A STUDY ON OPEN BUILDING IMPLEMENTATION THROUGH
APARTMENT ADAPTATION IN SAO PAULO, BRAZIL

ブラジル・サンパウロ市の集合住宅における住戸改造からみた SI ハウジングシステムに関する研究

*Marianne COSTA**, *Jiyoung JUNG***, *Hidekazu FUJIMOTO****
*and Hideki KOBAYASHI*****

コスタ マリアンネ, 丁 志 映, 藤本 秀 一, 小林 秀 樹

In Brazil, since informal and self-managed construction projects are compromising the individual and collective scale of multi-story apartment construction, this study aims to clarify the nation's support and infill (SI) system division, as well as its implementation requirements, in terms of housing demands, national laws, and the development level of the housing industry. To accomplish this, 16 remodeled apartments were examined and interviews were conducted with a number of Sao Paulo real estate developers and managers. The results showed the following: 1) self-managed adaptation is not only related to infill, but also to support level decisions; 2) local building legislation, condominium bylaws, and the available building systems are unresponsive to actual user demands and the decision-making processes.

Keywords: *Apartment Building, Support Infill System, Dwelling Improvement, Brazil*

集合住宅, SI ハウジングシステム, 住戸改造, ブラジル

1. Introduction**(1) Research Background and Purpose**

This study is based on Open Building concept¹⁾, and more particularly, on the SI System principle²⁾³⁾⁴⁾, which separates decision-making in a residential environment, according to a subsystems approach that distinguishes parts that should adapt according to the user's needs (Infill) and parts that should endure (Support). This basis has turned dwellings into user-oriented goods in Japan and could be restructured to bind benefits of industrial progress and new societal values in Brazil.

Currently, there is little background about Open Building in Brazil. The most closely related speculation was written by Brandao⁵⁾ as part of a study on apartment spatial flexibility, and by Nascimento *et al.*⁶⁾ in a study on the open building approach for social housing. Accordingly, there is little evidence on apartment adaptation towards Open Building notions.

In Brazil, multi-story dwellings have long been dismissed from housing programs as unable of providing decent home conditions for low-income people⁷⁾. Rather, innovative housing concepts have always first been experienced by high-income families⁸⁾. I.e., multi-story housing used to be a custom-built product for Brazilian higher income classes, even though such typology does not hold an elitist connotation in its origins.

Now, the structure and partitions of Brazilian apartments are primarily built with masonry because this method is inexpensive and meets the low-income housing demand. However, the technique offers low adaptability and unclear support and infill (SI) division. Furthermore, regardless of the household's income, most renovations are self-managed⁹⁾, and it should be noted that, even though remodeling regulations exist, condominium decision-making is typically organized in homeowners associations (HOAs)^{*1)}, and is thus usually managed by unskilled chairpersons (Law 4,591, 1964). Since such informal construction management have come to threaten the individual and collective scale of apartment buildings¹⁰⁾¹¹⁾, this study aims to clarify the SI system division in Brazil, as well as its applicability by observation of remodeled apartments.

(2) Research Questions

- 1) In Brazil, dwelling adaptation is commonplace⁷⁾¹²⁾. Are renovation purposes in Brazil different from those in Japan?
- 2) Brazil is not as earthquake prone as Japan¹³⁾, thus building policies can be less restrictive. Does this mean that Brazilian dwellers have more options and/or can remodel more often?
- 3) The recent growth of the Brazilian economy has been widely noticed and discussed in many aspects¹⁴⁾¹⁵⁾. How does this economic activity create opportunities for home adaptation?

* Grad. Stud., Department of Urban Environment Systems, Chiba University, M. Eng.

** Assist. Prof., Department of Urban Environment Systems, Chiba University, Ph. D.

*** Research Director, National Institute for Land and Infrastructure Management, M. Eng.

**** Prof., Department of Urban Environment Systems, Chiba University, Dr. Eng.

千葉大学大学院工学研究科建築 博士後期課程・工修

千葉大学大学院工学研究科建築 助教・学博

国土交通省国土技術政策総合研究所 研究室長・工修

千葉大学大学院工学研究科建築 教授・工博

(3) Housing Stock Classification and Urban Context of Sao Paulo

Throughout its history, Brazil's housing policies have emphasized the promotion of home ownership in formal markets as the best way of meeting the housing needs of the population, thereby assigning an inferior status to rental units¹⁶⁾. As a result, the housing stock Brazil is primarily owned, regardless of household income. Compared to the sum of detached dwellings, apartment availability is very low at metropolitan and national levels. Also, these apartments are concentrated in the city center and mostly belong to the upper-middle-class income population (Figs. 1 & 2).

Fig.1 National Housing Stock Classification¹⁷⁾

Fig. 2 Apartment Stock of Sao Paulo¹⁸⁾

Since the late 1980s, downtown Sao Paulo has been undergoing a renovation in order to keep it within the network of global cities. The renewal strategies have caused an increase in property values, resulting in urban gentrification. Hence, some groups are experiencing conflicts of interest between state, market, and popular classes, often relating to segregation and safety issues.

2. Survey Outline

This research is focused on remodeled upper-middle-class owned apartments in the center of the city of Sao Paulo (Table 1). Fieldwork activities were carried from July 11 to 31, 2012, as outlined in Table 2, with the help of two architectural students. Due to the social gap and urban issues already mentioned, Sao Paulo residents are very suspicious of outsiders. Thus, the investigation was built on observations of 16 remodeled homes selected through snowball sampling (friends referring to friends). Even though the representativeness of the samples could be questionable, it could be assumed that the data had little bias, as shown in Fig. 5, which confirms a user stratification profile that is similar to the national level, as is shown in Figs. 1 and 2.

Table 1 Samples: 10 condominiums; 16 adapted units

Code	Location	Year	Area (m ²)	Plan	Obs.
1.MG	Pinheiros	1970	120.60	3LDK	5
2.MR	Moema	1973	102.64	3LDK	1
3.IS	A.Pinheiros	1975	143.03	3LDK	3
4.PM	Jd.Paulista	1976	188.70	4LDK	1
5.IC	V.Olimpia	1983	62.54	2LDK	1
6.GE	V. Madalena	1986	129.36	4LDK	1
7.MV	V. Madalena	1987	123.42	3LDK	1
8.RI	Moema	1987	125.33	3LDK	1
9.MQ	Itaim Bibi	1991	61.49	1LDK	1
10.ST	Santana	1999	83.32	3LDK	1

Table 2 Survey Outline

Schedule	2012/07/11-17	2012/07/18-22	2012/07/23-31
Purpose	background info.	preparation work	observation
Subjects	3 developers; 2 furniture makers; 1 manager	research team intro. floor plans at city hall	16 apartments (10 condominiums)
Activities/Docs	interviews, booklets, flyers, etc.	condominium floor plans, legislation, etc.	interviews, photos, videos, sketches, etc.

3. Management of Adaptations in Apartment Buildings

Several agents make up the contemporary real estate market and handle all work related to the production and adaptation of multi-story dwellings in Brazil. Based on previous studies and interviews with company agents in Sao Paulo⁸⁾¹⁹⁾, adaptation management could be classified into the before and after key delivery stages (Fig. 3).

Fig.3 Management of Adaptations and Key Agents (by the author)

(1) Adaptations before Key Delivery (custom construction)

Company interviews revealed that adaptation management before key delivery is based on pre-set design options, from which the dweller can choose the floor plan layout (free of charge) and finishing options, such as flooring, tiling, basin, toilet, and sink (with additional fees).

(2) Adaptations after Key Delivery

Although most works are self-managed after key delivery, some contracts include professional management. For our upcoming analysis, after key delivery adaptations were classified by the engagement of technical expertise relating to the design, building, or on-site management stages (Table 3).

Table 3 Management Methods According to Contract Type

Contract	Design	Building	Management	Method
DIY	Dweller	Dweller	Dweller	Self-Management
B	Dweller	Contractor	Dweller	
DB	Designer/Contractor	Contractor	Dweller	
BM	Dweller/Contractor	Contractor	Contractor	Professional Management
DBM	Designer	Contractor	Contractor/Designer	

4. Sampling Characterization

(1) Household's Profile

Of 16 households observed, 15 are owned, and one is rented. Nuclear families purchased 10 of the owned units. These families, however, have matured or developed into other arrangements and now are equally distributed into four major family structures. Buildings age from 23 to 44 years, and years of residence vary from 2 to 41. Unit areas vary from 61.5m² to 188.7m², and the number of dwellers per unit ranges from 1 to 5 people (Table 4).

Table 4 Households Profile

Sample Code	Move- in	No. of Adapt.	Tenure	Family Structure		No. of Dwellers		Household Income
				Original	Current	Original	Current	
MG1	N/A ⁽³⁾	1	Owned	Nuclear	Nuclear	4	3	High
MG2	1973	1	Owned	S.Mother	Single	3	1	Lower Middle
MG3	1990	3	Owned	Nuclear	Couple	4	2	Upper Middle
MG4	2006	1	Owned	Nuclear	Nuclear	4	4	Upper Middle
MG5	N/A ⁽³⁾	1	Owned	Single	Single	1	1	Lower Middle
MR1	2007	1	Owned	Couple	Couple	2	2	High
IS1	2011	1	Rented	Nuclear	Nuclear	4	5	Upper Middle
IS2	2010	1	Owned	S.Mother	S.Mother	5	4	Upper Middle
IS3	1993	5	Owned	Nuclear	S.Mother	5	4	Upper Middle
PM1	1999	1	Owned	Nuclear	S.Mother	5	3	Upper Middle
IC1	2012	1	Owned	S.Mother	S.Mother	2	2	Lower Middle
GE1	1986	3	Owned	Nuclear	Couple	3	2	Upper Middle
MV1	1988	3	Owned	Nuclear	Nuclear	5	5	High
RI1	1988	3	Owned	Nuclear	Couple	4	2	Upper Middle
MQ1	2009	1	Owned	Single	Single	1	1	Lower Middle
ST1	1992	4	Owned	Nuclear	Single	5	1	Lower Middle

N/A: Not Available;

S. Mother: Single Mother

Income per Monthly Wage⁽⁴⁾

See Figure 5

Still, according to interviews, 50% of the householders were temporary residents. Within households with permanent purpose, the reason for moving in was primarily associated with relationship enhancement, such as having a larger space to raise children, or to be near the householder's parents. In turn, within households with temporary aspect, the reason for moving in was more associated with evading a previous condition, i.e., personal independence, changing jobs, or departing from other neighborhoods for safety reasons (Fig. 4).

Fig.4 Household Condition and Purpose

The dwellers were mostly between 30 to 59 years old (16 people), followed by elderly persons aged 60 years or older (10 people). Nine cases consisted of prior residents that had grown up, divorced and moved out, or passed away, indicating households' maturity. Based on monthly income, these families could be split in three groups⁽⁴⁾: high, upper-middle, and lower-middle (Fig. 5).

Fig.5 Households Income Classification

(2) Original Floor Plan Features

The model used for most contemporary Brazilian dwellings is based on the 19th century bourgeois concept of three parts: social, service, and personal⁽⁵⁾. The sampling showed typical floor plans, mainly built with three-bedrooms, one of which is a suite. The suite comprises of a master bedroom, often larger than the others, and a private bathroom. Additionally, the presence of the maid's room indicates another bedroom and bathroom set. Thus, the standard of a dwelling unit is better reflected in the number of bathrooms. The largest samples IS, PM, GE, MV, and RI, with over 120 m², have up to 4 or 5 bathrooms (Table 6).

5. Dwelling Adaptation Analysis

(1) User's Needs and Renovation Purposes

Observations revealed that the first adaptation is often related to assigning territory during the move-in stage and includes customization of interior components, such as furniture, bath & kitchen equipment, fixtures, and cladding. Later, motivations could include family needs, such as adapting rooms to receive new family members, or repurposing empty rooms after one has moved away. However, in general, the main need is renovation and maintenance, primarily for interior cladding, bathroom and kitchen equipment, and home furniture (Fig. 6 & Table 5).

Fig.6 Adaptation Stages and User's Motivations

Table 5 Summary of Dwelling Adaptations and Management Methods

Sample Code	I Service Lines	II Dwelling Expansion	III Exterior Cladding	IV Balcony Enclosure	V Exterior Fixtures	VI Interior Partitions	VII Interior Cladding	VIII Interior Fixtures	IX Bath & Kitchen	X Home Furniture
MG1	B				B	DB	B	DB	B	DB
MG2	B				B	B	B	DB	B	DB
MG3	B	DBM	DBM	DBM	DB	DB	B	DB	B	DB
MG4	B				B	B	B	DB	B	DB
MG5	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM
MR1	B						B	B	B	DB
IS1					DBM	DBM	DBM	DBM	DBM	DBM
IS2	DBM				DBM	DBM	DBM	DBM	DBM	DBM
IS3	BM					BM	BM		BM	DB
PM1	B				BM	BM	BM	BM	BM	DB
IC1					B	B	B	B	B	DB
GE1		B		B	B	B	B		B	DBM
MV1	DBM					B	DBM	DB	B	DBM
RI1	B		B			B	B	DB	B	DB
MQ1	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM	DBM
ST1	B	B				DBM	DBM	DB	B	DB

*D-B-M: see Table 3 ■ Self-Management: ■ Professional Management;

Table 6 Apartment Adaptations Before and After (1-2)

<p>MG1 Before After</p> <p>Remodeling Information I) Electricity, gas, plumbing; V) E (door), all windows; VI) LD, K, M, W3; VII) All rooms (tiles, wood, plaster); VIII) All rooms (doors replaced); IX) W1 (bathtub removed), W2, K; X) K, R1, R2, R3, C;</p> <p>Home-Theatre (HT) Kitchen (K)</p>	<p>MG2 Before After</p> <p>Remodeling Information I) Plumbing; V) E (door), R1, R2, R3 (windows); VI) K, M; VII) K, S, W1, W2, HO (tiles, wood, plaster); VIII) K, S, HO; IX) K, W1, W2; X) K, HO;</p> <p>Kitchen (K) Home-Office (HO)</p>
<p>MG3 Before After</p> <p>Remodeling Information D) Gas, plumbing II) L, R3; III) L, R3; IV) L, R3; V) E, B; VI) LD, K, M, C; VII) K, W1 (tiles); VIII) W3; IX) W1; X) K, R1, R2, R3, HO;</p> <p>Living Room (L) Home-Office (HO)</p>	<p>MG4 Before After</p> <p>Remodeling Information I) Plumbing; V) E (door), all rooms (windows); VI) M, W3, C; VII) All rooms (tiles, wood, plaster); VIII) All rooms; IX) K, W1, W2; X) K, R1, R2, R3, HT;</p> <p>Master Bedroom (R1) Home-Theatre (HT)</p>
<p>MG5 Before After</p> <p>Remodeling Information I) Electricity, gas, plumbing; II) LD; III) LD; IV) LD; V-X) All rooms; Note: This sample was completely demolished and rebuilt, and was observed during construction.</p> <p>Living Room (L) Bathroom 1 (W1)</p>	<p>MR1 Before After</p> <p>Remodeling Information I) Electricity, plumbing; VII) S (plaster ceiling removed); VIII) K (window), All rooms (door handles replaced); IX) W1, W2; X) K, HO;</p> <p>Kitchen (K) Bathroom 2 (W2)</p>
<p>IS1 Before After</p> <p>Remodeling Information V) All rooms, except W (windows); VI) D, K; VII) All rooms (tiles, wood, plaster); VIII) All rooms (doors); IX) K, W1, W2; X) K, R1, R2, R3, M, S, E;</p> <p>Home Theatre (HT) Entrance (E)</p>	<p>IS2 Before After</p> <p>Remodeling Information I) Electricity, plumbing; V) All rooms (windows); VI) LD, K, R3, S; VII) All rooms (tiles, wood, plaster); VIII) All rooms (doors); IX) K, W1, W2; X) K, R1, R2, R3, A;</p> <p>Kitchen (K) Laundry (S) & Atelier (A)</p>

I)serv.lines; II)d.expansion; III) ext.cladding; IV)balcony enclosure; V)ext.fixtures; VI) int.partitions; VII)int.cladding; VIII)int.fixtures; IX)bath & kitchen equip. X)furniture

Table 6 Apartment Adaptations Before and After (2-2)

<p>IS3 Before After</p> <p>Remodeling Information I) Plumbing; VI) L, D, M; VII) All rooms (tiles, wood, plaster); IX) K, W1, W2; X) HT, HO;</p>	<p>PM1 Before After</p> <p>Remodeling Information I) Electricity, gas; V) All rooms (windows); VI) K, W2, W3, W4, W5, M1, M2; VII) All rooms (tiles, wood, plaster); VIII) All rooms (doors); IX) K, W1, W2, W3, W4, W5, W6; X) All rooms;</p>
<p>IC1 Before After</p> <p>Remodeling Information V) All rooms (windows); VI) K; VII) All rooms (tiles, wood, plaster); VIII) All rooms (doors); IX) K, W1, W2; X) K, R1, R2;</p>	<p>GE1 Before After</p> <p>Remodeling Information II) B; IV) B; V) B; VI) E; VII) K, W1, W2, W3, S (wall tiles, plaster); IX) K, W1, W2; X) K, R1, R2, R3, R4;</p>
<p>MV1 Before After</p> <p>Remodeling Information I) Fireplace removed, plumbing; VI) R4; VII) All rooms, except LD (tiles, wood, plaster); VIII) R4; IX) W1(bathtub removed); X) R2, R3, R4;</p>	<p>RI1 Before After</p> <p>Remodeling Information I) Gas; II) Entrance hall (floor tiles); VI) LD, K, R1, W3, W4; VII) All rooms, except LD (tiles, wood, plaster); VIII) All rooms (door handles); IX) K, W1, W2, W3; X) D, K, R2, R3, C;</p>
<p>MQ1 Before After</p> <p>Remodeling Information I) Electricity, plumbing; II) B, T; III) B, T; IV) B, T; V) All rooms (windows); VI) R1; VII) All rooms (tiles, wood, plaster); VIII) All rooms (doors); IX) K, W1; X) All rooms;</p>	<p>ST1 Before After</p> <p>Remodeling Information I) Plumbing; II) W4; VI) M, R3, W3; VII) All rooms, except K (tiles, wood, plaster); VIII) All rooms; IX) W4; X) S;</p>

L(living); D(dining); K(kitchen); R(bedrooms); W(bathroom); HO(home-office); HT(home-theatre); B(balcony); A(atelier); S(laundry); M(maid's room); T(terrace); P(penthouse)

(2) Maid's Room on the Way to Extinction

Dwelling adaptations were not only due to family dynamics; there was also social change. Specifically, it was noted that the maid's room had been removed from 11 of the 15 samples^{*5)} (Table 6, MG1~5; IS2; IS3; PM1; MV1; RI1; ST1), and it was judged essential to study the reasons and effects for this particular adaptation. Those maid's rooms that remain as originally planned could be explained by two reasons: either the maid still lives with the family (IS1), or the room is left when contiguous to a toilet or laundry room (MR1, IC1, GE1). The adaptations could be split into two cases: demolition to expand adjacent rooms or renovation for functional change (Fig. 7).

Fig.7 Maid's Room Adaptation

For most of its national history, Brazilians have been accustomed to an abundant domestic work force. Even before the abolition of slavery in 1888, it was commonplace for people from all races to migrate from the countryside to the cities in hopes of finding work with wealthy families, and thus escape poverty. The market for maids remained dependent on the unequal income distribution over various Brazilian regions and the numbers of uneducated people. These factors ensured a constant supply of people willing to work for very low salaries, enough to fit the budgets of middle-class families (Fig. 8).

Fig.8 Domestic Labor Wage Compared to Others, Sao Paulo²⁰⁾

Fig.9 Relative Income Class Distribution in Brazil 1995-2011¹⁷⁾

However, in the past decade, Brazil's professional classes have burgeoned and the lower-middle class has been growing. (Fig. 9). This has reduced the availability of cheap labor for domestic hires, and the maid's room design itself has come to be seen as reflecting obsolete values. As families stopped hiring servants, maid's rooms became available for other purposes. However, it should be noted that the room size is often not appropriate for some activities, and the maid's bathrooms, which is always paired with such rooms, might require pipe relocation^{*6)}. As a result, depending on the layout, these tiny rooms are sometimes left idle or are simply utilized for storage.

(3) SI System Division through Analysis of Individual Decisions

In order to clarify SI system division in Brazil, we examined the range of individual decisions within different building levels. As a result, via fieldwork data analysis, several adaptation types were identified and classified as shown in Table 7.

Table 7 Adaptability According to the SI System Division^{*7)}

SI Div.	Subsystem	Decision-making	Components	Adaptability
Support	Base Building	None	Columns, beams, foundations	Fixed
	Common Level	Collective decision (HOA agreements)	Waterproofing, ext. walls and cladding, elevators	Adaptable
Infill	Boundary Level	Individ. decision according to rules	Window frames, entrance hall, doors, balconies	Adaptable
	Interior Level	Individual decision	Partitions, cladding, fixtures, furnit. equip.	Adaptable

Figure 10 shows the rate of different dwelling adaptations in the 16 samples. According to the SI system theory as well as the Civil Code of Brazil^{*8)}, adaptations on the left side of the chart should be more related to collective decisions, while adaptations on the right side should be more related to individual decisions. However, our observations have shown that all adaptations were the result of individual decisions.

Fig.10 Adaptation Works According to SI System Division

(4) Gray Zone of Decision and Policy Incompatibilities

Although condominium management policies in Brazil suggest a decision-making pattern similar to the SI system division, they are incompatible with the actual building process. For instance, partition elements should belong to the interior level and should be freely arranged according to individual decisions. Though, it is mainstream in Brazilian dwelling construction the use of load-bearing walls as partitions, with the same body of independent walls causing ambiguity between structural and non-structural parts. Therefore, a permit is necessary before partitions can be demolished.

Also, balcony enclosures are generally considered illegal because they can be seen as an addition of floor area. It is important to note that a balcony enclosure might include one or more of the following actions: (1) installation of an exterior glass sash; (2) removal of an interior glass sash; and (3) placement of floor cladding with the same material and height as the dwelling interior. Thus, the sum of (1) and (2), and/or (3) implies a dwelling expansion via modification of common level components, which would be considered illegal. But, in the case of (1) only, individual decision-making could be legal, if guided by common rules, as the originally proposed SI division. Hence, by confronting theory (SI

division, legislation) and practice (actual construction methods), it could be assumed that interior partitions, exterior fixtures, balcony enclosures, and exterior cladding are within a gray zone between individual and collective decision-making (Fig. 10).

(5) Self and Professional Management Analysis

To assess the informality of the dwelling adaptation market, we investigated the involvement of technical expertise in SI adaptation. Adaptation management methods were arranged according to the contract type (Table 3). Then, through interviews, rates were established for each adaptation type. It is important to note that in samples (MG1), (IS1), (IS2), and (MQ1), the adaptations were overseen by a family member that was qualified in the construction sector. These cases were classified as design-building-management contract instead of do-it-yourself. The results revealed that the involvement of experts is more related to the common level (Fig. 11).

Fig.11 Support and Infill Adaptation Management

Note that support adaptations generally require technical expertise, but that our samples include cases of self-management at this level. It could be assumed that it may be difficult to hire a professional to handle these adaptations, since they are mostly illegal.

(6) Industrialization of Infill Components: Furniture

Depending on the production method, furniture could be classified into six types (Table 8):

Table 8 Furniture Production Classification

Production	Definition
DIY	Made and assembled by the dweller
Self-Assembly	Standard goods bought in parts to assemble (ex.: IKEA®)
Full Custom	Made according to individual specifications (Made-to-order)
Semi-Standard	Standard parts combined to custom made parts attend individual specifications (ex.: Furniture Makers in Brazil)
Custom Assembly	Standard parts assembled according to individual specifications (ex.: System Furniture)
Standard	Standard parts and assembling in general
Built-in	Built to be a permanent part of the building

Considering the bedrooms and kitchens of the units visited, we found that most furniture was custom-made, semi-standard, or built-in (Fig. 12). In the case of bedroom design, built-in furniture is more popular. Among these, there were seven cases where the furniture had later been adapted by carpenters.

Fig.12 Bedroom and Kitchen Furniture Sampling

In the case of kitchen design, custom-made furniture was predominant, but semi-standard furniture is also very popular and different results can be obtained by including samples of other income strata. In semi-standard kitchens made in Brazil, furniture is usually roughly prefabricated in modules for later assembly. For instance, cabinet tops are often made of marble, thus requiring an on-site measurement, after the assembly stage, to provide a perfect fit. DIY and standard furniture are also popular in Brazil, but could not be found within these samples examined, probably because of the dweller age and income levels. However, self- and custom-assembly are not popular. Taken together, the market profile for furniture suggests a low level of industrialization that is highly dependent on skilled carpentry work.

6. Conclusions and Recommendations

(1) Regarding Home Adaptation in Brazil and Japan

The findings of this research revealed that the renovation purposes in Brazil are more related with the need for demarcating the family's territory during the move-in stage, and the need for preserving a home identity as the dwelling evolves along with the families' status.

Moreover, from the decision-making perspective, Japan's emphasis on safety prevents balconies from being remodeled for individual purposes. In the case of Brazil, however, even though there are laws governing the renovation of building boundaries, they do not always match the actual decision-making code enforced in condominiums. Since such laws are not being enforced, it could be assumed that the government is simply denying existence of any problem and is transferring related responsibilities to the dweller. Government oversight of balcony enclosures as a means to enable dwelling expansion could be seen as way to maintain a level of control in the process, and thus retard problems that might result from an excessive level of informal management, thereby ensuring safer adaptations.

Finally, the infill industry in Brazil shows clear signs of progress. However, the finishing parts still include a high amount of handcraft work within a scheme of coexistence of prefabrication and on-site construction. This could be explained by the remaining income gap that keeps the construction workforce affordable for members of the upper-middle class that live in apartments in the metropolitan area of Sao Paulo.

(2) Recommendations for Open Building Implementation in Brazil

Our observations on adapted apartments in Sao Paulo suggest that the Open Building concept should include flexible boundaries, with flexible facades, and pre-set design patterns, and should be implemented in a way that permits dwellers to enjoy decision-making freedom beyond the inner space of their homes while keeping condominium rules (Table 9).

Table 9 Support Infill System according to Sao Paulo ^{*7)}

	Support		Infill	
4 parts	Base Building	Common Elements	Boundary Elements	Interior Elements
Examples	Columns, beams, foundations	Waterproofing, exterior walls, cladding, elev.	Window frames, entrance hall, doors, balconies	Partitions, int. cladding, fixtures, furnit. & equip.
Life Span	Long		Short	
Space Use	Common		Private	
Concern	Collective			Individual
Decision Making	Small works: syndic Large works: HOA		Dwellers under common rules	Dwellers

However, even though the management of boundaries and common elements in multi-story dwellings is covered by Brazil's national laws, the relationship between individuals or user groups within these boundaries may vary depending on the region. For instance, climate differences between the north and south of the country may implicate a different user relationship with balconies. Therefore, it is recommended a review of local building policies regarding the definition of boundaries and common elements be conducted. This way, the SI system could be used to prevent building and management problems, improve the quality of living, and assure longer life spans for residential buildings in Brazil. Moreover, in order to help build a housing system that will include a wider group of users, future works should consider other income groups, embrace a larger amount of adapted apartment samples and/or detached dwellings, and should cover the nation's five climatic subtypes.

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Notes

- *1) According to Brazilian law (Civil Code, Art. 1331-1356; Condominium Act, law. 4191/1964), condominium management is led by a Syndic (chairperson) and an advisory board of three members elected among the householders. Management guidelines are set by the condominium Convention (master deed) and Bylaws (HOA document). Decisions are made during committee meetings, with the approval of a quorum fixed by condominium convention.
- *2) A gourmet kitchen in Brazil is understood as a concept that involves integration with living and dining rooms, with the purpose of turning the act of cooking into a social event. Often related to high-income users, it does not replace the everyday kitchen.
- *3) The homeowners were absent. The maid of (MG1) and the neighbor of (MG5) kindly hosted our visit.
- *4) Monthly Wages in Brazilian Real (BRL) were converted to US dollar exchange value in Brazil at the moment of the survey and classified according to the World Bank Atlas income division of 2013.
- *5) Sample MQ1 does not have a maid's room in its original plan.
- *6) Typical buildings in Brazil have mechanical fixtures, wiring, pipes, and ducts embedded into the load-bearing structure. This makes pipe relocation or renovation difficult because the components are assembled with no regard to their different life cycles and/or the functional purposes in the building. Such as, bathroom pipes are built within cavities inside the bricks, covered with a layer of concrete, and then another layer of ceramic tiles. As a result, it is basically impossible to replace one component without disturbing its relation with other components, or demolishing them all completely.

*7) Adapted from: Japan. Ministry of Land, Infrastructure, Transport and Tourism: Skeleton Infill Housing, Skeleton Infill Bulletin, 2003.

*8) According to the Civil Code of Brazil, Art. 1,336, of the duties of condominium dwellers are as follows: I) To contribute to condominium expenses, according to their shares of the property; II) To refrain from any construction work that could compromise the building safety; III) To refrain from modifying the facade shape and color, as well as its parts, and exterior frames; IV) To maintain the original purpose of the building and refrain from using it in any way that would disturb peace, health, safety, and morality of others.

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1. はじめに

ブラジルでは、中所得者向けマンションでもプールなどの共用施設が充実している点が特徴であり、1990年代以降はますますその傾向を強めている。マンションの住戸改造においては、入居者自身が内容を決めて工事のみ職人に発注するセルフ・マネジメント方式（自己発注方式）が一般化している。そのため、改造時に構造壁を破壊してしまう例が多数存在する。そこで本研究では、サンパウロ市の集合住宅における住戸改造実態を把握し、スケルトンとインフィルの区分と住戸改造に対する住要求について明らかにすることを目的とする。

2. 調査概要

サンパウロ市中心部の中高所得者向けのコンドミニアムを対象に、住戸改造の経験がある10団地16住戸の調査を行った。住戸の改造内容および方法、管理規約上のルールなどについての居住者へのヒアリング調査、実測による図面作成、住戸と団地内のカメラ撮影などを行った。また、新築時の個別対応および工事内容などを把握するため、マンションのディベロッパーにヒアリングを実施した。調査期間は、2012年7月11日から31日までである。

3. 調査結果

3-1. 新築段階の個別対応

ブラジルの建築制度は日本に比較的近かった。建築許可を取得後にマンション販売が行われ、販売と並行して建築工事、インフィル工事へと進んでいた。完了検査後に入居と登記という流れになる。引渡し前は、カスタム建設と呼ばれ、ディベロッパーがセミオプションとして簡易な個別対応のメニューを提供し、住人はその中から間取りと内装の仕上げなどを選択することができる。引渡し後は、セルフ・マネジメント方式によって対応することが多かったが、特に各業者との契約タイプによってマネジメントの対応が異なることがわかった（表3）。

3-2. 事例住戸の属性

調査対象の居住期間は、2～41年で幅広く、築年数は23～44年であった。また、住戸面積は61.5～188.7㎡であり、世帯数は1～5人であった。対象世帯の半数は定住を希望しており、その主な理由としては、子育てのための広い空間、義理の母親との近居などが上げられていた。

住戸の間取りは、3室部屋のタイプが60%を占めており、主寝室にはバスルームが付いていた。また10事例ではメイドの部屋が別途に設けられていた。

3-3. 住戸改修の特徴

①メイド部屋の変更と理由

メイド部屋があった11事例の全てに、メイド部屋の用途がなくなっていた。その理由としては、今は常駐するメイドがいなく、部屋が小さくトイレとベアになっているために、通常の家族のための居室として使用できず、SOHO、ホームシアターなどの多目的な空間へと変更されていた。しかし、限られた大きさのままで、貯蔵室または未使用の空間のままで残っている事例もあった。

②バルコニーの改修と意思決定

室内改修は一般的であり、さらに、一部ではバルコニーの簡易な室内化がみられた。ただし、景観に影響しない範囲で透明ガラスを入れる程度であり、目立つ窓枠やカーテンを設置すると法律上室内とみなされるため容積率オーバーになっている。このため、そのような改造は原則として禁止されていた。

③セルフ・マネジメント方式

入居後の個別対応は広く行われており、壁のペンキ、床の仕上げ材の変更は一般的であった。また、その方法として、セルフ・マネジメント方式が多かった。この傾向は収入にかかわらず同じであり、手間をかける習慣が広く定着していると考えられる。

④家具の工業化

事例での家具作りは、寝室では造り付け家具が10事例で最も多く、キッチンカスタム・メイドが12事例で最も多かった。ブラジルではDIYや既製品が一般的に普及されていることから、これらの結果は、今回の調査対象の所得や年齢が影響を与えていると考えられる。

4. まとめと課題

ブラジルでは、インフィル部においてある程度まで工業化が進みつつも、住宅部品は質が悪いものとみなされ普及は限定的であることがわかった。その品質向上が課題であろう。また、SとIの区分が不明確な中で自己発注方式が一般化しているため、改造時に構造壁を破壊してしまう例が存在することがわかった。このような危険行為の改善のためにSI概念の定着が求められ、ブラジルに適したSI区分について提示した。

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