

# *Vernacular Prefabrication in the Colonial Context: The 1862 Bintulu Type Fort in Sarawak*

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*The design, procurement and implementation of the Sarawak government's 1862 fort in Bintulu (on the northwest coast of Borneo) represented modern approaches. It was a standard design that appeared to contrast with vernacular and indigenous typologies. Its primary structure was prefabricated in the capital, Kuching, before being shipped out for erection. While defensive, it also introduced modern institutions to newly acquired areas. The Bintulu Type fort was also implemented at Sibü (1862), Mukah (1863), and Baleh (1875, moved to Kapit in 1880). Unlike most colonial jurisdictions, Sarawak's government explicitly relied on the dynamic maintenance of political relationships with locals, and negotiations and collaborations with indigenous, regional migrant and colonial groups to maintain authority. Its governance was a hybrid of vernacular and modern systems, and its European leaders indigenised their rule. This hybridity and indigenisation extended to fort architecture. Second-generation British colonial buildings in Southeast Asia emulated metropolitan designs while masking local involvement. However, the vernacular materials and construction of the Bintulu Type fort clearly show the involvement of regional migrant and indigenous actors. While prefabrication and remote manufacture can be considered modern, the vernacular carpentry traditions adopted for the forts were demountable and therefore appropriate for remote reconstruction. Using historical ethnography methods and fieldwork at the last extant Bintulu Type fort at Kapit, this paper explores how vernacular and modern approaches were brought together in the procurement and implementation of the Bintulu Type forts.*

*Keywords: vernacular architecture; colonial architecture; Sarawak; fort; prefabrication; carpentry*

In a 9<sup>th</sup> April 1862 letter from John Brooke Brooke to Rajah James Brooke, he reported that he had “been to Bintulu [,] chosen the site of the new fort at the mouth of the river. We brought the frame of it with us”.<sup>1</sup> Bintulu, on the northwest coast of Borneo, was part of a new territory acquired by Sarawak after laying siege to the area, and establishing a fort imposed authority through a physical presence. From the Bintulu Type fort at Kapit, Sarawak,<sup>2</sup> we know that its construction allows prefabrication: Brooke Brooke’s ‘frame’ was the building’s disassembled primary structure. In the context of nineteenth century colonialism, this might suggest the adoption of a modern system to overcome local labour and skills issues in order to implement colonial governance. However, Brooke Brooke goes on to say “... and the local people have cut plenty of wood” for the fort, implying that local collaborators helped source and supply building materials. This timber was used as cladding, suggesting significant indigenous involvement in fabricating building materials. The Bintulu fort can be considered a result of flexible and adaptive modern processes, but also a vernacular building. This is problematic as vernacular architecture has often been considered in opposition to modern (and colonial) architecture. Vernacular architecture is thought of as ‘frozen in time’ and unable to adapt to contemporary issues,<sup>3</sup> whereas modern architecture is seen as dynamic, progressive and adaptable. This binary opposition limits how modern and vernacular architecture are considered, but recent historiographical approaches have questioned and problematised this schema, including expanding its conceptualisation.<sup>4</sup> This includes the intertwining of modern and vernacular, where vernacular approaches form modern buildings.<sup>5</sup> This paper seeks to extend this line of investigation by exploring modernity’s encounter with the vernacular in nineteenth century Sarawak.

## Context

The state of Sarawak began in 1841 when Indian-born Briton James Brooke became governor (with the title of Rajah) of a district of the Brunei Sultanate in Northwest Borneo from Cape Datu to the Sadong River,<sup>6</sup> later becoming its autonomous ruler within Brunei’s ruling structure.<sup>7</sup> With his successor Charles Brooke, Sarawak was expanded five times to its area today as a state of Malaysia. Like Francis Light and Stamford Raffles did in Penang and Singapore respectively, James adopted indigenous practices to acquire new colonial territory for Britain, to modernise it for colonial trade, agriculture and industry.

1 John Brooke Brooke, *John Brooke Brooke Letters*, ff 435-43 in *MSS Pac. s 90 Basil Brooke Papers 5* (Oxford: Rhodes House Library, Oxford University, 1866)

2 John Ting, *Precarious Power, Forts and Outstations: Indigenisation, Institutional Architecture and Settlement Patterns in Sarawak, 1841-1917* (Melbourne: University of Melbourne, 2015), 304.

3 Greig C. Crysler, “Time’s Arrows: Spaces of the Past,” *The Sage Handbook of Architectural Theory*, ed. Greig Crysler, Stephen Cairns, and Hilde Heynen (London: SAGE, 2013) 289-307

4 Mark Crinson, “Dynamic Vernacular— an Introduction,” *ABE Journal* 9/10 (2016): <https://journals.openedition.org/abe/2944?lang=en>

5 Chrysler, *Times Arrows*, 296.

6 S. Baring-Gould and C. A. Bampfyld, *A History of Sarawak under Its Two White Rajahs, 1839-1908* (London: H. Sotheran, 1909), 74.

7 D. E. Brown, *Brunei: The Structure and History of a Bornean Malay Sultanate*, Monograph of the Brunei Museum Journal 2, No. 2. (LOCATION?): Brunei Museum, 1970) 153.

However, Britain chose not to acquire Sarawak and James decided to fulfil his aims without formal colonial support. This was an unusual situation—James ruled as a Malay regent,<sup>8</sup> and his *kerajaan* (Malay government) lasted until WW2. While it introduced modern systems, it also governed as an independent Malay state whose Rajah happened to be ethnically British. It was undeniably under the shadow of British colonialism, but careful and deliberate negotiations and collaborations with colonial agents and indigenous and migrant groups were necessary for governance and expansion. This resulted in the government employing processes which hybridised modern and vernacular approaches to rule and produce its architecture, although period historiographies privilege the James Brooke's more conventional modernising and civilising mission over his ability to indigenise his approach.<sup>9</sup> Despite local collaborations, the government modelled the late nineteenth century architecture of the capital on metropolitan examples.<sup>10</sup> Like neighbouring colonial jurisdictions, it aimed for the maintenance of hygienic uniformity in its architecture's appearance.<sup>11</sup>

The government's fort network in its expansion areas can be seen in the same light. The forts built in Sarawak's first expansion area from 1849 contrasted with local Malay and Iban examples, with modern elements such as strip windows, protective lattices and lookout towers.<sup>12</sup> While conceived as

8 John Walker, *Power and Prowess: The Origins of Brooke Kingship in Sarawak*. (Honolulu: University of Hawaii Press, 2002), 67.

9 For example, see Baring-Gould and Bampfylde, *History of Sarawak*.

10 A. B. Ward, *Rajah's Servant*. (Ithaca, N.Y.: Southeast Asia Program, Dept. of Asian Studies, Cornell University, 1966), 16.

11 Steven Runciman, *The White Rajahs: A History of Sarawak from 1841-1946*. (Cambridge: Cambridge University Press, 1960), 205.

12 Ting, *Precarious Power, Forts and Outstations*, 199.

Figure 1. Photo of the Bintulu Fort, Bintulu, Sarawak, 1862. Reproduced by permission from Anthony Richards, "Photographs," *A.J.N. Richards Collection*, (Kuching: Tun Jugah Foundation, 1964).



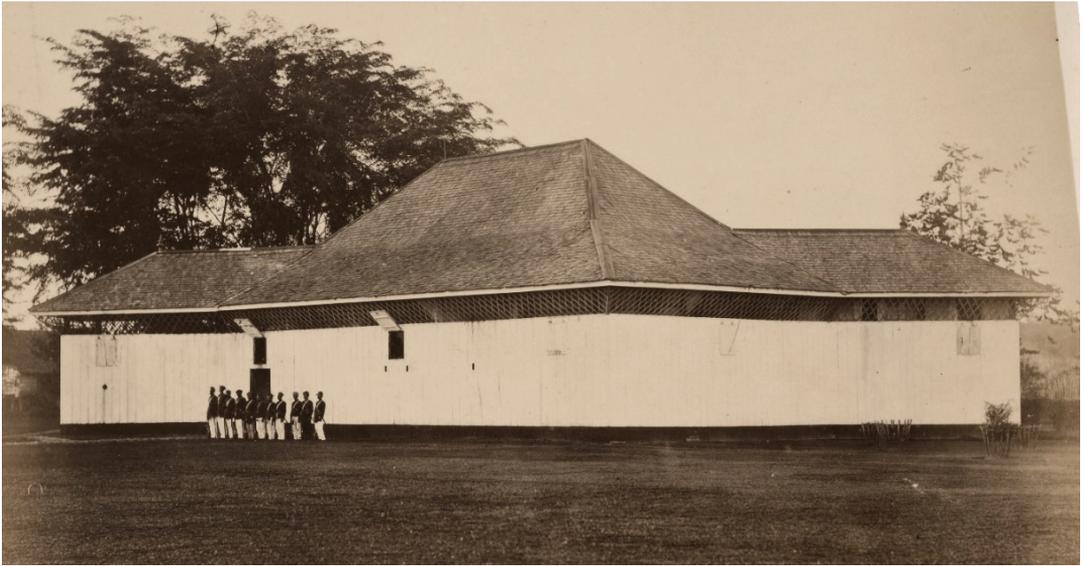


Figure 2. Photo of the Sibul Fort, Sibul, Sarawak, 1862. Reproduced by permission from Alexander Hill Gray, "Photographs," (Lancashire: Stonyhurst College, 1875).

defensive architecture they also housed modern institutions such as legal courts, dispensaries and agricultural stations. They were later whitewashed, further reinforcing their modernity. The forts established during the state's 1861 expansion introduced further modern approaches. A standardised design, they were whitewashed, two-storey buildings with continuous strip windows and lattices along the first floor perimeters and the ground floors were walled in. They housed modern governance of vernacular (indigenous and regional migrant) groups. These characteristics contrasted with indigenous architecture, suggesting modern approaches to design, function and implementation. The primary structural timber frames of the Bintulu, Mukah (fig. 1) and Sibul forts (fig. 2) were prefabricated and transported to site for erection. A fourth Bintulu Type fort was prefabricated and established at Baleh in 1875, which was later disassembled, transported downriver to Kapit (fig. 3) and re-erected there, where it still stands.<sup>13</sup> These prefabricated forts were preceded by temporary forts erected by the government's collaborators, for example in Bintulu and Mukah in 1861,<sup>14</sup> or by a government boat providing security during the fort's construction, in the case of Baleh.<sup>15</sup>

## Prefabrication

In terms of early Australasian colonialism, prefabrication was a modern idea to address contemporary problems. Arthur Philip brought a prefabricated and disassembled house of British manufacture with him on the first fleet to settle New

13 Baring-Gould and Bampfylde, *History of Sarawak*, 324.

14 Owen Rutter, ed., *Rajah Brooke & Baroness Burdett Coutts: Consisting of the Letters from Sir James Brooke, First White Rajah of Sarawak, to Miss Angela Burdett Coutts.* (London: Hutchinson, 1935), 107.

15 Robert Pringle, *Rajahs and Rebels: The Ibans of Sarawak under Brooke Rule, 1841-1941* (Ithaca, N.Y.: Cornell University Press, 1970), 255.

South Wales, Australia, in 1788 to address the lack of familiar labour, materials and dwellings.<sup>16</sup> Prefabrication allowed for quick establishment in new locations. In the early nineteenth century, prefabricated disassembled houses of standard designs manufactured by British companies such as H. Manning were being imported into the early colonial settlements of Sydney, Perth and Adelaide.<sup>17</sup> In the 1830s, the colonial manufacture of prefabricated buildings began, to reduce labour and material costs and shipping distances. For example, ‘Singapore Cottages’ were prefabricated in Singapore for sale in Hong Kong and Australia.<sup>18</sup> Prefabrication is often conflated with modernity as it was the triumph of modern technology and commerce over the tyranny of distance and perceived lack of skilled local labour.

However, prefabrication could rely heavily on vernacular approaches. While Manning’s prefabricated cottages were specifically designed to be quickly and easily erected on arrival at remote locations by untrained people, many of the early prefabricated buildings manufactured in Britain were heavily based on established vernacular traditions. As Miles Lewis has noted, “Traditional [British] timber framing ... was well adapted to prefabrication”<sup>19</sup> as they relied on mortise and tenon joinery that could be erected at the place of manufacture to test the connections and dismantled without damaging the primary carpentry joints. The businesses that manufactured Singapore

16 Philip Cox, John Freeland, and Wesley Stacey, *Rude Timber Buildings in Australia* (London: Thames and Hudson, 1969), 16.

17 Gilbert Herbert, “The Portable Colonial Cottage”, *Journal of the Society of Architectural Historians* 31, no. 4 (1972): 261, 267 & 269.

18 Miles Lewis, “The Asian Trade in Portable Buildings”, *Fabrications: The Journal of the SAHANZ* 4 (1993): 33-34.

19 Lewis, “The Diagnosis of Prefabricated Buildings.” *Australian Journal of Historical Archaeology* 3 (1985): 58.

Figure 3. Photo of the Kapit fort. (Photography by Ho, Ah Chon. “Black and White Negatives.” *The Ho Ah Chon Collection* (Kuching: Pustaka Negeri Sarawak, 2010.))



Cottages were established by Europeans with access to pan-colonial commercial networks. However, the vernacular joinery and carpentry employed for these buildings is evidence of the involvement of Malay and Chinese carpenters.<sup>20</sup> At that time, Singapore was a hub for regional labour flows, sojourners from China and insular Southeast Asia gathered there for employment or to learn of other areas where labour was required.

The main difference between industrial manufacture and vernacular or traditional systems is the hand-made nature of connections. To achieve tight fitting joinery in vernacular carpentry, connections at each location were considered individually, were unique and specific to that location and members of the same type could not be interchanged to other locations.<sup>21</sup> H. Manning's products were modular and mechanically mass-produced to consistent and exacting tolerances and dimensions so that standardised components such as the posts and wall panels did not rely on specific joinery locations to maintain a consistent and reliable fit.<sup>22</sup>

## The Bintulu Type

The prefabrication of the Bintulu fort relied on vernacular carpentry traditions. It was part of Sarawak's second expansion, when the government acquired by treaty the area between the lower Rejang River and Kidurong point from the Brunei Sultanate in 1861 after a short siege and occupation.<sup>23</sup> Official acquisition saw local collaborators in Bintulu, Mukah and Sibuk to support the establishment of government infrastructure but those settlements lacked construction approaches familiar to the government. Because resources such as Sarawak ironwood, *belian* (*eusideroxylon zwageri*), and skilled carpenters familiar to the government were both available in Kuching, the Bintulu fort's primary structural frame was fabricated in Sarawak, before being transported to Bintulu for erection.<sup>24</sup> Migrant Chinese carpenters were active in Kuching from 1845, where they were responsible for fabricating the *belian* weatherboards to replace thatch walls in the settlement.<sup>25</sup> At that time, Malay carpenters were mainly involved in boat-building,<sup>26</sup> but were also involved as construction labour. Although the 1849 Anglican Mission House's carpentry in Kuching was European, Chinese carpenters and Malay labourers constructed the building.<sup>27</sup> The British missionaries Francis and Harriette McDougall brought carpentry tools with them, intending to teach local carpenters to make arches and mouldings for the mission's buildings under their German carpenter, Stahl.<sup>28</sup> European carpentry approaches

20 John Ting, "Who Built Fort Alice? An Analysis of Subaltern Involvement in Nineteenth Century Institutional Architecture in Sarawak", *Gold. The Proceedings of the 33rd Annual Conference of the Society of Architectural Historians Australia & New Zealand*, ed., P. Phillip and A. Brennan (Melbourne: SAHANZ, 2016): 684-86.

21 Ting, *Precarious Power, Forts and Outstations*, 202.

22 Lewis, "Diagnosis of Prefabricated Buildings," 59.

23 Runciman, *White Rajahs*, 146.

24 Brooke, John Brooke Brooke Letters, ff 435-43.

25 Hugh Low, *Sarawak: Notes During a Residence in That Country with H.H. The Rajah Brooke*, (Singapore; Oxford: Oxford University Press, 1848/1988), 117.

26 Low, *Sarawak*, 154.

27 Harriette McDougall, *Sketches of Our Life at Sarawak*, (London: Society for Promoting Christian Knowledge, 1882), 24.

28 McDougall, *Sketches of Our Life*, 24.

were not widely adopted, however, with the government choosing to instead employ the Chinese and Malay carpenters and labourers to construct its buildings.

The construction of the Bintulu fort's structural frame in Kuching began with the procuring of *belian* timber for fabricating the frame's components. Due to the complexity of the structure's construction system, it was fabricated in Kuching where, as outlined above, there was available skilled and unskilled labour in addition to materials. At that time, *belian* was sourced from upriver groups close by and brought down to Kuching, as it did not grow in the lowlands geography of the capital. The hard-wearing nature of this timber and its resistance to rotting and termites had established its desirability with indigenous groups for building their upriver longhouses, and it became popular with Kuching's officials and vernacular groups. Rough timber sections were split with steel wedges where trees were felled and shipped to Kuching where they were, with adzes, hewn into smooth and square members of nominally consistent dimensions, from which the forts' primary vertical and horizontal members were fabricated. The connections of these elements followed standard rules but were bespoke and not modular. As with other pre-modern prefabricated systems, the frame was likely test-erected in Kuching's government timber yard, when the connections of the various components could be verified for fit and strength as a system. This was done to minimise any on-site adjustments that might be required, as familiar tradesmen were unavailable in the state's new territories. Each connection's components were uniquely coded in-situ before disassembly, transport to Bintulu and re-erected in the same arrangement at the remote site. This process contrasted with industrially produced prefabricated buildings, which did not require test-erection before being transported to the colonies.

The consistency of industrial manufacture and considered design allowed standard instructions to be given to easily erect Manning houses,<sup>29</sup> so the manufacturer did not need to send trained people to supervise the assembly of those buildings. This is not the case with the Singapore Cottages. When six Cottages were imported into Melbourne in 1851, they were accompanied by Louis Ah Mouy, a Chinese carpenter from Singapore familiar with the construction and marked components for assembly.<sup>30</sup> This suggests that the system was more complex than the Manning houses, probably due to each connection being unique to specific members, and the coding of members being in an unfamiliar language. It also suggests that there were no

29 Lewis, "Diagnosis of Prefabricated Buildings," 59-60.

30 Lewis, "Asian Trade in Portable Buildings," 35; Ching Fatt Yong, "Ah Mouy, Louis (1826-1918)," *Australian Dictionary of Biography* 3, 1851-1890, ed. G Serle, B Nairn and R Ward, (Melbourne: Melbourne University Press, 1969),

available tradesmen in Melbourne familiar with the carpentry traditions that produced the Cottages. In the case of the Bintulu fort, Francis MacDougall reported that two Chinese carpenters accompanied the disassembled frame on a government steamer “Rainbow” to Bintulu to “build the fort”.<sup>31</sup> This suggests that, despite the coded members, the construction of the frame was of a level of complexity that required skilled tradesmen involved in its original fabrication to erect it, and that Chinese carpenters outside of Kuching were rare at that time. The spoken *lingua franca* for Kuching’s Malay, Chinese and European inhabitants in the late 1840s was Sarawak Malay.<sup>32</sup> There was, however, no common written form when the Bintulu fort’s frame was fabricated, with Malays using *jawi* (Arabic script), Chinese using Chinese characters and Europeans using Romanised English. The fort’s components’ were coded in Chinese, the language of the installing carpenters.

31 McDougall, *Sketches of Our Life*, 206.

32 McDougall, *Sketches of Our Life*, 24.

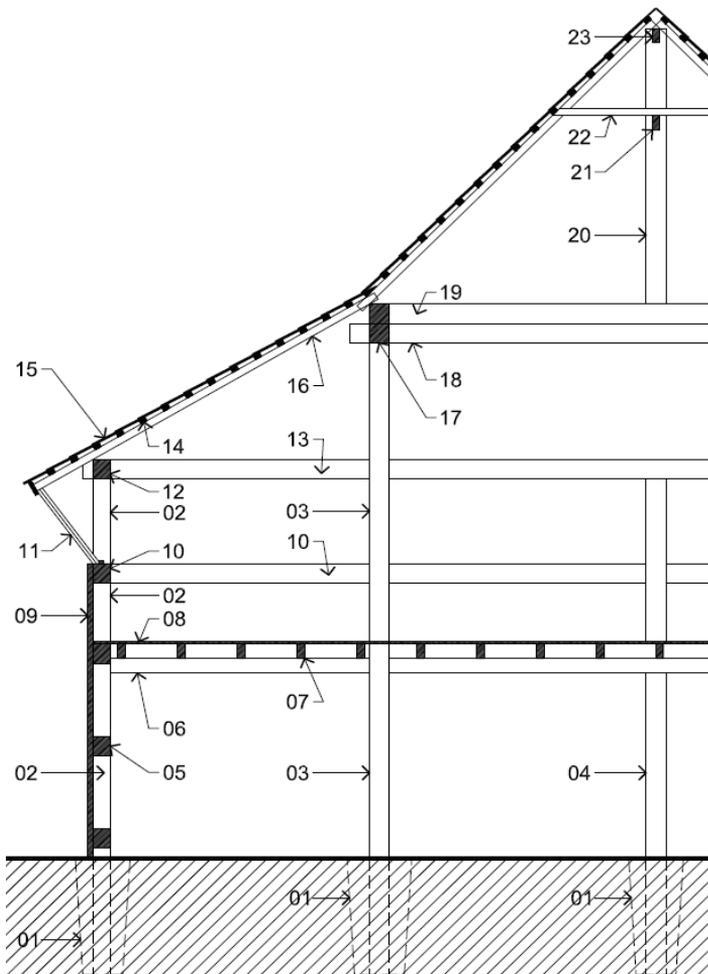


Figure 4. Partial and indicative section of the Bintulu Type fort (not to scale). (Drawing by author.)

- 01 Post Hole. 02 Perimeter Post. 03 Main Post. 04 Stump. 05 Fixing Rail for Cladding. 06 Bearer. 07 Floor Joist. 08 Floorboards. 09 Cladding Boards. 10 Sill Rail. 11 Defensive Lattice. 12 Top Plate. 13 Top Plate. 14 Batten. 15 Timber Shingles. 16 Rafter. 17 Beam. 18. First Cross beam. 19 Intermediate Cross Beam. 20 King Post. 21 Intermediate Beam. 22 Collar Tie. 23. Ridge Beam

Evidence from the last extant Bintulu Type fort at Kapit show that the design of this type was similar to most permanent government forts. In addition to the common characteristics outlined above, the forts were two-storey structures with the main inhabited level being the first floor. Except for the first outstation fort at Skrang (later moved to Simmanggang) which originally had an open undercroft, ground floors were walled in for defence and storage but not used for habitable purposes (fig. 4). Like contemporaneous longhouses, early forts had retractable, external access ladders to access the first floor, but the Bintulu Type had a European style internal stair connecting the two floors. Forts had a large, rectangular floor plate, often with extended elements such as lookouts at some corners and occasionally entry elements in the middle of the front of the building, which addressed the river. The Lingga and Skrang forts of the first expansion had attached wings to the rear of the main fort building. With a main floor plate of 329m<sup>2</sup>, the Bintulu Type was the second largest fort type ever built (fig. 5), with only the unique design of the second Marudi fort being larger with a main floor plate of 359m<sup>2</sup>. In the context of nineteenth century Sarawak, the bigger forts were large, singular buildings, much larger than detached Malay buildings. Longhouses were considerably longer, but they were also constructed as a collection of independently owned and implemented connected sections, rather than the forts' singular structure of robust construction. While indigenous detached houses and longhouses were generally elevated off the ground to a defensible height, the heights between the first floors and roof structure were modest, perhaps 2m. In contrast, the forts had generous clearances between their first floors and the underside of the roof structure, measuring 3.6m in the Bintulu Type.

Most buildings in Northwest Borneo at that time were constructed of timber and other plant-based materials, with cladding only to the exterior of the structure. Unlike rendered masonry construction, the lack of internal wall lining allows structural elements to be visible. While they did not originally have ceilings, one was later installed at the Kapit fort. However, the wall and floor structure remain visible internally, which has facilitated the investigation of the building's structure. At Kapit, the primary structure's geometry is driven by the double-pitched hip roof, with a central roof at about 45°, surrounded by a 30° lower roof that skirts around the base of the central roof. The steep pitches help shed high volumes of tropical rain and to allow a space for hot air to rise into, but a shallower pitch was required for headroom at the perimeter of the building.

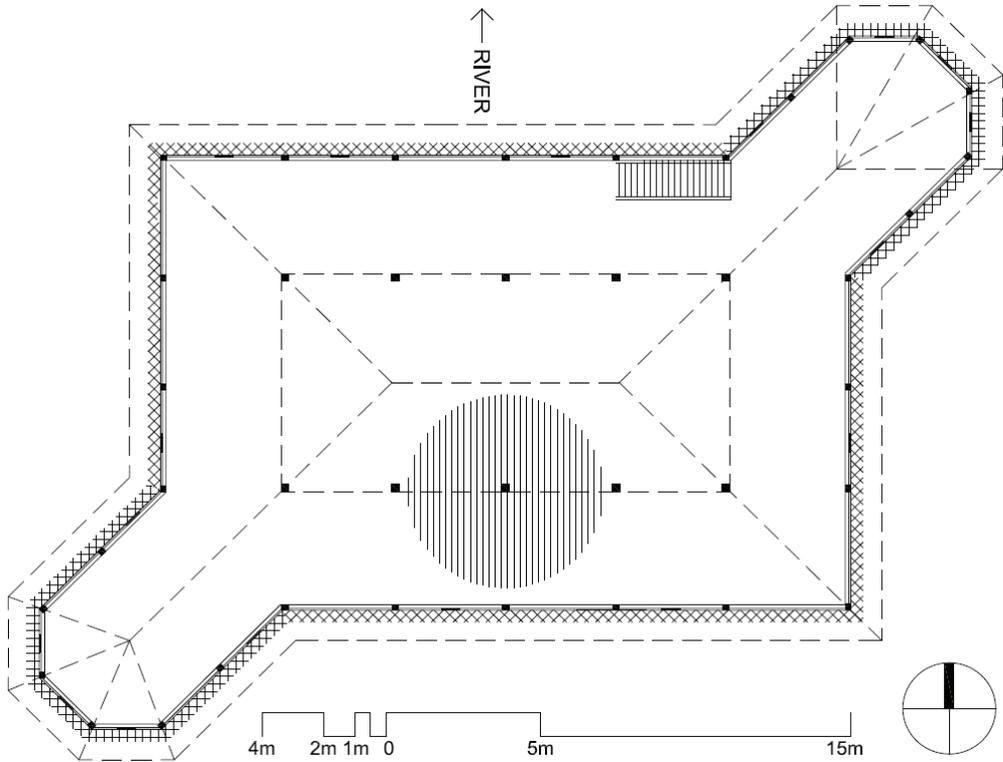


Figure 5. First Floor Plan of the Bintulu Type fort, shown without internal partitions. (Drawing by author.)

33 Miles Lewis, Personal Communications with the author, the University of Melauburne, May 8, 2009.

The central roof was supported by two rows of large main posts, connected longitudinally by beams (fig. 4). One beam spanned between two posts in the same row and was connected to the next by a lightning scarf at the top of a post. Scarf connections were commonly used in Europe and elsewhere in Asia, but in Southeast Asia lightning scarfs are associated with Chinese joinery methods.<sup>33</sup> For Chinese carpenters in Sarawak, the name of this scarf translates as a “hand-in-hand connection”. The scarf joint was mortised onto a tenon at the top of each post. Laterally, cross-beams were placed over the longitudinal beams, mortised into the same post tenons that extended up past the beams. At the first and last main posts, the beams and cross-beams crossed and were rebated into each other, with the post’s tenon going through both. In the Kapit fort, the longitudinal and first and last cross beams are visible as the ceiling was installed between these members, under the other cross beams. The ceiling was likely installed after WW2 and now obscures the roof structure. In the Bintulu Type forts, king posts with tenons were mortised into the second to penultimate cross-beams. The king posts had mortises about two thirds along their height for intermediate beams and at the top for ridge beams. The use of an intermediate roof beam (known in Malay as an *alang muda*

*tunjuk langit*) is a Malay carpentry practice regionally,<sup>34</sup> and indicates the involvement of Malay carpenters in fabricating the primary structure. At that time, there was an influx of Malays who were coming to Sarawak from elsewhere in Southeast Asia. In Sarawak, the intermediate roof beam was used to support collar ties that braced each pair of opposing rafters that met at the ridge. The significance of the visibility and recognisability of these construction details is that, in the context of nineteenth century colonial Southeast Asia, the government remarkably chose not to obscure the contribution of vernacular carpenters in the architecture of a permanent institutional building.

Vernacular approaches are also visible around the perimeter of the building. The skirting roof was supported on smaller perimeter posts at the edge of the building, connected by top plates, each spanning one bay and connected at the tops of posts with lightning scarfs which were mortised onto tenons at the tops of perimeter posts. At the corners, top plates crossed and extended past the joint, and were rebated into each other, and mortised onto a tenon at the top of the corner post. Crossed top plates are another joinery detail associated with Chinese carpenters.<sup>35</sup> Below the top plates were a row of sills for the strip window that ran around the building. The sills had tenons at each end, mortised into the perimeter posts with timber pegs locked the two in place. There were three horizontal rails between the sill and the ground, for structural rigidity and fixing points for the cladding. Bearers running across the building were mortised into the perimeter and main posts, as well as stumps located between main post rows. Following indigenous practices in Northwest Borneo, posts and stumps were piles, visibly set in post holes in the ground, rather than sitting on separate footings above the ground.

While the Bintulu 'Type forts' primary structure was fabricated in Kuching and erected by carpenters from the capital, the secondary structure and cladding required less precision and was locally sourced locally. The secondary structure included timber rafters, collar ties, battens and floor joists, all visible from inside the building (fig. 4). With no carpenters familiar to the government in Bintulu, local collaborators provided not only construction labour, but also fabricated the secondary structure and cladding. The roof was clad in thatch before timber shingles and battens could be fabricated, the external walls with 50mm thick vertical timber panelling nailed to the sill and rails, a timber lattice was attached to the eaves fascia and the sill, along the strip window, and the first floor had nominally 25mm timber floorboards laid across the joists. The 10mm timber shingles

34 Jee Yuan Lim, *The Malay House—Rediscovering Malaysia's Indigenous Shelter System* (Penang: Institute Masyarakat, 1987),

35 Lewis, Personal Communications, May 8, 2009.

were cut from *belian* blocks, likely to have been imported from other areas in the state where this was used by indigenous groups, such as by Ibans on the Undup tributary of the Lupar River.<sup>36</sup> These shingles were widely adopted by the government for its buildings across the state, perhaps as a symbol of its collaboration with certain Iban groups. Government buildings in Kuching also used these *belian* shingles despite the availability of imported terra cotta roof tiles.

<sup>36</sup> Henry Ling Roth, *The Natives of Sarawak and British North Borneo 2*, (London: Truslove and Hanson, 1896. Reprint, University of Malaya press, 1980), 12.

The government also leveraged their relationship with their local collaborators to provide construction labour to build the fort. The dimensions and weight of the largest framing components meant that the carpenters from Kuching were unable to do it alone. They acted as the foremen under the direction of European and Malay government officers, who procured local labourers. Once the Rajah of Sarawak gained jurisdiction over Bintulu, his position allowed him (and his agents) to acquire labour as tribute. In exchange, the workers were offered the protection of their new rulers and paid in rice or Sarawak dollars. The largest framing members in the fort were the cross-beams and the main posts. The cross beams were approximately 250 x 250mm sections, and 7.5m long, and the main posts were of similar dimensions, with the length depending on how deep the post holes were. As *belian* has a specific density of 1050kg/m<sup>3</sup>, the cross beams and main posts could weigh some 500kg.<sup>37</sup> If each worker could consistently carry 40kg each, a gang of at least thirteen people would be required to manoeuvre each of those members off the steamer and carry them up to the site, get posts upright with the help of ropes and hoist the beams to the top of the posts. If two gangs of workers were active on site, there may have been some 30 people working on the project. Local architectural traditions helped this process – the tall houses built by the local indigenous Melanau government collaborators were said to be taller than the forts and were quite large structures.

<sup>37</sup> *Handbook of Some Sarawak Timbers*. (Kuching: Sarawak Forests Department, 1999), 9.

## Conclusion

This paper has sought to complicate the traditional differences between vernacular and modern architecture. The example of eighteenth and nineteenth century prefabricated buildings transported to the colonies has demonstrated that this process, while it began to engage industrialised manufacturing processes, was intertwined with European vernacular construction. Through the Bintulu Type fort, it has shown that the trope of vernacular architecture as an unchanging and unresponsive

to modernity is problematic. While able to be considered as products of modernity, the forts of the Sarawak government can also be seen as the result of the dynamic interaction between vernacular and modern approaches, where vernacular approaches and labour have produced significant parts of the architecture. The Kapit fort, as the only extant example of the Bintulu Type, is a significant building as it is a constructed result of the Sarawak government's hybrid processes, from which the involvement of vernacular traditions can be read.