

Furniture Design Of Condominium Tenants In China Based On Modular System Case Study Of Public Condominium In Chongqing

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ABSTRACT

Since the implementation of the Public Rental Housing Policy in 2010 and when the state is vigorously developing the construction of public rental housing, public rental housing has become an important part of the housing of low-income people. This has greatly improved the living conditions of urban groups with housing, but due to the relatively compact area of public rental housing and the limited economic income of tenants, the problem of difficult renting still exists. Therefore, the furniture is very difficult to buy the suitable furniture in residential areas. The research objectives of this paper is to design the furniture design suitable for the tenants of public rental housing in Chongqing by using the principle of modular system. Its research method is to study the characteristics and combination mode of modular furniture through the modular theoretical analysis, the tenant situation data research and the qualitative analysis method. The research scope is the existing public rental housing in Chongqing, and the typical communities are selected for specific analysis.

The results of the research found that the use of modular system furniture design is more suitable for the characteristics of public rental housing tenants. This paper use modular system to build furniture and make a demonstration of Furniture design. In the public rental housing model in Chongqing, the modular furniture is small, flexible, recyclable, replaceable and easy to transport, which can well meet the needs of tenants for public rental housing

Keywords: Public Rental Housing; Modular System; Furniture Design

INTRODUCTION

When Chinese authorities began investigating public rental housing in 2007, they hoped to "explore housing problems for college graduates and other newly employed people" through public rental housing. For the "sandwich layer" group who cannot rent low-rent housing and cannot buy affordable housing, the government builds, rents below the market rent, and can live steadily for a long term, providing affordable housing for this blank. The "sandwich layer" refers to the college graduates and newly employed workers and stable employed workers in urban.

According to the policy of public rental housing, the public rental housing only provides housing security for eligible families in the form of rent, and provides transitional housing solutions for the

insured objects, with a short lease term, generally less than five years. The rent standard is determined by the principle that the rent level is slightly lower than the housing market in the same lot. Public rental housing has been simply decorated, and the lessee only needs to add furniture and electrical appliances. The indoor space of public rental housing is relatively compact, The area below 60 m² covers more than 85%, among which 35m²-60m² is the largest proportion. On the choose and purchase of furniture product, the limitation of size leads that room space cannot be used reasonably so this narrow space loses storage function. There is multi-functional combination furniture on the market, but these furniture is generally expensive, beyond the economic affordability of tenants. The research of

indoor furniture in public rental housing is the key to solve the actual living problem of tenants. As the earliest and most mature city in the development of public rental housing in western China, Chongqing has made outstanding achievements in both policy formulation and rent pricing. Public rental housing has even become another name card of Chongqing. (Xu Liu , 2012) its construction and operation mode has certain reference value. In just a few years, the construction of public rental housing in Chongqing has made remarkable achievements, with its unique "Chongqing model".(Hao Long , 2011) According to the data survey, Chongqing is one of the cities with the largest number and the most mature public rental housing projects, and it is the representative city of public rental housing projects. The existing space and demand of public rental housing in Chongqing were selected for research, and the furniture design was discussed by modular methods and data analysis.

RESEARCH OBJECTIVES

The furniture design of public rental housing tenants in China is discussed based on the modular system

LITERATURE REVIEW

I. Modular Furniture

Modular design is both a way of thinking and a new design method, which has been widely used in the production of industrial products. Modular

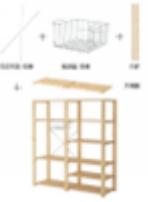
products are composed of functional modules. Compared with traditional products composed of parts, modular products are combined structure rather than integral structure, easy to disassemble and assemble, and can meet the needs of multi-functional functions through multiple combinations of modules. (Cao Saini, Zhu Jiangang, Tan Xuan, 2019(40)) Different from the bottom-up design method adopted in the traditional product design, the modular design method is more diversified and complex. Modular furniture products not only divide the parts of the product, but also analyze the function of each module based on the function of furniture. So that each module can maximize its own function, and to achieve the functional superposition by a variety of combinations.

2 Combination Mode of Modular Furniture Design

The modular design should firstly divide the modules according to their classification. The combination of modules and modules determines the basic framework of the later product production, so the combination of each modules in the product should be divided before the design of the product structure. There are several main ways to combine the modules:(1) laminated type; (2) nested type; (3) frame type; (4) mounting type; (5) plug type. (Huang Jiachen, 2018)

Table 1: Modular combination of furniture

Compound Mode	Furniture show	Characteristic
Laminated Type		Stacking modules with relative functions is the direct accumulation between module units. This combination is relatively simple to split, which can quickly realize the disassembly of complete household products into parts or several parts, which is convenient for handling and later maintenance after purchase.
Nested Type		Assemble different modules into one class of modules to form products. It belongs to the system of plug-in module and cabinet class. Highlights in the internal plug-in can have multiple replacement methods, users can freely choose the internal structure of the product according to the needs.

Frame Type		It is composed of rod frame and plug-in module (including mesh, wood, etc.). Different types of plug-in modules can be selected according to the needs of consumers to expand the functions of the product.
Mounting Type		Several kinds of modules with different structure and appearance are assembled in the form of assembly. Advocate the combination between modules, its composition of products have a variety of shapes.
Compound Mode	Furniture show	Characteristic
Plug Type		The functions of the interior are adjusted to form new furniture products. In contrast to nested composition, it combines box plug-ins with separate capabilities in an externally connected manner. The products formed in this way are varied and convenient for installation, disassembly and maintenance.

3 Type of Furniture Base Module

Construction

The optimizing design of structure, interface and module parameters is the first step of the furniture module establishment, and then the designed modules are stored into the module library, and classified, and the divided modules are designed

and updated. All forms are composed of the element such as point, line, surface, body, furniture is no exception also. (Feng Xia, 2013) Through the study of modern modular furniture, the modeling elements of single parts are summarized into the following three forms:(1)Line type; (2)Plane type; (3)Block type.

Table 2: The components of the module

Compound mode	Furniture show	Characteristic
Line type		Furniture combined with line pieces. The line can be divided into straight line and curve, different line can shape a different furniture style, straight line is hard, strong, the curve is smooth, dynamic. Line commonly appears as basic part in combination furniture.
Plane type		Furniture combined with plane pieces by bending or cutting, let the surface material become the basic module of different shapes. It can be either regular or irregular. The plane type is mostly used in the combination furniture such as table case, cabinet frame and bed couch.
Block type		block type is the most form in combined furniture. "block" includes all geometric objects with a volume. sphere, cube, cuboid, and other simple geometry are more common but also petals, trees and other bionic bodies. They are thick and stable, so they not only exist in the form of simple parts, but also often appear as

		functional modules or furniture units with independent functions.
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METHOD

The research steps of this paper are as follows:

1. Summarize the theory of modular furniture, and the characteristics of the structure and combination of modular furniture.
2. Four mature public rental housing communities in Chongqing were selected to conduct data research on tenant characteristics and public rental housing space.
3. Analyze the tenants' demand for furniture according to the survey results.
4. Select a set of public rental housing in Chongqing and use the modular theory to display the basic modules of furniture in different combinations.
5. Through different combinations of basic modules of furniture, different furniture of sitting and lying, by chair and storage categories can be changed, which can basically meet the needs of tenants for furniture.

This paper used the method of questionnaire, chose four built longer public housing communities, "Min Xin Jia Yuan" in Yuan area "Kang Zhuang Mei Di" in Da Zhu Lin area, "Fu An Hua Fu" in Hua Yan area, "Cheng Nan Jia Yuan" in Nan An

area the four communities had been put into use, development is relatively mature. A total of 400 questionnaires were distributed in the four public rental housing communities, and 391 were collected, of which 364 were valid questionnaires, with an effective recovery rate of 91%. Eight of them were in-depth household visits.

1. Research on public rental housing types in Chongqing Tenants: 8.5% of the respondents have only a single room, one-bedroom for 45.3%, two-bedroom for 33.2%, and three-bedroom for 14%. Area of public rental housing: the construction area of 30-40 m² accounts for 14%, 40-50 m² for 36%, 50-60 m² for 24.2%, 60-70 m² for 15.7%, over 70 m² for 10.1%. For the largest proportion of one room, one hall and two rooms and one hall.
2. Research on the basic characteristics of tenants and furniture needs of public rental houses Among the 364 valid questionnaires, the basic information of the public rental tenants surveyed is found in the form below. Statistics on the overall sample of the first part of the questionnaire, and analyze the group characteristics of the effective samples based on the basic information of the respondents:

Table 3: Basic information of tenants

Characteristic	Category	People Counting	Proportion
Crowd	Recent graduate	13	7.75%
	Migrant workers	105	61.24%
	Local people without houses	53	31.01%
	Special imported talents	0	0.00%
Age	16-25 years old	19	10.85%
	26-35 years old	69	40.31%
	36-45 years old	41	24.03%
	46-60 years old	31	18.06%
	More than 60 years old	11	6.20%
Family Structure	single	11	6.75%
	couple	41	24.25%
	A family of three	63	37.00%

	three generations under one roof	32	19.00%
	others	24	14.00%
Education	Junior high school or below	56	33.00%
	senior high school and technical secondary school	63	37.00%
	junior college	32	19.00%
	regular college	15	9.00%
	Graduate Student	5	3.00%
Household Income	below 1500 yuan	36	21.00%
	1500-3000 yuan	94	55.00%
	3000-5000 yuan	36	21.00%
	more than 5000 yuan	14	8.00%
Household Expenses (In addition to rent)	below 800 yuan	21	12.00%
	800-1200 yuan	51	30.00%
	1200-2000 yuan	51	30.00%
	2000-3000 yuan	31	18.00%
	more than 3000 yuan	17	10.00%

RESEARCH RESULTS

Taking the existing public rental housing type in Chongqing as an example, modular furniture is displayed and applied in its space. Through the combination of three basic modules, the overall construction of three basic types of indoor board furniture of public rental housing with reference, sitting and storage is completed (Figure 1 General plan of public rental housing):

- 1 .Project Location: Minxin Jiayuan Community (two bedrooms and one living room), Yuanyang District, Chongqing
2. Project area: 69.7 m²
3. Design object: public rental housing tenants
4. Design content: modular (board-type) furniture
5. Furniture material: particleboard



Figure 1: Two rooms and one hall floor plan; Furniture layout plan

Source: Xi chen 2022

From Figure 1 that the size and placement of furniture in each space are reasonable, which can adapt to the characteristics of small public rental housing. In the case of insufficient space, furniture design can increase a lot of storage space to reduce the impact of sundries on space fluency. The basic

module ABC can be combined in the living room to be: tea table (module B + module C) and TV cabinet (superposition of module C). Sitting and lying home has: double sofa (module A), low bench (module B).With: multi-function shoe cabinet (module A + module B + module C), small storage cabinet (module C).(Figure 2 Living room)



Figure 2: Living room furniture layout drawing

Source: Xi chen 2022

From Figure 2, the modular furniture of the living room space increases the functional setting, and the sofa, sitting and waiting increases the storage space. The partition of the internal plate structure can be adjusted at will. Household lockers increase the function of both telescopic and hanging items. Reflects the modular flexible and personalized use.

The basic module ABC can be combined in the restaurant space to be: dining table (module A + module B + module C).Sitting and sleeping class home has: stool (module C).Storage type has: low cabinet (module B + module C).(Figure 3 Restaurant)



Figure 3: Dining room furniture layout drawing

Source: Xi chen 2022

From Figure 3 that the table can meet the personalized needs of tenants through the superposition and extension of modules, and solve the shortage of space for most public rental housing restaurants. The living room locker and dining table use the same basic module, through the superposition and change of modules to extend multiple functions. The basic module ABC can be combined in the second bedroom space to be: single bed (module B + module C), stool (module B + module C).The storage home has: bedside cabinet (module A), bookcase / wardrobe (module

B + module C).The space area of the second lie is smaller, use for single person, the space is arranged after wardrobe, single bed does not have too much space, increase study space to appear crowded again. Module A solves this problem very well when used as a removable bedside table. When the size of the bed is 1000mm, the width of the bedside table and the bed width into a nested combination form, can do mobile desk to use.(Figure 4 sleeper mobile learning area) When it is not necessary, move module A to the head of the bed and use it as a bedside table.



Figure 4: Children's room furniture layout drawing

Source: Xi chen 2022

The basic module ABC can be combined in the main bedroom space to be: double bed (module B + module C).The storage home has: bedside table (module C), bookcase / wardrobe (module B + module C).(Figure 5 main bedroom) The size of the

**Figure 5:** Master bedroom furniture layout drawing

Source: Xi chen 2022

CONCLUSION

This paper takes the public rental housing in Chongqing as an example to study the furniture design with the theory of the modular system. Through the investigation of the public rental housing and tenants in Chongqing, it uses the modular theory to establish the basic furniture module matching the house type space and displays the modules in combination.

In this paper, the basic module combination method of furniture adopts laminated type and nested type. According to the summary of this paper, these two combination methods save the most space when receiving. It is concluded that the basic module of public rental housing furniture should have the following 4 characteristics:

- (1)The basic module is not only a component, but also needs to have independent use functions.
- (2)Through the change of the combination mode, the basic module can form the furniture by chair, storage, sitting and lying.
- (3) The basic module is easy to split, easy to install, can repair and replace.
- (4) The size of the combined furniture should be ergonomic.

wardrobe and the bed can be freely adjusted by the tenant, and the internal storage space can also change its closed and open pattern according to the actual needs.

Based on the modular furniture model and display in Chongqing. After different combinations of basic modules, reasonable modular furniture is established in the living room, dining room, master bedroom and second bedroom respectively. The results show that the single-double bed, locker, sofa, tea table, work bench, wardrobe and other furniture can be established through a combination of 3 basic modules. The research has found that modular furniture can meet the needs of house types and tenants in terms of size, flexibility, recycling, replaceable, and easy transportation.

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