

Construction Techniques of Locally Crafted Prefabricated Houses of “Ghorer Hat” in Munshiganj

Humayra Anan^{1, 2*}

¹Department of Architecture, DUET, Gazipur, Bangladesh (anan0302@duet.ac.bd)

²Department of Architecture, BUET, Bangladesh

Abstract

To coexist with the scourge of recurring river erosion in Bangladesh, local masons of Munshiganj devised an indigenous solution: prefabricated and portable wooden houses which can be dismantled and relocated during disasters. These handcrafted dwellings are bought and sold as products in local marketplaces known as “Ghorer Hat” or “House Market”. The houses of “Ghorer Hat” are adaptable to the ever-changing landscape of the erosion-affected areas. Due to demand, the local industry of prefabricated houses has bloomed in different parts of Munshiganj in the last three decades. This research aimed to investigate and document the existing construction process and techniques involved in producing these prefabricated houses. The researcher used qualitative research methodologies and adopted participatory strategies to achieve the research objectives. The inquiry began by collecting secondary data from existing literature. The investigation continued in the form of a physical survey in the prominent Ghorer Hats of Louhajang, Munshiganj. The data collection method included observation, transect walk, semi-structured interview, focus group discussion, hands-on workshop, architectural sketching, audio-video recording and photograph. The analysis of the chosen data resulted in the identification of production stages and complete documentation of the whole building process. In the final stage, the researcher located the need for innovation in the existing system and recommended improvements based on successful existing practices that can be implemented through a collaboration among the architect, the producers (local businessmen), the builders (local masons) & the users (local people).

Keywords: *River Erosion; Prefabricated; Portable; Vernacular Construction; Participatory Approach*

1 Introduction

Munshiganj district is bounded on the south by the Padma River, east by the Meghna River and north by the Dhaleshwari River (Bangladesh National Portal, 2023). Southern and eastern parts of the Munshiganj district often fall victim to river erosion caused by the mighty Padma and the Meghna (Wikimapia, 2012). All the rivers running through this district make it susceptible to seasonal flooding. In this ever-changing landscape, people are routinely stripped of their belongings and become socioeconomically vulnerable (Ophra et al., 2018). Local people and masons have developed unique house forms to cope with this continuous struggle. They raised their houses above flood level using wooden stilts and designed all house parts to be knock-down and portable, allowing relocation during river erosion (BDnews24, 2023). As the years progressed, the dwelling forms began to evolve. Local masons and artisans started incorporating modern tools and machinery in the production process. The houses used to be entirely made of wood using manual tools. The columns, walls, floors, doors, windows, and even roofs were made of different types of locally available wood. Introduction of corrugated sheets in the local markets resulted in modifications in roofing materials. To meet the demands of people from different economic strata and to make the construction process faster, local masons replaced the wooden infill of wall panel structures with tins. Less use of wood made these houses affordable, and demand spiked among local people. Meeting these housing demands presented a potential economic opportunity for local businessmen. Soon after, they began mass-producing and selling these houses in a local marketplace.

The marketplaces where the traditional wooden houses of Munshiganj are bought and sold are locally known as “Ghorer Hat” (Hasan, 2017). In front of these house markets, the “House for Sale” sign greets the visitors and rows of empty houses are displayed. These houses are currently made with prefabricated timber structures, timber wall frames with plain white plain tin sheet infill and multiple chala corrugated tin roofs (Anan, 2020).

Local businessmen own or rent an open space with enough area to produce and display these wooden houses. Local masons craft different parts of these houses in the market compound and assemble them to showcase the completed homes as ready-to-move-in houses. A buyer can come to this place, choose from displayed samples or order a custom size. After that, the chosen house is flat-packed and delivered to the buyer's homestead. The builders reassemble the house on site within a few days.

Prefabricated houses of "Ghorer Hat" in Munshiganj enable people to achieve a sense of security where being displaced is the only truth of life (Anan, 2020). This local industry has developed from years of dialogue between manufacturers, customers and the site. The distinctive characteristics, such as portability, knock-down, etc., are not introduced by outsiders but are invented and improved by local people in the face of environmental threats. The review of relevant literature revealed that a thorough investigation of this unique local housing provision is yet to be conducted. This paper aspires to address this research gap.

House markets of Munshiganj are selected as the setting for this research to learn about the context and local hazard-resistant strategies developed in response. The author believes that slight modifications and application of new approaches can significantly impact and sustain local practices. This research aims to investigate and document the existing construction process and techniques involved in producing the prefabricated houses of "Ghorer hat" in Munshiganj. The objective of this paper is to understand the production process of these prefab dwellings, identify the stages of construction and explore scopes for improvement. This local industry uses indigenous techniques and materials, creating employment for local people and contributing hugely to rural housing provision. This study attempts to start a discussion regarding this local housing provision and to act as a resource for future research.

In the following section, the author will introduce the study technique applied in this research. This section narrate the methodologies employed and tactics taken to attain the goal of this research. After that, the author will provide a brief overview of the field survey findings and data analysis procedure. The following section will review the author's recommendation based on the analysed data. Finally, the closing remarks will address how to implement the ideas and the scope of future studies.

2 Methodology

The investigation and documentation of the current production process and construction techniques of Ghorer Hat prefab houses required extensive consultation with the local masons, businessmen and end users. To fulfil the goal of this research, the researcher followed qualitative methodology and adopted participatory strategies. The initial stage of this research entailed secondary data collection through a review of relevant literature, including books, peer-reviewed journals, conference proceedings, published news articles and website articles. The search for published journal articles and conference proceedings from reputed sources revealed a significant research gap in this context. The author extracted information about the location of "Ghorer Hat", available house sizes, use of material and labour costs from the reviewed news articles. However, the lack of adequate data highlighted the necessity of primary data collection. For this purpose, the researcher surveyed house markets in Louhajang upazila of Munshiganj through multiple field surveys. The convenience sampling method was used, and the markets were selected to include a wide range of annual production, sale, size, and experiences. The data collection method included observation, transect walk, semi-structured interviews, focus group discussion, hands-on workshop, audio and video recording, photography, architectural mapping, and sketching. Participatory tactics used in the documentation process aided in developing an understanding between the researcher/architect and the local people/artisans, allowing them to communicate their experiences and concerns. The researcher transcribed all the responses and used narrative analysis to code the collected data. Analysis of the sorted data revealed the layout and activities of house markets, components used in construction, production steps, construction techniques, and scopes for improvement. In the final stage, the researcher located the need for innovation in the present system and recommended simple modifications that can be implemented through stakeholder collaboration.

3 "Ghorer Hat" (House Market) Survey

The investigation and documentation of the current production process and construction techniques of Ghorer Hat prefab houses required extensive consultation with the local masons, businessmen and end users. The prefabricated houses of "Ghorer hat" are responsive to the ever-changing landscape of erosion-affected areas in Munshiganj. Because of its portable nature, Munshiganj residents choose to acquire these dwellings rather than invest in more permanent ones. During a natural disaster, these dwellings can be dismantled in a day and

reconstructed in a safer location. On the other hand, buildings composed of brick and concrete are not moveable and are lost permanently. These prefab dwellings offer progress and a way to preserve identity. To meet the growing demands, the local industry of prefabricated houses has flourished in different regions of Munshiganj. Below is a list of market sites located in different Upazilas of Munshiganj

- Munshiganj Sadar Upazila: Katakali, Hatimara, Bojrojogini
- Tongibari Upazila: Paikpara, Bettka
- Sirajdikhan Upazila: Malkhanagar, Kuchiamora
- Louhajang Upazila: Kathpotti, Ghordour, Konkosar (Masud, 2016).

In addition to the marketplaces in these places, some families use the courtyard of their homesteads to construct two to three wooden dwellings at once for sale. For this study, house markets of the Louhajang area were selected and studied as this area suffers from severe river erosion and hosts most of the significant house markets. The study conducted in these markets assisted in learning about the process of building these houses, identification of different parts, vernacular construction techniques, utilisation of production space, method of delivery, and so on. The results of the field surveys are presented in the following subsections.

3.1 Layout and Activities of a Typical “Ghorer Hat”

House markets are usually located on the sides of a primary road, making them conveniently accessible to locals. At the entryway to these marketplaces, there is generally a handwritten "House for Sale" sign with the contact information of the business owners. Visitors can see the local masons hard at work upon entering the markets. The entire market compound is dotted with half or fully-constructed prefab houses. The researcher observed that a group of masons erected the structures of the house while another group produced different components. Several skill sets are required to construct the whole house. That is why a group of diversely skilled labourers are involved. These marketplaces also provide a complete picture of the lifecycle of these houses. One can observe components being constructed, new houses being built and displayed, parts of old houses parts being thrifted, houses being disassembled for delivery, and vehicles being packed with all the house parts for delivery to be reassembled on site again. The layout of each marketplace is distinct and designed to provide an optimum user experience. People can walk through the displayed houses and experience their preferred homes beforehand. The seamless operation of the business requires a vast open area. Local entrepreneurs typically rent or lease available land. Another benefit of this industry is that these marketplaces do not need additional structures. After adding the roof to a structure, builders can move inside and continue their work.

3.2 Identification of Components

The prefabricated houses have several parts. The parts can be categorized as structure, floor, wall, roof, door, window and stairs. The structure comprises C.C. components (10 sq cm square section) with variable lengths. They are locally known as “Tolkhuti” and are used under wooden columns as foundations. These components prevent rotting and protect the primary columns. The main columns are made of “Lohakath”, an extremely resilient and sturdy wood. These wooden columns are 9 sq cm sections. Wooden beams are used to connect the columns. They are typically 5cm*9cm wood sections. The wooden floorings are usually processed from local trees (Mahogany, Shal, Shegun, Mango, Jackfruit etc.). These components are attached with nuts and bolts, allowing for easy removal. The wall panels include several parts. The basic structure is a wood framework with white tin sheets used as filler. The wall panels have variable lengths and widths corresponding to house dimensions. These houses usually have a “Chouchala” roof (Hipped roof). These roofs are durable and strong wind resistant. They have wooden skeletons and corrugated sheets on top. All parts of the roofs are detachable. Wood is also used for the doors, windows and staircases. It is observed that not all the house markets build all of their components within their compound. Some shops sell structural components, doors, windows and other parts. The site survey revealed that business owners outsource building components when market area is limited.

3.3 Steps of Construction

The production of multiple houses runs parallelly in the large house markets. The production may not always repeat the same steps, but they can be summarized as having the following steps.

Raw material processing: Different wood sections are extracted from “Golgach” (tree trunk). 9 sq cm section for columns, 5 by 9 cm sections for beams and wall frames, and smaller sections for decorative parts are extracted.

Frame Production: Wood sections are joined using Tenon-Mortice Joint. For extra stability, epoxy glue and nails are used.

Frame infill: Plain sheet tin is cut from its coil and fixed on the top of the frame using nails. Decorative bits are fixed on the sides to prevent water seepage. These decorative bits used to be hand-crafted by local artisans in the past. However, currently, they are produced using CNC machines.

Wall: Frames that wrap the lower and upper-storey walls are built separately. It enables the builder to produce them simultaneously and speeds up the process.

Steps of Production: In the current process components needed for one house are produced parallelly and then assembled as shown in the diagram.

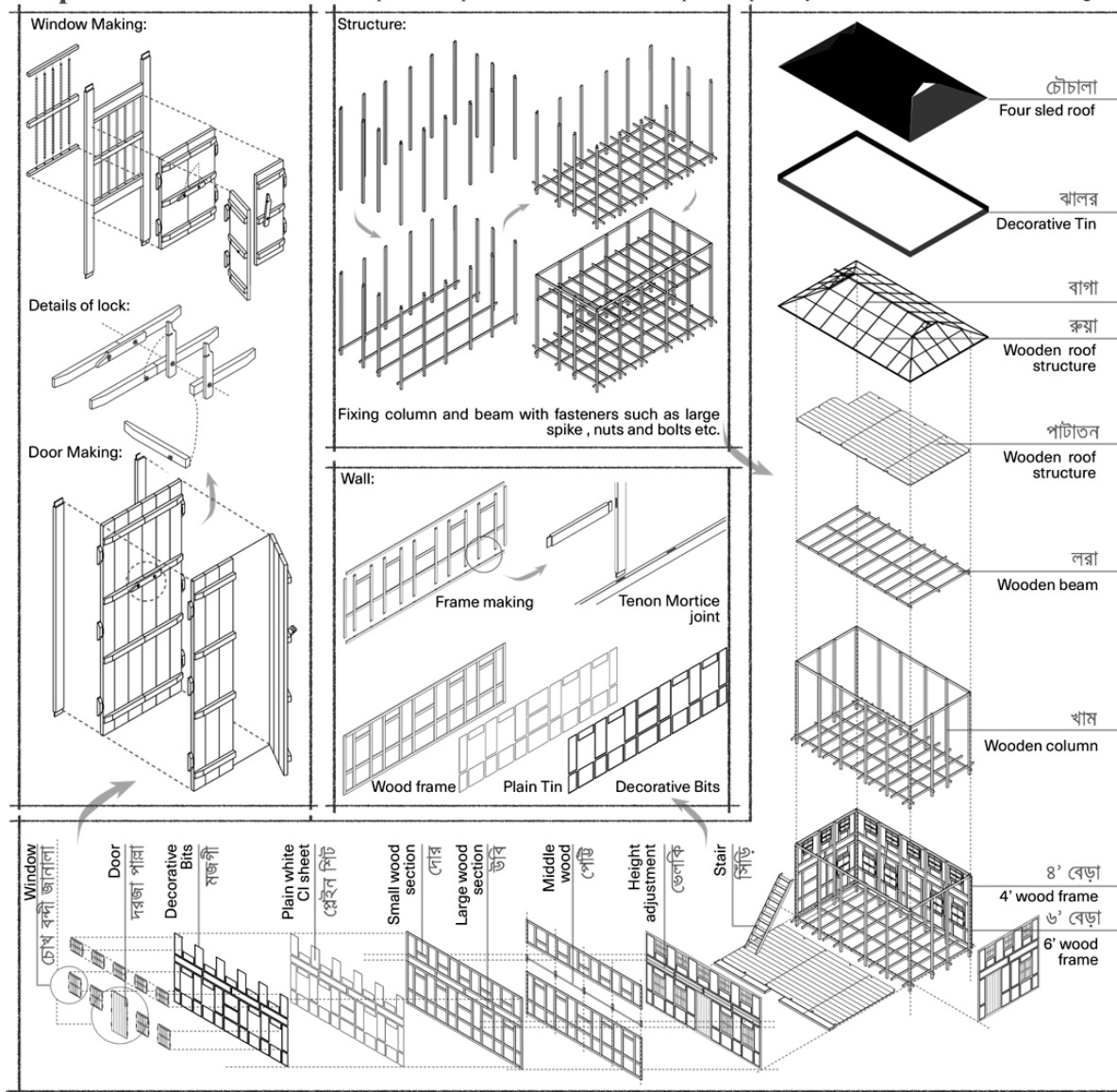


Figure 1. Steps of production and assembly process.

Structure: C.C. Foundations are placed approximately 1.2 meters apart. Square wood sections are placed on top of these and attached with nuts and bolts. These wooden sections work as columns. To form the flooring system, two layers of wooden beams placed perpendicularly are attached to the columns at 60 to 75 cm above ground level. The same structure is repeated at 2.4-3m height, forming the attic floor.

Fixing Elevations: After fixing the first storey wall frames in place, a wood piece measuring 30 to 45cm in length is placed above the frame on all four sides. Then the upper storey frames are fixed. In this 30 to 45cm gap, an extra tin sheet and decorative wooden bit is added. This is locally known as “Velki” (illusion) and gives an illusion of seamless wall panels.

Floor Plates: 30cm by 180-240 cm rectangular wood having 25-50cm depth are used as floorplates. These are fixed in place with nails to form the floors of the houses.

Roof: Each type of house has different and complex roof structures. Different parts of the roof frames are made separately using wood. Then they are pulled on the top using rope, and builders push the structure to form a precise angle. After fixing the form in place, tin is added.

Window and Door: Ready-made doors and windows are found in markets. They are bought or made in the “Ghorer hat” and fixed to the wall frames.

Adding Stair: Finally, a stair, which can also be found ready-made or built, is added to ensure vertical circulation. Steps are also added in front of the house.

The production process can be simplified as follows: gathering raw materials, processing the raw materials, producing parallel components, assembling the components, showcasing the product, delivering it to the buyer's location, and reassembling it on-site (Figure. 1).

4 Analysis

The researcher used the narrative analysis method to analyse the collected data. Through narrative analysis, a more thorough investigation into the housing markets of Munshiganj was conducted, revealing its effects on individuals and communities.

4.1 Analysis of Components

As the analysis of the building components unfolded, areas for improvement became apparent. It was discovered that the wooden beams and columns were often connected using spikes and nuts, resulting in unfortunate wood splitting. The lack of proper markings for nailing positions made the reassembly process challenging. Additionally, the wall frames proved to be too large to maneuver. Their considerable weight necessitated the joint effort of three to four individuals to move them, exhausting their strength. Using nails to fix the wall frames to the structure also presented risks of damage during disassembly. The floor panels, unfortunately, suffered from an excess of nails securing them to the flooring structure, impeding emergency disassembly efforts. The complexity of the roof structure added another layer of complication. Disassembling the substantial roof pieces proved to be a formidable task, often resulting in damage during relocation. Furthermore, the overuse of nails made it challenging to keep track of their placement throughout the disassembly process. Distressingly, local people shared their grievances, as they were compelled to purchase nails and replace damaged components after the relocation, creating additional financial burden.

4.2 Analysis of the Production Process

The existing production process is a unique and vibrant system. However, the system can be made more efficient with slight modifications. Currently, the method operates on a "house by house" rather than a more systematic "component by component" approach. The masons work on a contractual basis to complete a house, as in they build one house at a time. If the business owners can afford to hire multiple teams of masons, they can sponsor the construction of multiple homes. This process, while dynamic, posed challenges for standardization. For example, there is no price limit for a particular-sized product. The price may vary depending on the quality of the material used, the number of masons hired to complete the house, woodwork detailing, craftsmanship and so on. As a result, the user-seller relationship is not transparent. There is always a tendency for negotiation rather than focusing on the integrity of the structure and longevity of the product. Another problem is the lack of standard component dimensions. Each market relies on builders' intuitive sense of proportion, with most measurements taken by sight. The builders complained that their inputs are not adequately evaluated in most cases, and they are not fairly compensated. They shared that this type of patronage affected their creative process and created a detachment from their crafts. This unique local housing provision system requires a transformation that will foster transparency, fair compensation, and a renewed connection to the artistry of construction.

5 Recommendation

The prefabricated houses known as "Ghorer hat" in this region represent the cultural identity of the area. These houses are designed to adapt to the climate, withstand disasters, and prioritize environmental considerations, all while staying true to the local context. Enhancing this vernacular construction technique will result in multiple benefits, including strengthening community unity, boosting the local economy, and safeguarding traditional building expertise. Based on the analysis of gathered data, the author proposes the following suggestions to maintain these unique attributes and address identified challenges.

5.1 Recommendations for Components

- The production of "Ghorer Hat" houses should use standardized components to achieve efficiency. Standardized components have several advantages for scaling up this local housing provision. Manufacturing components in large quantities can reduce the cost per unit, making these houses more cost-effective than traditional construction methods.
- Additionally, using a standardized manufacturing process for components can minimize waste by optimizing material usage and recycling production leftovers. A standardized process also offers design flexibility, allowing for customization in terms of size, layout, and aesthetics to meet specific project requirements.

- Furthermore, the dwelling models can be designed to be expandable. With removable walls and the availability of standardized components in the housing market, people can purchase additional parts and expand their homes according to their needs.
- On the other hand, standardization of house prices will ensure standard labour costs. The masons will be able to receive the deserved amount for their skills. They will also benefit more in component production as it will help them to improve their skillset. Furthermore, construction process standardization will assist business owners in mitigating loss.

5.2 Recommendations for the Production Process

- The construction procedure should adopt the "component by component" method to improve efficiency.
- Currently, these industries require significant space for constructing and displaying houses. However, this process involves disassembling and reassembling the houses before users can occupy them, resulting in a loss of production time and compromising quality. An alternative approach is for markets to exhibit a variety of houses on their property while preserving the components necessary for building dwellings of different sizes. People can then select their homes by examining the displayed options, and the required parts for their chosen homes can be supplied to their location.
- This will reduce the time needed to erect the dwellings in the "Ghorer Hat" compound, enabling owners to operate their industries in smaller compounds with less capital.
- Another recommendation is to explore redesign possibilities for the component joineries to streamline the disassembly process. The focus should be on minimizing the use of joineries and components while ensuring the durability of the components for longevity and allowing for multiple relocations with minimal damage.

6 Conclusion

This study aimed to carefully document the construction process of the prefabricated houses known as "Ghorer Hat." The author aspired to capture the essence of this unique housing initiative by applying various participatory strategies. The focus of this study was to recommend improvements that can maintain the cultural identity cherished by the local people while also ensuring personal growth. These suggestions aim to foster a transparent relationship between the local industry responsible for producing the houses and the local people who will eventually call them home. The researcher firmly believes that for this local housing provision to thrive, key stakeholders, such as the architects, the owners of local industries, the skilled builders, and most importantly, the local community, need to join forces. By collaborating and pooling their collective wisdom, they can identify areas for improvement and generate fresh ideas for further development. Through collaboration, preservation, and growth, the landscape of local housing provision can transform for the better.

Acknowledgement

This paper is partially based on the B. Arch Thesis by the Author, supervised by Prof. Dr. Shayer Ghafur and Simita Roy, Department of Architecture, Bangladesh University of Engineering and Technology (BUET).

References

- Bangladesh National Portal (2023). Rivers of Munshiganj. [Online] Available: <https://www.munshiganj.gov.bd/>
- Wikimapia (2012). Munshiganj District Town. [Online] Available: <http://wikimapia.org/24390076/Munshiganj-Dist-Town>
- Ophra, S. J., Begum, S., Islam, R., and Islam, M. N. (2018). Assessment of bank erosion and channel shifting of Padma River in Bangladesh using RS and GIS techniques. *Spatial Information Research*. 26. 10.1007/s41324-018-0202-2.
- BDNews24. (2023). Climate-resilient homes in Bangladesh aim to put communities first. [Online] Available: <https://bdnews24.com/bangladesh/y30dc31tba>
- C. M. T. Hasan, "মুন্সীগঞ্জের ঘরের হাট!," *Bangla Tribune*, Apr. 28, 2017. [Online]. Available: <https://www.banglatribune.com/country/news/202115/মুন্সীগঞ্জের-ঘরের-হাট>
- H. Anan. (2020). Prefabricated Houses of "Ghorer Hat" in Munshiganj on KVDForum. [Online]. Available: <https://www.kvdforum.in/humayra-anan/>
- K. Masud, "ঘরের হাট," *Kaler Kantha*, Sep. 3, 2016. [Online]. Available: <https://kalerkantho.com/print-edition/oboshore/2016/09/03/401086>