been carried out by archaeologists from the Institute of Malay World and Civilization (ATMA), in which a single unroofed, rectangular brick structure had been unearthed. Based on the analysis of archaeological remains, the *candi* has been identified as a 9th-10th century structure. Using measurements taken on-site, a digital model had been constructed to visualize the ancient structure, interpret its function and facilitate potential physical reconstruction in the future.

Keywords: *archaeology; ancient architecture; candi; digital reconstruction; conservation.*

1. Introduction

The unexpected discovery of an ancient structure in an area that was formerly utilized as a Muslim cemetery in Kampung Baru, Kota Kuala Muda in 2015 provided an opportunity for a broader study on the archaeology of the Malay Peninsula. The preliminary excavation of the site in 2016 revealed a brick monument characteristically similar to protohistoric shrines of Old Kedah; the *candis*. The whole perimeter of the structure was consequently unearthed during the second excavation in 2017, revealing one of the most well-preserved ancient clay brick structure in the Bujang Valley.

However, the now unearthed structure presents another challenge. Unlike granite or laterite monuments, clay bricks are not as forgiving to physical disturbance. As the area is constantly exposed to the elements and occasional flood, the remaining arrays of bricks could easily be damaged or displaced, threatening the shape and integrity of the structure while causing irreparable setbacks that could effectively debilitate future conservation endeavors. The probability for the *candi* to be damaged is high considering the fact that several ancient structures previously discovered near the banks of Sungai Muda had now been totally destroyed [1] [2]. Nonetheless, the next phase of archaeological study, which will involve excavation on the interior part of the *candi*, would inevitably cause disturbance to the pile of earth that retains the still-standing wall, exposing the structure to the risk of collapse.

The obvious solution is physical conservation works, which would preferably involve relocation and reconstruction. However, the notion of reconstruction before the completion of subsequent digs is rather futile. Physical reconstruction is also notably costly while involving a lot of consideration, and thus only 8 *candis* in the whole of Bujang Valley had ever been reconstructed [2]. As such,

reconstruction projects are normally done at a much later date, possibly resulting in erroneous reproduction of the original structure due to failure in adhering to original excavation data, as exhibited by the dissimilarities between the physical reconstruction of *candis* at Site 11 and Site 19 with archaeological records from the early 20th century [3]. While the differences might seem minor, the variation could potentially lead to inaccurate interpretations of their form and functions.

An alternative for this predicament is to conduct a digital reconstruction, which would digitally preserve valuable field data that could otherwise be compromised. Nowadays, 3D modelling of cultural heritage monuments is considered a common practice and represents a critical component that can preserve cultural heritage assets digitally [4]. Archaeological sites around the globe had benefitted from the advent of technologies that enable lost or ruined ancient structures to be visualized once again [5]. Moreover, digital models provide opportunities for hypothetical anastylosis to be thoroughly analyzed before physical reconstruction is carried out, ensuring that the structure is accurately represented.

Consequently, the role of digital reconstruction in the studies of ancient Southeast Asian temples has considerably grown in recent years. As demonstrated by [6], 3D models are not only valuable in the visualization of ancient structures, but to a certain extent provided the means to map the architectural evolution of *candis* and *prasats* from their South Indian origins. As such, this study also aims to employ the digitally reconstructed Candi Kampung Baru as the basis for an archaeological analysis of its form and function.

2. Research Methodology

This study adheres to a very simple structure (Fig. 1). Following the excavation at the site of Kampung Baru, data are gathered through field survey and detailed measurements. Based on the

plans produced, a digital reconstruction is carried out to generate a 3D model that represents the *candi* in its original form, which is in turn used to identify and interpret the function of the actual *candi*.



Fig. 1: Methods employed in the digital study of Candi Kampung Baru.

3. Field Data Acquisition

Field mapping and measurements were conducted at the end of the second excavation, with the objective of producing scaled plans for the structure. Although parts of the *candi* were in ruins, the remaining brick walls are reasonably well-preserved for a proto-historic site, providing discernable features that are relatively measurable. A set of 2 x 2 meter horizontal and vertical grid lines, with 20 x 20 cm subdivisions, was erected from a predetermined datum line to facilitate the measurement process.

Due to cave-ins and dislocation of the walls, it is hard to determine the precise dimensions of the structure. The *candi* stands as a rectangular construction with a perimeter of about 12 by 11 meters at the base and a height of about 1.5 meters (Fig. 2). From top to bottom, 23 layers of bricks are observable. The foundation is marked by a 44 cm high *adhithana* (raised base) constituted of 6-7 consecutive layers of bricks. Bricks from layer 8 to 12 adorned the façade with a set of moulding 31cm in height while the remaining 11 layers form a 73 cm straight line to the top. No traces of stairs or entryways had been found, making this *candi* an enclosed structure.

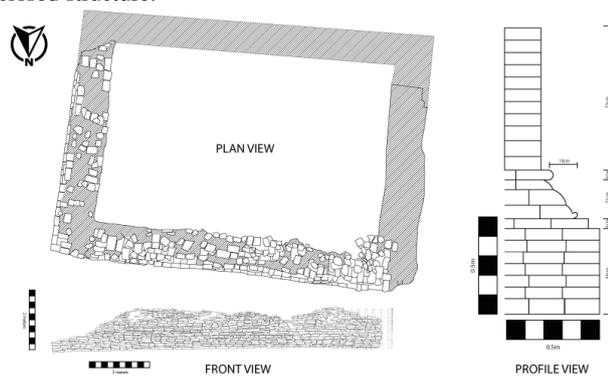


Fig. 2: Plan, elevation and profile view of Candi Kampung Baru.

The *candi* is oriented north by east, about 6° from the north, in the direction of Mount Jerai, the local representation of Mount Meru. Based on relative dating, the site is believed to be built around the 9th – 10th century A.D. [7]. While artifacts found during the excavations lack any notable religious associations, the discovery of 2 granite plinth bases (usually used to support statues of deities) on top of the structure is a strong indication that the site was once used for sacred rituals.

Survey done on the bricks recorded blocks of highly varying thickness, width and length. No usage of mortar can be traced. It is apparent that the builders did not put much emphasize or care for precision during the bricklaying process. However, better attention was evidently given to the production of bricks that form the moulding; while not precisely identical in dimension, the size difference is markedly reduced.

4. Digital Reconstruction

The digital reconstruction was carried out via interpolated extrusion of scanned plan, elevation and profile mappings in Autodesk 3DS Max. This method ensures that the original plans are accurately represented by the 3D model [8]. The damaged sections of the *candi* are restored to their original form based on other comparable sections that are still intact. As the objective is to visualize the complete form of the *candi* through digital anastylosis, the usage of textures is purposely omitted. The rendition of the reconstruction is displayed in Fig. 3.

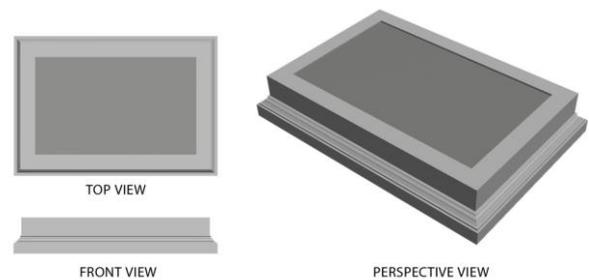


Fig. 3: The digitally reconstructed Candi Kampung Baru

5. Discussion

The digitally reconstructed model provides a visual representation of the *candi* in its original, undisturbed form, which can be visually assessed and compared with other archaeological findings. While the structure had been identified as a religious monument based on the discovery of plinth bases, the identification of the associated religion requires a certain amount of justification. The absence of a *garbhagriha* (inner sanctum located underneath a *vimana* superstructure) and *mandapa* (porch) as well as the north by east orientation negates the possibility that the *candi* is of Hindu architecture, which is customarily oriented east-west to correspond to the movement of the sun. Additionally, the structure is similar in form to *stupa* shrines, in which Buddhists perform *pradakshina* (ritual circumambulation) in a clockwise manner. It could be safely assumed that the immediate area around the *candi* was cleared in a certain radius in order to provide a pathway that would enable this ritual.

An interesting feature can be observed in the intricate shape and composition of the wall moulding. It should be noted that although the *candi* is erected in the most simplistic form, the level of details displayed by the wall moulding is exceptional for an Old Kedah protohistoric structure. The moulding is composed of (in order, from top to bottom) thread, torus, cyma and plinth. This configuration matches the general arrangement of *candi* moulding that features torus [9]. While some reconstructed sites display the torus (e.g. Site 19, a 12th-13th century Hindu structure), the presence of pronounced torus and cyma is a rather uncommon occurrence for Malaysian *candis*, much less the usage of deliberately shaped clay bricks (Fig. 4). It should also be noted that Degroot's study [9] implies that in the early period – specifically, up to 830 A.D. as proposed by [10] – the torus is generally present on Buddhist monuments but absent on Hindu structures. It was only after the spread of Hinduism in areas where Buddhism was firmly established that the torus began to be adopted in the construction of some Hindu *candis*. This observation on moulding style appropriately matches the relative dating that placed Candi Kampung Baru in the 9th-10th century, besides being in line with the theorized establishment of Buddhist practice in the Bujang Valley before the spread of Shaivism in the 10th century [11].

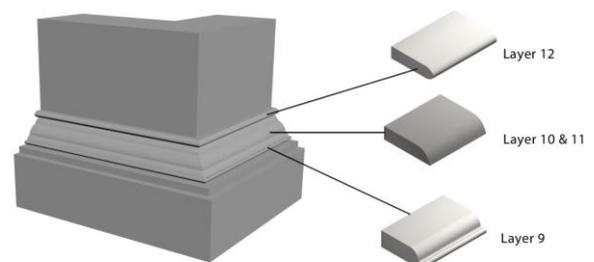


Fig. 4: Sectional reconstruction of moulding and bricks

The rudimentary build quality, particularly the use of non-standardized brick sizes, advocates another possible connection to ancient Buddhist practice. The erection of religious monuments was viewed by devotees as an offering that warrants divine merit. The emphasize of this practice was oftentimes strictly placed on

the noble intention but not on quality and durability; as long as the building is completed, the objective was considered fulfilled. Constrained by limited resources and funds, builders were generally compelled to employ the least expensive construction techniques and materials [12]. In the case of clay brick *candis* located in the Bujang Valley, the materials used were scientifically proven to be produced locally by means of open burning after being shaped from clay harvested in the nearby areas [11] [13] [14].

The strong association to Buddhism, the perceived simplicity in the form of the structure and absence of stairs all point to the possibility that this *candi* is a *chaitya*, a type of *stupa*-like structure that was customarily built by Buddhists to commemorate important events [15]. Further information on the function and meaning of this *candi* could potentially be provided by the next phase of the excavation works. The form of the structure will not however be subject to change, as all visible architectural features had been documented in this study.

6. Conclusion

This paper has presented a real scenario in which the 3D modeling approach was used in the digital reconstruction of a cultural heritage site. Through 3D modelling of field measurements, the otherwise delicate *candi* site had been preserved and reconstructed in digital form. Analysis done on the digitally reconstructed model strongly suggests that Candi Kampung Baru is a religious structure associated with Buddhism. The visual form of the *candi* matches the characteristics of a 9th-10th century structure, which is consistent with relative dating of artifacts found during excavation.

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