TYPOLOGY OF THE FRAMEWORK SYSTEMS IN MINKA, JAPANESE VERNACULAR HOUSES

A methodological study on the extent of repetition of the core frame style and the correlation between the central and peripheral structures

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This paper aims to advance a systematic typology to explain the diversity and complexity of the framework of minka, or Japanese vernacular houses, by examining 18 distinctive local framework systems. First, it describes the framework and the plan of minka, and the arrangement of beams. Finally, a methodological typology is developed by determining the extent to which the core frame style is repeated, both crosswise and lengthwise, and by verifying the linkage between the central and peripheral structures.

Keywords: vernacular houses, framework, flying beam, core unit, central structure, peripheral structure

1. Difficulty in understanding the intricacies of vernacular timber-framed houses and the new approach of this paper

Many scholars have noted the spatial diversity and heterogeneity of timber-framed structures of Japanese vernacular houses, which are often called minka not only by Japanese native speakers but also by foreign researchers and enthusiasts as well. In spite of such attention, minka construction has not gained academic recognition as a specific, defined style in Japan.

Kazuo Shinohara repeatedly mentioned the essence of space in minka. He pointed out that minka comes closer to being a natural phenomenon rather than an artificial product because it is extremely difficult to make a definitive identification of the architectural grammar of the minka style. Recently, Kunihiro Ando proposed the new term “minka-zukuri” to be of equal ranking with conventional terms like “syoin-zukuri” and “sukiya-zukuri” as a style of traditional architecture. This attempt is extremely stimulating because most scholars had taken the approach that the characteristics of minka is originally depended on regional diversity or anonymity.

The difficulty of understanding space and formation of minka is undoubtedly caused by the complexity of frameworks such as the arrangement of beams. Many attempts have been made by scholars to investigate the problem of minka framework. The first scholar to give much attention to this problem was Teiji Itoh (1965)31, who categorized eight types of frameworks of minka based on the concept of “primary structure”.

Itoh’s typology has been very influential at home and abroad. For instance, Guntis Plesums (1997)42 cited Itoh’s typology in his examination of structural systems in Japan. However, Itoh’s theory is merely conceptual since he did not compare each of his types with actual cases.

The most important methodical research based on a number of examples is probably that of Sei Yoshida (1985)43, who made a very detailed classification of the arrangement of “unit structure”. However, he did not check whether the arrangement of beams which characterizes one “unit structure” is used in another “unit structure”.

Therefore, past discussions of typology may be considerably effective as early attempts to make the subject more clear-cut and understandable, but their typologies are not sufficiently verifiable to analyze various aspects of actual cases of each local framework system in Japan.

The author has been grappling with this difficult problem, and has made some attempts to unravel the complexity of beam arrangement through modeling studies, and has presented the results40. But too much effort was made to systematize the results using an overly complex approach involving all applicable case studies that strayed from the true intention of the typology.

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Against this context, this study sets out to clarify how the primary structure determines the whole framework of each house, and to advance a simple and methodological typology to explain the diversity and complexity of frameworks.

This study deals with 18 distinctive local framework systems in Japan and analyzes a typical case of each of them (See Table 1).

First, it describes the framework and the plan of minka, and defines the integral structural timbers and identifies them in the whole frame.

Secondly, various core units of the frame are categorized according to the beam arrangement. The present paper takes special note of beams which are set below the top of the primary posts, which are tentatively called flying beams. Flying beams are a principal element in minka, both structurally and esthetically. But past studies did not provide a detailed means for distinguishing them from other beams. That is why they could not penetrate the complexity of beam arrangement.

Thus, this study was designed to verify how the beam arrangement of the core unit has influenced the surrounding framework, that is, whether the framing style of the core unit is repeated in other areas in the house or not.

Finally, a concise and methodological typology is developed based on the extent to which the core frame style is repeated, both crosswise and lengthwise, and the correlation between the central and peripheral structures.

2. Composition of the framework and method of this study
(1) Terminology of structural timbers

Fig.1 illustrates an outline of the framework, the plan and the perspective as the complex of several framing units. The plan of minka is generally categorized into three sections that are arranged in a distinct order from the main entrance: the doma or earthen floor for work space, the hiroma or main living space and the zashiki for guest rooms. This study defines two axes of hierarchical directions according to the plan shown as Fig 1b. One is the front — back or omote — ura direction whose axis is crosswise. The other is the lower — upper or shimote — kamite direction whose axis is lengthwise.

The framework usually consists of the central structure called joya (the central unshaded area in Fig.1c) and the peripheral structure called geya (the shaded area in Fig.1c). The former is based on tall structural posts and the latter is the surrounding part based on shorter posts. Taller posts belonging to joya are called joya-bashira or primary posts, while shorter posts belonging to geya are termed geya-bashira or peripheral posts.

Beams are categorized as follows. Joya-bari, a term derived from tie beams in British vernacular architecture, are a series of transverse beams that are constructed on the top of primary posts to serve as the bottom of the roof structure (which is outlined by the dotted line in Fig. 1a). The length of the tie beams determines the roof span. In some cases, the end of a tie beam is supported by a primary post (See A in Fig.1a) while in other cases, a primary post supporting a tie beam stands inside of the end of the tie beam (See B in Fig.1a).

Several longitudinal beams which directly support the tie beam are defined as shiki-geta, a term derived from plates in British vernacular architecture (See Figs.1a and 3). Those shiki-geta which are situated beneath the two ends of the tie beam are called joya-geta, which correspond to arcade plates in Britain.

Those shiki-geta which are set between two joya-geta are called hiki-bari, and those which are laid in almost the middle of the tie beam are called naka-biki-bari. Geya-geta is a term coined in this study to refer to a kind of plate which is laid on top of geya-bashira or peripheral posts. Although this horizontal member corresponds to a wall plate in British carpentry, this study calls it a “peripheral” plate instead of a “wall” plate because Japanese vernacular houses often lack a wall around the periphery.
Next, flying beams (defined previously) are categorized. The fundamental flying beams that are entirely located in the area of the central structure are termed main beams. Others are supplementary beams, such as tsunagi-bari which are short beams that are mostly located in the area of the peripheral structure and are linked with the central structure (See Figs. 1a and 3).

This study also makes note of tenoned beams in lintel height called sashi-gamoi. This horizontal member is derived from a concept unique to Japanese carpentry involving the insertion of a deep structural beam, which also serves as a kind of kamoi or guide rail for sliding fittings. Sashi-gamoi or tenoned lintel beams may correspond to either main beams or supplementary beams (See Fig.1a). This member is treated as a component of the framework: moreover, it can be considered as a device that can be used to eliminate the need for a post or a series of posts around the room.

Subsequently, tenoned lintel beams are naturally set along the edge of the room, while other beams are located either along the edge of the room or traversing the center the room.

(2) Procedure for defining framing units and classification of horizontal members

This study defines a framing unit as a structural part surrounded by a series of posts and tenoned lintel beams or substitutive thick beams\(^1\) that are often partitioned by an area spanned by several flying beams (See Fig.1a). A core unit is defined as the framing unit which is a wide and lofty space exposing the full shape of flying beams, usually situated in the center of the house and functioning as the main living space.\(^2\) In this study, the core unit is indicated by a capital U.

The arrangement of flying beams is categorized into the following 6 types in Fig. 2: (o) no flying beams, (a) parallel longitudinal flying beams set crosswise, (b) parallel transverse flying beams set lengthwise, (c) crossed beams, (d) surrounding main posts, and (e) beams extending radially from the center post.

For instance, the core unit in the chanoma (main living room) in Fig.1 is regarded as Type d, since it consists of four corner posts and surrounding beams without other flying beams. The lower adjacent unit in niwa has a lot of freestanding posts but there are also short beams linked with them, so collectively they form a Type d. Such a unit indicated as U’ is identical to the core unit. In this situation, this study considers the core frame style to be repeated in another unit. The smaller adjacent units in Fig.1 accompanying U or U’ which are not large enough for a room are defined as sub units, shown as u or u’ in lower-case letters (See Fig.1c). In contrast, the upper adjacent unit corresponding to these forms crossed beams configurations (See Fig. 2-c), thus it is different from the core unit (shown as D) in terms of the flying beams arrangement. This situation is not regarded the core frame style to be repeated.

A look at the whole framework of the house in Fig.1 reveals the following information. First, this house is composed of 6 framing units, but the area of each unit does not always coincide with each room. For example, the frame corresponding to chanoma is made of three parts, i.e., the central core unit, the front sub unit, and the back lean-to structure, which is merely attached to other structures and is not standing alone. This study does not regard such lean-to structures as a framing unit.

Secondly, the area of the complex of 6 units does not always coincide with the outline of the plan. On the back and lower sides, the row of primary posts coincides with the edge of the central

\[\text{Table 1 List of the local framework systems and analyzed cases}\]

<table>
<thead>
<tr>
<th>No.</th>
<th>name of framing system</th>
<th>Prefecture</th>
<th>name of building</th>
<th>Plorid</th>
<th>beams arrangement type of the core unit*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Archetype</td>
<td>Hyogo</td>
<td>Furui house</td>
<td>16C–17C</td>
<td>○</td>
</tr>
<tr>
<td>2</td>
<td>Echizen III Type</td>
<td>Fukui</td>
<td>Tsubokawa house</td>
<td>mid-Late17</td>
<td>a</td>
</tr>
<tr>
<td>3</td>
<td>Settan Type</td>
<td>Osaka</td>
<td>Izumi house</td>
<td>mid-17C</td>
<td>a</td>
</tr>
<tr>
<td>4</td>
<td>Shihou-Geya-zukuri</td>
<td>Kanagawa</td>
<td>Kitamura house</td>
<td>1887</td>
<td>a</td>
</tr>
<tr>
<td>5</td>
<td>Chonou-zukuri I</td>
<td>Toyama</td>
<td>Emukai house</td>
<td>early-18C</td>
<td>b</td>
</tr>
<tr>
<td>6</td>
<td>Chonou-zukuri II</td>
<td>Toyama</td>
<td>Nohara house</td>
<td>late18C</td>
<td>b</td>
</tr>
<tr>
<td>7</td>
<td>Jo–So Type</td>
<td>Ibaragi</td>
<td>Shira house</td>
<td>1674</td>
<td>b</td>
</tr>
<tr>
<td>8</td>
<td>Echizen II Type</td>
<td>Fukui</td>
<td>Hashimoto house</td>
<td>early-18C</td>
<td>c</td>
</tr>
<tr>
<td>9</td>
<td>Yoko Type</td>
<td>Shiga</td>
<td>Miyagi house</td>
<td>1754</td>
<td>c</td>
</tr>
<tr>
<td>10</td>
<td>Wakunouchi</td>
<td>Toyama</td>
<td>Saeki house</td>
<td>1768</td>
<td>c</td>
</tr>
<tr>
<td>11</td>
<td>Sashimono-zukuri</td>
<td>Ishikawa</td>
<td>Zasu house</td>
<td>early-18C</td>
<td>c</td>
</tr>
<tr>
<td>12</td>
<td>Nishi-Kubiki Type</td>
<td>Niigata</td>
<td>Yamaguchi house</td>
<td>1779</td>
<td>c</td>
</tr>
<tr>
<td>13</td>
<td>Yotsu-date</td>
<td>Yamanashi</td>
<td>Ueno house</td>
<td>early-17C</td>
<td>d</td>
</tr>
<tr>
<td>14</td>
<td>Tori–date’</td>
<td>Gifu</td>
<td>Makimura house</td>
<td>1701</td>
<td>d</td>
</tr>
<tr>
<td>15</td>
<td>Futagawa-zukuri</td>
<td>Niigata</td>
<td>Sato house</td>
<td>1738</td>
<td>d</td>
</tr>
<tr>
<td>16</td>
<td>Higashi-shinano Type</td>
<td>Nagano</td>
<td>Sunohara house</td>
<td>late18C</td>
<td>d</td>
</tr>
<tr>
<td>17</td>
<td>Karakasa-date’</td>
<td>Fukui</td>
<td>Yamashita house</td>
<td>mid 18C</td>
<td>e</td>
</tr>
<tr>
<td>18</td>
<td>Echizen I Type</td>
<td>Fukui</td>
<td>Horihachi house</td>
<td>early18C</td>
<td>e</td>
</tr>
</tbody>
</table>

*The information of the beams arrangement is shown in Fig.2.
structure, and there is a detachable lean-to structure as the periphery. Such a configuration is called “structure with lean-to periphery” in this study (See also Fig.3 A).

In contrast, on the front side there are primary posts that stand inside and form a gap with the edge of the central structure, using tsunagi-bari which functions to link the peripheral structure with the central structure. This is referred to as “structure with linked periphery” (See also Fig.3 B).

Another possibility, which is the simplest, is a framework with no accompanying peripheral structure, which here is called “central-only structure” (no illustration).

Subsequently, it is quite likely that there will be extremely complex frameworks involving all of the above aspects. This study tries to classify these horizontal members and select some of them to explain the framework simply according to Fig. 3.

First, the highest beam or tie beam which basically exists in every building is not drawn in the beams plan (Fig.4) to avoid complication in the diagram. Secondly, all plates including joya-geta, hiki-bari, naka-biki-bari and geya-geta are shown collectively as a broken line. These are all common as longitudinal members lying on the top of a series of posts. Then flying beams are classified into two groups which are drawn in different ways. Main beams are shown as slender squares drawn with thick lines, whereas supplementary beams such as tsunagi-bari are drawn with solid thick lines. Tenoned lintel beams, which often mark the edge of units, are shown as slender rectangles covered completely over in black. Geya-bari, corresponding to aisle ties in British vernacular houses (Fig.3 A), are not drawn in the beams plan because they belong to the lean-to structure and are thus regarded to have less relation with the central structure.

3. The composition of the core unit based on the type of beam arrangement

Fig.4 is a systematic and comprehensive beams plan of all 18 cases in Table 1 that were analyzed according to above-described methodology. This figure singles out the most integral framing members from a pile of beams in each actual case. This study notices the core frame of 18 cases corresponding to the six framing members from a pile of beams in each actual case. This is referred to as “structure with linked periphery” (See also Fig.3 B).

Broadly speaking, Nos.8, 9, 10, 11, 12 are all applicable to Type c, crossed flying beams. Nos. 8 and 9 consist of only one large core unit which occupies more than half of the whole house frame. The other units are composed of different types of frames depending on the type of space required. In No.10, the core frame style is adopted in the lower part but a somewhat different style is applied in the upper part. Nos.11 and 12 are of transverse multiple units. In No.11, the crossed beams style of the core unit is almost completely repeated both crosswise and lengthwise, so it is regarded as the most expansible of the core frame style in this group. No.12 shows a little different aspect: the front units almost completely follow the style of crossed beams, but the back units contain only parallel beams so they are regarded as sub units. It does not relate to the short depth of the back units in No.12 because the depth of the back units in No.11 is also short, but some of them strictly adhere to the crossed beam style. In brief, the difference between them depends on not the size but on the tendency to repeat the core frame style.

Nos. 13, 14, 15, and 16 correspond to Type d, flying beams set crosswise. In No.2, three parallel beams characterize not only the core unit but also adjacent units on both sides. On the other hand, in Nos.3 and 4, a row of central posts stands in the upper part of the house, clearly divided into front half and back half categorized as Type D. Therefore, in the former case the framework system of the core unit has an influence on every part of the house, while in the latter two cases it does not prevail throughout the house.

Nos. 5, 6, and 7 correspond to Type b, with parallel transverse flying beams set lengthwise. All of these three cases are composed of multiple transverse units, with a linked peripheral structure on both sides. Looking at the tendency to repeat the core frame style, in No.5 the core frame style is completely repeated in other parts, while in No.6 it is partially repeated because in the two framing units other types of beams, rather than flying beams, are used to create space on a second floor. In No.7, the arrangement of the unit is rather complicated: two large units and a sub unit are installed crosswise, and three units are set lengthwise with a little unevenness in their arrangement.

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In contrast, on the front side there are primary posts that Nos. 2, 3, 4 correspond to Type a, with parallel longitudinal tendency to repeat the core frame style.

10 nos. correspond to Type c, crossed flying beams. Nos. 8 and 9 consist of only one type.

Another possibility, which is the simplest, is a framework of multiple transverse units, with a linked peripheral structure that here is called sub structure, and there is a detachable lean-to structure as the most expansible of the core frame style in this style.

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surrounding main posts. No.13 is the purest and simplest form because the adjacent units follow the core and there are no other types at all. In Nos.14 and 15, the style of surrounding beams is adopted in the two units including the core, but other units have a different style divided into the front half and back half. Thus, they have less repetition of the core than No.13. Incidentally, in No.16 the arrangement of flying beams is not sufficient even at the core unit, so it is considered to be a transitional form between Types o and d.

Lastly, Nos. 17 and 18 are applicable to Type e, like an umbrella shape. Neither case conforms to the ideal form of extending radially from the center post; rather, in each case T-shaped beams are formed to match the requirements for dividing interior space. Another feature different from other types is that a portion of the adjacent unit overlaps the area of the original core unit, as shown in Fig. 4.

4. Systematic typology according to the expansibility of the framing unit

(1) Defining three factors of expansibility

In the preceding chapter, this paper examined the composition of the core frame itself and the tendency to repeat the core frame style in other parts of the house. Moreover, it is also important for the formation of the framework to adjust the gap between the central and peripheral structures. However, it may become too cumbersome if all the above factors are included in the typology. Therefore, in this chapter the expansibility of the framing unit is exclusively analyzed while disregarding the internal composition of the core unit in order to express the typology of the framework simply and systematically.

Fig. 5 indicates the three factors of expansibility, i.e., X, Y and Z, and their respective applications.

First, factor X indicates the extent to which the core frame style is repeated crosswise (See Fig. 5, top). In cases where X=0, the core frame style does not repeat any sides transversely, that is, there is only one core. Where X=0.5, there is a core unit accompanied by a sub unit (see the frame of chanoma in Fig.1). Next, X=1 corresponds to the core style repeating only one side, namely, a transverse section of the frame consists of two full spans of the core. When the value of X is 1.5, the core style repeats fully on one side and is accompanied by a sub unit on the other side. Lastly, X=2 indicates the largest form where the core style repeats on both sides, forming three full spans of the core.

Factor Y indicates the extent to which the core style is repeated lengthwise (See Fig. 5, middle). The value of Y=0 shows that the core frame style does not repeat any sides longitudinally, but usually accompanied the different type of units on one or both sides. Next, Y=1 corresponds to the core style repeating on only one side: namely, it consists of two full spans of the core. Finally, Y=2 means the core style repeats fully on both sides, and the core unit is considered to be dominant throughout the house. In the same way as with X above, it is possible to imagine values of 0.5 and 1.5 for Y, but they are not schematized in Fig.5.

Factor Z indicates the extent to which the structure appears with linked periphery (see Fig. 5, bottom). It depends on the correlation between the roof span and the depth of the unit(s). The value of Z=0 means there are no sides using a structure with a linked periphery, namely, all outer edges of the units coincide with the area of roof structure. This state corresponds to not only the central-only structure but also to the structure with lean-to periphery on either or both sides. In short, even if a peripheral structure exists (spatially), if it is structurally independent, then Z=0.

The value of Z=1 represents a structure with linked peripheries on one pair of opposite sides along either the front-back direction or lower-upper direction. In other words, both edges of the units in either direction coincide with the area of roof structure.

Finally, the value of Z=2 indicates a structure with linked peripheries on two pairs of opposite sides. That is to say, the structure has a linked periphery on all four sides, meaning that all edges of the units project from the area of roof structure. It should be noted that if a linked peripheral structure is used on only one side in any direction, 0.5 is added to the value of Z.

(2) Schematized typology of framework

Fig. 6 is a systematic and comprehensive diagram depicting the three factors X, Y and Z defined above. It is also a typology illustrating special combinations of X, Y and Z values extracted in the form of (x, y, z) according to the framework of 18 actual cases in Fig.4. In other words, this typology views expansibility of the framing unit in terms of the following three points: the extent of crosswise repetition of the core frame style, the extent
of lengthwise repetition of the core frame style, and the extent to which the structure appears with linked periphery.

First (0,0,0) is the least expansible type which is so simple in form that there is fundamentally only one core derived from the original minka frame style and there is no structural device taking the peripheral area into the central area. The nearest actual case is No.9, the Yogo type whose value is (0, 0, 0.5). If it were not for two adjacent different types of units (See Fig.4), this case would exactly correspond to (0,0,0).

Secondly, (0, 1, 0) and (0, 2, 0) indicate types whose lengthwise repetition is developed but other factors are not expansible at all, corresponding to the No.10 Wakunouchi and No.13, Yotsu-date types.

Then, (0, 0, 2) means that the framework is designed to create a larger space by using the structure with linked peripheries, but not repeating the core style in any direction. It corresponds to No.8, the Echizen II type.

In contrast, (2, 0, 0) indicates only crosswise repetition of the...
core style, corresponding to no actual cases in this study. However, while it is theoretically possible to create a great amount of space in the crosswise direction, it is not practical because it can require too many crosswise framing devices due to the structural limitations of the roof span.

Next, looking at the distribution of compound types consisting of multiple expanding factors, two groups become apparent.

One group is located on the Y-Z plane. It corresponds to 4 types and 7 cases in Fig. 6. There are various kinds of framing forms: (0, 1, 1) as in No.14 Torii-date,11) No.16 Higashi-shinano type and No.18 Echizen I type; (0, 1, 1.5) as in No.3 Settan type; (0, 1, 2) as in No.4 Shihou-Geya-zukuri and No.17 Karakasa-date; and (0, 2, 0.5) as in No.2 Echizen III type. These are all common types that constitute one span of the framing unit in which the value of X is 0, though some minor discrepancies are apparent among them.

The other group includes the factor of crosswise repetition of the core frame style to a greater or lesser extent. Nearly all of these are situated on a plane defined by Y=2 and X=2. This means that there is repetition of the core frame style both crosswise and lengthwise, with a linked periphery style that has been developed to a certain extent. There are 4 types and 5 cases in Fig. 6: (0.5, 2, 2) as in No.12 Nishi-Kubiki Type; (1, 2, 1) as in No. 5 Chouza-zukuri I type and No. 6 Chouza-zukuri type II; (1, 2, 2) as in No.11 Sashimono-zukuri; and (1.5, 2, 2) as in No. 7 Joso type. The last one was the most expansive case in this study. Theoretically, the type exhibiting the greatest extent of all three factors would be (2, 2, 2).

Looking at the distribution, it is clear that the three factors of the expansibility of the framing unit do not appear with consistent frequency, nor do they appear as independent phenomena. We can comprehend that the characteristics of Japanese minka tends to be situated a certain portions of the diagram. We could also find some possibility to verify the feature of other types of framework systems in foreign countries such as medieval open halls in Britain and Halenhauss in the northwest Germany by using this typology. Subsequently this study provides an elementary schema for further comparative researches.

5. Conclusion

This study analyzed the timber framework of minka (Japanese vernacular houses) by investigating the complex composition of the various kinds of units according to the arrangement of their beams. It was found that diverse and complicated frameworks could be understood by examining the manner in which the core frame style was repeated both crosswise and lengthwise and by systematically verifying the structure with linked periphery. The typology shown in this study is valuable in that it was based on such factors as spatial volume and its relationship with the gap between the central area and periphery.

This paper is based on a significantly revised work originally written as a graduation thesis by Takuya Kurihara and Tomoro Nakaya,12) which Masahiro Chatani and I supervised in 1997.

Notes

1) Shinohara, Kazuo (1964): Jyutaku kenchiku, Kinokuniya syoten, p.69
3) Insh, Teji (1965): Minka, Heiboneya
5) Yoshida, Sei (1985): The stylistic development of farming houses(Minka, Noka) in Japan, Publication of Nara national cultural properties research institute, No.43
7) I cannot find any other appropriate terms but these kinds of beams are often called just “beam” in the past articles.
8) Hashira or bashira literally means a post.
9) Hari or huri literally means a beam.
10) A plate means a longitudinal timber, set square to the ground, on the top of a wall or in a roof truss in British vernacular architecture (after Alcock, N.W., Barley, M.W., Dixon, P.W. & Meeson R.A. (1996): Recording timber framed buildings: an illustrated glossary, Council for British Archaeology). While “Keto” or “geta” is basically coined as a horizontal timber on the peripheral posts in Japan but this study expands the meaning of it considering a various kind of the terms in some local framework systems.
11) It is located at the almost same level as a tenoned lintel beam.
12) It is often called Chanoma or Hiroma in Japan, corresponding to a hall in Britain.
13) It is akin to the composition of “nave and aisles” in Europe.
14) As No.17 is called Karakasa-date, “karakasa” literally means an umbrella.
15) Wakunouchi literally means that inside the box like framework.
16) Yotsu-date literally means the structure with 4 freestanding centralposts.
17) Torii-date means the structure based on several torii composed of twofreestanding posts and a tenoned beam between them.
18) Shihou-Geya-zukuri literally means the structure with linked centraland periphery on four sides.
1. 民家架構の把握の困難さと、本研究による新たな試み

日本の民家（vernacular house）における、木造架構の複雑さに基づいた空間の多様性・不均質性は、これまで多くの講者が注目して
きた。民家の空間と造形の把握の難しさは、梁の配置に見えるような
ような構造システムの複雑さに起因している。この架構の問題に関す
る従来の類型論は、解釈やすさ、明快さを目的とした試みとして
は、効果があったとも思われが、日本各地の架構法の実例における様々
な様相を分析するために実証的なものとはいえなかった。こうした
背景から、本論は、日本の18地域の特徴的な架構法の典型的な事例
を分析対象とし、基本的な架構システムがどのように建物全体の構
成を決定づけているのかということを明らかにしたうえで、簡明か
つ体系的な架構模式を示すことを目的としている。

2. 架構の成り立ちと本研究の方法

(1) 部材用語の定義

架構の概要と平面との対応を示した、軸組架構が立ちの高い上屋柱
（primary post）から成る上屋構（core unit）と、その周囲の
下屋（peripheral structure）から成ることを述べたのち、梁を以
下のように分類した。上屋柱の太部を載る架構方向の梁を上屋梁（tie
beam）とし、上屋梁の下を支えている桁行方向の部材を桁桁（さら
に上桁桁、桁桁、中桁桁と分類）とした。上屋柱顶部よりやや低い
位置にかかる飛梁（flying beam）を、全部または大部分が上屋の範
囲に属する主要梁と、主梁と上屋柱を繋ぐ繋梁を含む副梁に分
別した。また上屋は高さに接し付けられた梁である桁梁を、部屋の
周囲に立ち柱を介して位置する部材として区別した。

(2) 単位架構による架構の定義と水平材の分類

柱列および差柱屋またはこれに代る大梁により囲まれ、しばしば
飛梁のかかる範囲で区切られた部分を単位架構（framing unit）と定
義し、単位架構のうち、広く吹き抜けた空間に飛梁を露出させ、し
ばしば家の中心に位置し主室として機能しているものを核架構（core
unit）と呼ぶ、核架構よりも規模が小さなものを副架構（sub unit）、
核架構とは対立する組みみこのものを異形架構として区別する。単位
架構における飛梁の組みみの形式を、(a) 飛梁なし、(b) 桁架架梁行
方向、(c) 桁架架桁行方向、(d) 交差架梁、(e) 4本柱を取り巻き配
置（圧縮縁）、(f) 中柱から放射状配置（放射形）に分類した。

民家単位架構の集合形態を見た場合、各々の単位架構が占
める領域は必ずしも割り取れる点において、単位架構の集合体が
必ずしも関取の外側に一致しない点が注目される。これは上屋と下
屋の関係として、両者が構成的に連なった「下屋造り（structure
with linked periphery）、「上屋・下屋の構成（structure
with lean-to periphery）、「上屋のみの構造（central-only
structure）など多様なためである。

本研究では水平材を分類し、主要な飛梁を逐ずぐる手順を示し、
複雑な様相の架構から、その特質を担う部分を把握できるような。

3. 桁架架構による核架構の構成

各事例の共通に積層した梁組から、最も重要な架構部材を際立
たせた梁架図を、18棟の事例すべてについて作成した。飛梁配置の
各タイプが核架構に用いられたときに、建物の他の部分で、核架構
の架構形式が飛梁によって用いられているかどうかを、各棟について検
証した。タイプ0（飛梁の無いもの）では、桁梁、梁行に比較的短
い間隔に柱を配した均質な空間にあった。タイプa（桁架架梁行
方向）では、核架構が下柱、上手の隣接する部屋とも反復している
ものと、下手だけに反復しているものがあった。タイプb（梁架架
方向）では、すべて桁行方向に単位架構が複数並並び、同時に前
後が下屋造りになっていた。核架構の反復性は様々であった。タイ
プc（圧縮縁）では、唯一の核架構が家の半分以上を占めたもの、
単位架構が梁行1列のもの、梁行2列のものが見られた。タイプd
（圧縮縁）では、核架構が単一に反復するものと、下手、下手の末尾
が異なる架構形式になっているものが見られた。タイプe（放射形）
では、中央柱から四方に配置する理想的な版型ではなく、間取り
に従って組立され7字型になっていること、降解構架で反復される
梁組が核架構と重なりながら繰返される点に特徴が見られた。

4. 単位架構の拡張性から見た類型化

(1) 拡張性を示す因子の定義

核架構の内的な組成を度外視して、単位架構の拡張性の視点にしぼっ
て、拡張性のファクターX,Y,Zを用いて架構形式の類型を簡素かつ
体系的に示した。Xは、梁行方向の反復の因子である。X=0は梁行
方向に核架構がひとつだけであるが、X=0.5は核架構と副架構が並
列したもの、X=1は片側の核架構が反復するもので、X=1.5は両側
に核架構が反復し、反対側に核架構が配置した形に、X=2は両側に
核架構が反復したものを示す。Yは、桁行方向の反復の因子である。
Y=0は、桁行方向に核架構が反復しないものを意味し、片側ま
たは両側に異なる核架構の単位架構を取ることが多い。Y=1は片側
のみ核架構が反復するもので、Y=2は両側に核架構が反復するも
のである。Zは、下屋造りの発達の程度を示す因子であり、単位架構の
側面と小屋スパンの関係に基づいて、Z=0は下屋造りがどの面
にも用いられていないもので、Z=1は、一方の相対する面で下屋造
りにしているもので、Z=2は、二方向の相対する面で下屋造りが実現
したものである。

(2) 架構類型の図式化

単位架構の拡張性を、桁行方向、桁行方向それぞれの核架構の反
復および下屋造りの出現しやすさの3点から位置づけ、個々の
類型を示した。分析対象18棟の観を基にして、拡張性の最
も高い事例から最も低い事例までの図示上の分布の特性を考察した。
これらの分布を見ると、3つの架構拡張性の因子は、同程度で現れ
ているものの、独立的に現れているのでもない。日本の民家が特徴が、
図のなかの一定の部分に位置づけられるかという形で理解すること
が可能である。この類型を作って、日本と異なる架構法の特徴を検
証できる可能性がある。本研究は今後の比較研究のための基本的な
図式を示したものといえる。

5. 結論

本研究は、日本の民家多様で複雑な構成を、梁組の架かり方か
ら決まる単位架構の集合形態により分析した。その結果、梁行およ
び桁行の核架構の反復性と下屋造りの有無によって、体系的に架構
の構造を位置づけた。本研究で示された類型は、架構法の問題を、
空間的なポリュームや、中央と周縁のズレとの関係から示したこと
に新たな価値がある。

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