

EXAMINATION OF THE EFFECT OF BUILDING CONSTRUCTION POLICIES ON THE CONSERVATION OF VERNACULAR BUILDING TECHNIQUES

Policies Adopted after WWII in Japan

Ayako Fukushima

School of Design, Kyushu University, Japan
af@design.kyushu-u.ac.jp

Abstract. Vernacular building techniques and system for timber-framed residential buildings practiced before WWII in various regions in Japan were induced to disappear due to government policies adopted since the 1950s. This is because government policies on building construction aimed to standardize construction techniques and system all over Japan regardless of different climate characteristics and diversity in custom and did not have a room for vernacular buildings techniques and system to be practiced. The government policies need to be redefined so as to give the local stakeholders back the right to define policy and make decisions by themselves based on their own reassessment of the values of the vernacular building techniques and system.

1. Neglected Vernacular Building Techniques and System and Needs to Reassess their Intangible Wisdom

The adverse effects and results of the building construction policies, especially for timber-framed residential buildings, adopted in the latter half of the 20th century on the conservation and inheritance of the “intangible wisdom of building”, as well as, the “tangible source of wisdom” are the focus of this paper. The case study examines the process of how the vernacular architecture and distinctive building construction methods formally practiced on the islands in southwestern Japan has all but vanished due to centralized and standardized policies.

This paper focuses on timber-framed residential buildings. The “vernacular building system” refers to the organization of human resources needed to build private residences, which includes the owner, carpenters, technicians, and the local residents. “vernacular building techniques” refers to the building techniques observed only in specific regions. In both cases, there are the non-practiced and practiced “vernacular building system” and “vernacular building techniques”. The paper also aims to re-evaluate the values of the non-practiced vernacular building system and techniques because these values need to be recognized not only by policy makers and heritage conservation professionals, but more importantly, by local carpenters and residents as the supporting body of the vernacular building system. This is because the vernacular building system and techniques embody locally developed sense of values as well as wisdom for sustainable development.

This viewpoint is important especially as Japan currently faces extensive recovery and reconstruction as well as new planning of numerous towns and villages, which were destroyed by the earthquake and Tsunami in March 2011. A sensitive and non-standardized plan is crucial to revitalize the vernacular building system and techniques in a given region where tangible and intangible values are embedded.

2. Vernacular Building System and Techniques

2.1 VERNACULAR BUILDING SYSTEM

Amami Islands, the case study for this paper, which is located in the southwestern part of Japan has a subtropical climate (Fig.1).

Until the end of WWII, the vernacular building project delivery system was basically based on a “master builder” system in Amami as well as most of regions in Japan. This system involved the owner, usually the male head of the household, enlisting a master builder and other technicians who were farmers and fishermen by trade, but also, had specialized knowledge on roof thatching and other traditional building techniques to carry out the construction. Each village or district used to have at least several of those skilled people (Amami Islands Housing Research Team 1960). The timber to be used for building the frame was usually provided from the owner’s forest, or a forest commonly owned/used by a multiple number of villagers (Committee for Editing Tatsugo Town History 1988).



Fig.1 The location of Amami Islands

Local villagers were recruited to help collect thatch material, construct the frame, and provide other support. This system involving villagers is called “Yui” and was widely practiced in Japan (Torigoe 1985; Onda 2006). Locals provided physical labor on a volunteer basis for those who were in need in a village. This mutual support system functioned without payment, and over time, these exchanges among themselves eventually benefited all the villagers. The most popular Yui practice was roofing, which needed an intensive amount of labor. The general helpers were responsible for collecting, bundling, and transporting thatch such as *Imperata cylindrica*. Only experienced Thatchers could handle laying and fastening wrapped bundles of thatch on the roof. The roofing project was planned and organized by the owner of the building, or a leader of the village so that villagers would find it difficult to refuse assisting (Committee for Editing Tatsugo Town History 1988). The Yui system functioned effectively because all the male residents had sufficient knowledge of building techniques and the system. The male residents came to acquire the building knowledge through continuously participating in Yui practices (Shin, Tohiguchi and Hashimoto 1996). Yui was practiced not only in building works, but also many other activities such as rice planting and harvesting and funerals, which were too demanding for a single household to handle in a specific short period of time.

2.2 VERNACULAR BUILDING TECHNIQUES: HIKIMON AND ISHIZUE

Situated in the sub-tropical climate region, typhoons with strong wind and heavy rain regularly hit Amami. Humidity is very high throughout the year, which is ideal for the spread of termites, so there are many termite damaged wooden structures.

A typical residential site plan is composed of several independent small buildings (Fig.2). Each building is

given a specific use. According to Nomura (1976), one of the explanations for such a site plan is that each small building is built and added to existing ones whenever the family requires expansion (Amami Islands Housing Research Team 1960). Another explanation is that this site plan is more durable in strong winds that often come to Amami. The eaves height of each building is deliberately low so as to minimize the wind force and damage.

The climatic characteristics of Amami demanded the use of some specific building materials made of locally grown native timber such as *Ijuu*, *Inumaki*, *Hitotsuba*, *Sumomo*, *Shii*, which are all highly resistant to termites and humidity (Hisamitsu Toku, interview by author, Amami Oshima, Japan, August 2, 2010.).

The climate in Amami led to the development of the unique framing style called “Hikimon (or Hikimun)”,

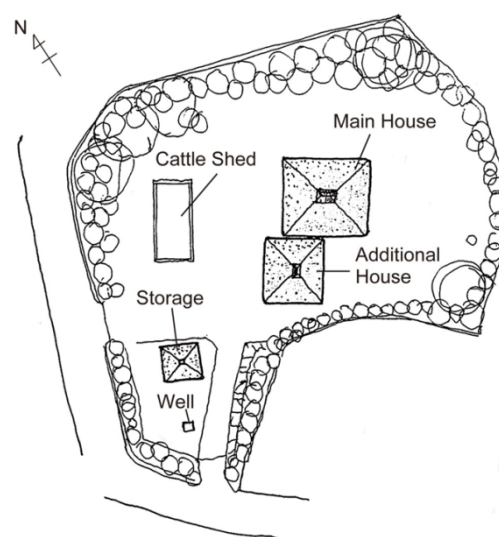


Fig.2 Typical residential sites plan
Source : Miyazawa 1996

which made the frame highly durable during typhoons. “Hikimon” was a specific framing method, in which the columns were inserted into the holes cut inside the beams, girders, and joists (Fig.3 and Fig.4). Such a composition made the frame much stronger than usual framing construction and reduced the risk that the frame was damaged by strong wind. Due to this durable construction style, some of these structures remain. Even if damaged, the Hikimon style frame is easier to restore. It was practiced during the period from the mid 19th century until the end of WWII and only on two islands of Amami-Oshima and Kakeroma among the Amami Islands (Miyazawa 1996). Hikimon has not been practiced since the end of WWII.

Another vernacular building technique was called

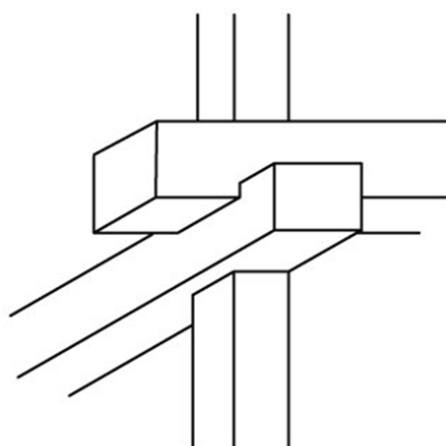


Fig.3 Composition of the Hikimon frame
Reference Nomura : 1976



Fig.4 Hikimon frame, the residence reconstructed at
Amami City Museum



Fig.5 Ishizue, the residence reconstructed at
Amami City Museum

“Ishizue”, which was column footing with footstones (Fig.5). The timber columns were erected on footstones. The stones and columns were not connected with an anchor bolt or connectors. It allowed the frame to be flexible in strong wind. Even if the whole frame was blown away from footstones, it was possible to pull the whole frame back onto the stones (Amami Islands Research Team 1960). The heavy thatched roof also provided the necessary weight in order not to be easily blown away by strong wind.

Those building techniques unique in Amami indicate that the buildings there needed techniques especially catered to minimize damages from the extreme climatic conditions. Solidity as well as flexibility of frame and foundation was considered the most important element to minimize the damage from natural disasters.

3. Introduction of New Policies and Their Effects after WWII

After WWII, Japan adopted various new policies in order to achieve a basic quality of living for all citizens. Two important regulations were enacted in 1950. One was the Building Standards Law (BSL), and the other was the Government Housing Loan provided by the Government Housing Loan Corporation (GHLC). Both regulations have been applied throughout Japan regardless of regional diversity in climate, techniques, materials, or system.

These required timber-framed buildings to be standardized. The objective of the BSL is to safeguard the life, health, and property of people by providing minimum standards concerning the site, structure,

equipment and use of buildings (*The Building Standards Law*, art. 1). Regarding timber-framed buildings, the BSL requires lying sills over the foundation and the use of vertical and horizontal braces.

The GHLC was set up in 1950 to support citizens to acquire quality homes in a sound and secure manner. Through this program, financing (housing loan programs) was provided to citizens of every class to build, purchase, or renovate homes in the event that private institution financing is unattainable (Ministry of Finance 2001).

The GHLC, by providing detailed design drawings of model houses, supplied housing loans that required the users to comply with “Standard Specifications”, in which structure, construction methods, and materials were strictly specified to improve the safety and durability of timber-framed residential buildings. In addition, the GHLC publicized examples of proper and desirable house that were properly qualified for a loan. For example, the specifications required the foundation to be concrete continuous footing. It also required the foundation and sills to be connected with anchor bolts, use fasteners to make strong connections with the framing, and use non-flammable materials for roofing (Tsubota 2007, 2009).

Since the 1980s, academic research on the vernacular building system came to be explored. This research revealed that accelerated urbanization, standardization, mass production and prefabrication of buildings after WWII resulted in the demise of the uniqueness and diversity of the vernacular building system and techniques in different regions in Japan (Fujisawa 1986). It was also pointed out that standardization tended to yield exaggerated specifications and unnecessary costs.

As stated below, Matsumura (1999) points out that these guidance and instructions by the government policies and accelerated changes of timber-framed residential building techniques:

- Composition of timber frame: before WWII, it was usually practiced to apply horizontal rails between columns in order to make walls solid. However, the current method is, instead, to apply braces or structural wood panel made of plywood as a wall. This change was introduced to increase aseismicity.
- Construction methods and materials of walls: before WWII, mostly walls were made of clay and bamboo lath, and columns and beams were exposed. The current standard is stud wall made of structural wood panel consisting of wafer-board faces bonded to an insulating foam core.
- Hand-hewn timber: only experienced carpenters could properly hew connections and joints for the timber frame, using tools such as a booster and a saw.

However, it has been replaced with precut timber by an automated machine. The prevailing use of fasteners to connect timber further led to the decline of the craftsmanship of hewing.

- Locally grown trees were used for building material before WWII; however, the current primary source is from imported timber.

Matsumura (1999) also called attention to the prevalence of new building materials such as gypsum lath board, printed plywood, and aluminum sash as well as changes of owners’ or occupants’ sense of values towards the residences have accelerated changes in building materials, techniques, and system.

3.1 CHANGES IN BUILDING TECHNIQUES IN AMAMI

Both regulations of the BSL and the GHLC’s Standard Specifications prohibit the use of some of vernacular techniques including the ones observed on Amami as previously described, and imposed other techniques that were not necessarily suitable for the Amami environment. For example, Ishizue did not comply with Standard Specifications and the BSL as the foundation, sills and columns were not connected, and there was an opening under the flooring (*The Building Standards Law Enforcement Order*, art. 42). Hikimon went out of practice since it did not meet the national standard frame, which mandated the use of metal fasteners and braces, so it was replaced by stud wall framing. Miyazawa (1994) assumes that another reason why Hikimon became unpopular was Hikimon itself was a transitional framing technique in between the simpler frame in earlier times, and became a more established one that developed around the 17th century.

The use of locally available building materials, such as thatch for roofing, is also prohibited by the new policies, as they are flammable, and not earthquake-resistant. Galvanized metal sheets were introduced in Amami for roof sheeting in the 1950s and quickly replaced thatched roofing. Galvanized steel roof or batten-seam metal roof was favored because it was easier and cheaper to install and did not always require a roofing master, or a group of villagers mobilized by Yui. However, galvanized metal roof has some disadvantages; for example, it has poorer insulating properties than a thatched roof (Amami Islands Research Team 1960), and, it is much noisier when it rains. (Yaeko Yamada, interview by author, Amami-Oshima, Japan, August 5, 2010). Even though a galvanized metal roof has disadvantages, the new policies have led to the decline of thatched roofs and master Thatchers since the 1970s.

The characteristics of building techniques in Amami

indicate that the most important element for residential buildings is wind-resistant, structural durability, and flexibility. However, the nationwide standardization prohibited carpenters and residents in Amami to continue to use vernacular building techniques, and instead, forced them to apply techniques for earthquake-resistance, which demanded the use of connectors that are actually vulnerable to strong wind.

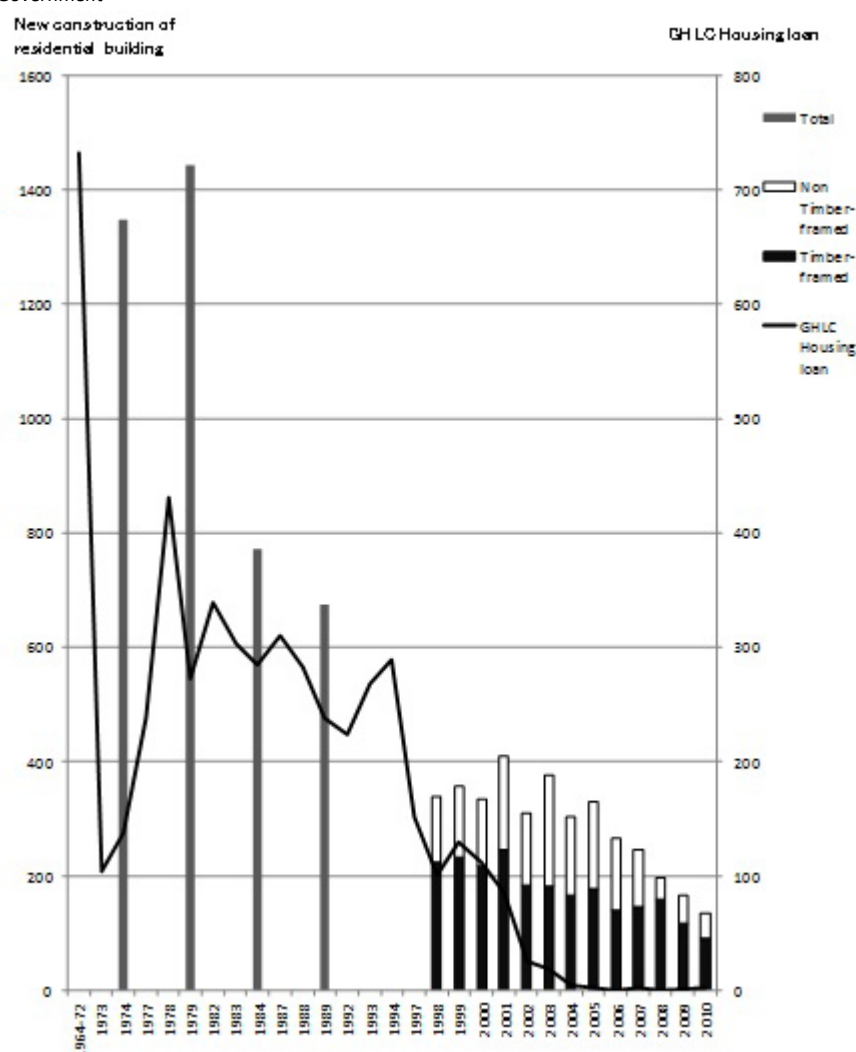
Since the 1940s, the national government promoted planting coniferous trees such as cedar and cypress in order to use them as building materials all over Japan including Amami. However, these species are not suitable for the climate in Amami and did not grow well; consequently, they could not be utilized for building material. (Hisamitsu Toku, interview by author, Amami Oshima, Japan, August 2, 2010). Therefore,

the private and commonly owned forest in villages became unused and abandoned (Hisamitsu Toku, interview by author, Amami Oshima, Japan, August 2, 2010).

Hewing handworks by carpenters became less in demand, especially since 2000 in Amami, as imported pre-cut timbers became the dominate source (Hisamitsu Toku, interview by author, Amami Oshima, Japan, August 2, 2010). Consequently, the local lumber mills disappeared. Before WWII, carpenters were responsible for most of the construction work; however, except for erecting the timber frame, a majority, such as the concrete foundation, interior fittings, and electrical and mechanical fittings are handled by specialized contractors. This change has led to the decline of skilled carpenters.

Table 1 shows the number of new residential building

TABLE 1 The number of residential buildings constructed, housing loan by the GHLC and structure
Sources: Kagoshima Ohshima Subprefectural Office (1975-2001); Fund and structure of newly constructed housing by municipalities provided by Public Works Department of Kagoshima Prefectural Government



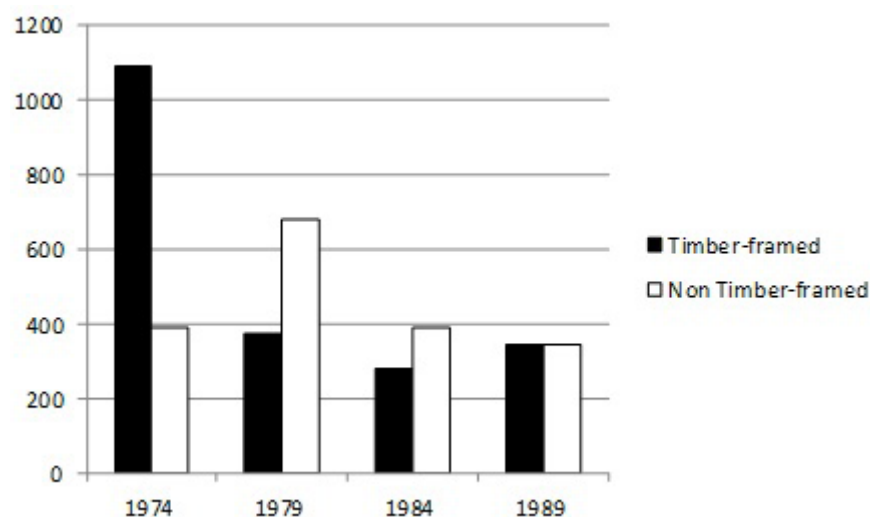
construction projects and the number of housing loans by the GHLC on Amami Islands. The data of the GHLC funded housing since 1998 also shows the ratio of timber-framed and non-timber framed buildings. Table 2 shows the number of new construction sites of all types of buildings, timber-framed or non-timber-framed, on Amami Islands in the listed years. The data demonstrates that the increase of housing loans and the decrease of timber-framed buildings correspond until 2000. This fact, especially in the 1970s, most likely reflects the design adaptations due to the Standard Specifications for GHLC housing loans and

the carpenters' role as "master builder" and resulted in closing down their business (Hisamitsu Toku, interview by author, Amami Oshima, Japan, August 2, 2010).

Another influence relates to the fact that Amami Islands were under the sovereignty of the U.S. after WWII from 1945 to 1953. After the return of the Islands to Japan in the 1950s, academicians, who were assigned to conduct research to make a proposal on how to improve living conditions in Amami, evaluated the vernacular buildings as "extremely simple and poor", and "unsuitable for living" (Amami Islands

TABLE 2 The number of buildings constructed by structure

Sources: Kagoshima Ohshima Subprefectural Office (1975-2001); Fund and structure of newly constructed housing by municipalities provided by Public Works Department of Kagoshima Prefectural Government



some regulations in the BSL, which led to changes or abandonment of vernacular timber-framed buildings in Amami.

3.2 CHANGES IN BUILDING SYSTEM IN AMAMI

By the late 1950s, the building system in Amami had shifted from the vernacular master builder system, which was directly contracted and managed by the owner, to lump-sum (design-bid-build) contract system or design-build system. Governmental regulations demanded the involvement of licensed architects or building engineers as well as detailed building plans prepared by them so that the government would be able to assess whether the building to be constructed would be qualified for a housing loan, and the various requirements such as earthquake and fire codes were met. These new regulations denied

Housing Research Team 1960). Even though this research is important and meaningful as it is the first academic research on the vernacular building techniques in Amami, the proposed standard for "improved housing" for Amami through this study did not positively incorporate the vernacular building techniques and materials. For instance, they promoted the concrete masonry foundation and frame because concrete blocks were cheaper and fire-resistant.

The traditional residential site plan, which consisted of several independent and interconnected buildings was denied; thereby, condensing all the functions in one building as the standard for all regions in Japan. The favored timber was defined as cedars produced in mainland Japan (Amami Islands Housing Research Team 1960). Even though the author has not confirmed to which degree the improved housing proposal

has been implemented, the mindset of academia and the government were clearly inclined toward the standardization of the building system and techniques.

As the standardization of the building system and techniques proceeded nationwide, the vernacular building system and techniques on Amami had to be abandoned by the people who had developed and supported the building system over the centuries without the opportunity to examine the value of their system and the techniques. They were not consulted, or a part of the decision-making on the new building policies, they were simply required to comply with the policies, as were all other regions in Japan.

Adverse consequences can be observed in buildings following the codes. Suda reported that the typhoon in 1977 damaged the residential buildings in Okino Erabu Island greatly because they lacked proper provisions to resist the strong wind (Suda 1984). The new materials and techniques such as galvanized iron roofing, connectors used for the frame and truss, and the aluminum window sashes, were too light or weak to resist the wind from the typhoon. The new residential site plan, composed of one large building instead of several small buildings, was also not appropriate for wind resistance. The new building materials proved to be unable to resist termite and the humid conditions found on Amami.

The changes in the building system brought a change in human relationships. For instance, there used to be a traditional custom performed by the master carpenter and the building owner. On a designated day, the owner visited the master carpenter's house to offer gifts to the God of Carpenter shrine to thank the carpenter for his work (Fig.6). This signified that the owner formally received the house from the carpenter. This custom is no longer practiced because the modern building techniques and system reduced the responsibility of the carpenter greatly; thus, the traditional relationship between the owner and the carpenter which was based on close mutual trust as well as much respect for the carpenter by the owner has vanished (Hisamitsu Toku, interview by author, Amami Oshima, Japan, August 2, 2010.).

Yui has not been practiced in building projects for many years, so some elder villagers sense that younger villagers, who lived outside the island for a long time and came back to the village after retirement, do not have an understanding of Yui spirit, which can cause some miscommunication among villagers (Eizo Katsu and Masayuki Watari, interview by author, Amami-Oshima, Japan, August 4, 2010.).

4. Conclusion

The significance of vernacular building system and



Fig.6 God of Carpenter enshrined at a master carpenter's house

techniques in Amami is described below:

- The vernacular building techniques provided necessary wind resistance function, which was comprehensively provided in the foundation, frame, roof, site plan, and building materials. All the building materials were produced, sawn, and fine-tuned locally on the islands.
- Those techniques and knowledge as intangible wisdom were possessed by all the male residents and performed by carpenters.
- Yui in vernacular building system provided not only the owner of the building with the necessary and voluntary workforce to build a house, but also local residents with knowledge and the skills necessary to manage the building project based on the master builder system. Therefore, Yui was a sustainable and self-contained building system.

Due to the changes in the vernacular building system and techniques, people in Amami, who are younger than their 60s, have no knowledge or experience of a building project. This means they have no understanding of the values of vernacular buildings in their own culture and area.

The current situation demands that researchers, policy makers, as well as architects, local contractors, and local residents as end-users recognize the intrinsic value of the nearly extinct vernacular building system, techniques, and materials. In addition, building construction policies and their application must be more flexible and decentralized in order to give the local stakeholders back the right to define policy and make decisions on whether they would apply the vernacular system and techniques that correspond to each local climatic and geological context rather than applying uniform requirements nationwide.

References

- Amami Guntou Juutaku Chousa Dan (Amami Islands Housing Research Team) 1960. Amami Guntou Juutaku Kaizen Chousa Kenkyu Houkoku [Report on Research of Housing Improvement in Amami Islands]. Kagoshima: Amami Guntou Juutaku Chousa Dan.
- Fujisawa, Yoshikazu. 1986. "Shusi Setsume (Chiiki no Juutaku Seisan Sisutemu)(Kenchiku Keizai Bumon Kenkyu Kyougi Kai)" [Explanation of the purposes (vernacular residential building system).] *Journal of Architecture and Building Science* 101(1248), 137-138.
- Matsumura, Shuichi. 1999. *Juutaku to iu Kangaekata: nijusseiki teki juutaku no keifu* [20th century concepts of house-building.]. Tokyo: University of Tokyo Press.
- Ministry of Finance. 2001. The Government Housing Loan Corporation. FILP Report 2001 Extension Volume Policy Cost Analysis of FILP Projects FY2001. Internet. Available from http://www.mof.go.jp/english/filp/filp_report/zaito2001e-exv/01.pdf; accessed 6 October 2011.
- Miyazawa, Satoshi. 1996. Amami Oshima Kasari Cho no Minka Chousa Houkoku [Report on Research of Private Residences in Kasari Town, Amami Ohshima.]. Tokyo: The Japan National Trust for Cultural and Natural Heritage Conservation.
- Nomura, Takafumi. 1976. *Nansei Shotou no Minka* [Residential Buildings in Southwestern Islands] Rev. ed. Tokyo: Sagami Shobou.
- Ohshima Sicho (Kagoshima Ohshima Subprefectural Office). 1975-2001. Amami Gunto no Gaikyo [Outline of Amami Islands].Nase: Kagoshima ken Ohshima Shicho.
- Onda, Morio. 2006. Gojo Shakai Ron: Yui, Moyai, Tetsudai no Minzoku Shakai Gaku [Mutural Help Networks in Japan: Ethnosociological study on Yui, Moyai and Tetsudai]. Kyoto: Sekaishisosha.
- Shin, Ogyun., Mamoru Tohiguchi, and Seiyu Hashimoto. 1996. "Jiba Gata Juutaku Kensetsu to Kyojuuchi Kanri ni kansuru kenkyu: Tsushima Kamiagata Chou no Shuuraku Keitai, Hirabashira zukuri Juukyo." [A Study on the regional housing and the control of human settlement: Survey on village from and Hirabashira-zukuri house in Kamiagata of Tsushima Island.] *Journal of architecture, planning and environmental engineering* 489, 179-186.
- Suda, Shojiro. 1984. "Tousho no Kenchiku Seisan ni kansuru kenkyu: Okino-Erabu Jima (Kenchiku Seisan)." [Study on building system in islands: Okino-Erabu Island (Building system).] *Kenkyu Houkoku Shu: Keikaku Kei* 54, 405-408.
- Tatsugo Chou Shi Rekishi Hen Hensan linkai (Committee for Editing Tatsugo Town History). 1988. *Tatsugo Chou Shi* [History of Tatsugo Town.]. Kagoshima: Tatsugo Cho.
- Torigoe, Hiroyuki. 1985. *Ie to Mura no Shakai Gaku* (Sociology on Household and Village) Kyoto: Sekaishisosha.
- Tsubota, Shinsuke., Yuji Katsuki and Shiro Sasano. 2007. "Mokuzou Juutaku Heimenzushu oyobi sono kaiteiban ni miru Juutaku Kinyu Kouko no Juutaku Zou" [The Housing Idea for Commons presented by the Housing Loan Corporation through collections of drawings of the Wooden Standard House.] *Journal of Achitecture and Planning* 617, 151-157.
- Tsubota, Shinsuke. 2009. "Juutaku Kinyu Kouko Sakusei no Mokuzou Juutaku nikansuru Kensetsu Kijun to sono Kaisei Joukyou" [Standard Specifications and their transition for timber-framed residential buildings prepared by Government Housing Loan Corporation.] *Kenkyu Houkoku Shu II, Kenchiku Keikaku, Toshi Kikaku, Nouseon Keikaku, Kenchiku Keizai, Kenchiku Rekishi, Ishou* [Proceeding of the architectural research meetings: architectural planning and design, urban planning, rural planning, building economics, history and theory of architecture.] 79, 325-328.