A research for China's new code for fire protection design of buildings in residential building's fire safety design

住宅の防火設計における中国の新建築防火設計基準の研究

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この研究は、火災安全の法体系と火災安全設計（主にパッシブ防火システム）の観点から、中国の新しい建築防火設計基準を日本や米国の火災安全に関連する法律や技術基準と比較することにより、中国の新基準を評価する。

この研究では、火災安全のための法制度の観点から、中国の技術基準自体には法的有効性や強制力が無いことを示した。しかしながら、技術基準と行政上の条項を分離しておくことは、ユーザーにとっては、システム全体の拡張性と利便性を高めることになる。火災安全設計として、要求項目のいくつかの目標値は、国際的な先進レベルに引けを取っていない。ただし、判定条件の精緻化や先端的な技術・実践例を適切な時期に導入することについては改善の余地がある。

キーワード：建築防火設計基準，防火設計，中国，高層住宅
Keywords: Code for fire protection design of building, Fire safety design, China, High-rise residential building

1. Introduction

1-1 Background

In China, because of the people concentrated in the city gradually, the population of cities keeps increasing for years. To address the urban population housing issue in the limited land, the high-rise residential building with high people density is the best choice. On the other hands, for each real estate enterprise, to build a high-rise residential building with high floor area ratio on the precious urban land is in their own interest as well. Therefore, in recent year, almost all the newly built residence in China is high-rise residential building.

However, several fire cases of high-rise residential building happened all over the world exposed the weak point of this kind buildings. And these cases that caused heavy casualties made people consider the safety of high-rise residential building when the fire happened. From the aspect of fire safety, the high-rise residential building brought plenty of difficulties in fire extinguish, rescue and evacuation. Therefore, the fire safety of high-rise residential building has become an important issue in China.

1-2 Literature review

For this research, literature review as the following shows.

(1) Kazuyoshi OHNISHI' s research[1)]

From the research, the author made a comparative of China and Japan's law system structure and determined the characteristics, similarities, and differences between China and Japan's fire safety basic law systems. However, in the age of this paper was finished, China's fire safety law system still in the early stages of development. After about twenty years of development, China's fire law has become a complete system with its own characteristics. Japan's

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related law had many changes very much in these twenty years as well. Therefore, to recheck the advantages, and disadvantages of China and Japan's fire safety law system is necessary.

(2) Qi Zhang's research[2)]

From the research, the author determined the similarities and differences of China and Japan's fire safety law system in the field of fire safety law structure and the method of classification for the buildings. However, about twenty years after the research was finished, China has been published one law, two fire protection codes, several amendments to the fire protection code and one amendment to the law. Japan's related law has been revised several times as well. Both law system structure has been changed. Therefore, to recheck the related content of China and Japan's fire safety law system's structure is necessary.

(3) Xiaorong Wang's research[3)]

Through comparative research the specific content of China's <Code for fire protection design for buildings >, and Japan's <Building Standard Act>, the author determined two countries' fire safety related code and law's similarities, differences, advantages and disadvantages of in fire safety design. However, China's old < Code for fire protection design for tall buildings> was abolished, the related content was integrated with old <Code for fire protection design for buildings > and new code has been published in 2015, The new code is much stricter than the older one and made many changes to face the new challenge. Japan's <Fire Service Act>and <Building Standard Act> also revised several times to adapt to the development of technology and society.

1-3 The method and the purpose of the research

The United States has the most complete and advanced fire safety design system, the relevant department gain rich experience from experiments and practices and reflect in their codes. In this system, compared with the other codes, the I-series codes are adopted by almost all the states in the US and any other countries in the world, the codes in this series are representative. Therefore, the research would be according to consult the China's <Code for fire protection design for buildings>, <Residential building Code>, Japan's < Building Standards Act> and the United States' <International Fire Code>, <International Building Code> and take the China's code as the main body to make comparative research between China, Japan and the United Stats' related codes or laws and the changes of new code for fire protection design for buildings, to determine the improvement, advantages and disadvantages of related codes in law system and relevant content about fire safety design (especially passive fire prevention). To lay the foundation for further research in the future.

2. The research of China's new code for fire protection design of buildings

2-1 China's fire safety law system

2-1-1 Introduction

After Reforming and opening, China started to construct law system of each industry. China's first basic law of fire safety industry was published in 1998. And After about twenty years of development, China's fire law has become a complete system with its own characteristics.

From the content, China's law system could be categorized into two large parts, administrative clause, and technical standard. And the administrative clause could be categorized into fire prevention law, fire prevention or administration regulation, and local regulation.

From the judicature, China's law system could be separated into two parts, legal validity part, and non-legal validity part. In legal validity part, the fire prevention law has the highest position in this system because it was approved by National People's Congress (short as NPC) of People's Republic of China, the highest legislature. The fire prevention or administration regulation was drafted and published by the relevant department of State Council, it has the second position in this system. The local regulation was approved by local NPC, the position was in accordance with the local government's administrative level. All this law and regulations has mandatory. On the contrary, technical standards have no legal validity, it was published by relevant ministry. such as the code for fire prevention design for the building was published by Ministry of Housing and Urban-Rural Development, it just provides a basis for fire safety design to the designer and a supervision standard for the relevant department. It has no mandatory. For ensuring related employees could comply with these codes. Fire prevention law authorized the fire department to inspect and supervise the drawings of fire safety design. Just all the drawings compliance the requests of code, the process of design could step into next stage.

2-1-2 Comparative Research with Japan and United States

Japan's fire safety law structure is quite simple, fire prevention administrative clause and technical standard are included in Fire Service Act and Building Standard Act. For legal validity, because of these two laws was approved by Japan's highest legislature. These two laws have the highest position in fire safety law structure. Below these two laws, cabinet ordinance and ministry ordinance refine the related clause such as operation method. Local regulations as similar to China, their position is in accordance with local government's administrative level. Because of all these laws and regulation was approved by the central government or legislatures, it has mandatory. For inspection and supervision, from 1999, the adamant of Building Standard Act allows the third-party agency that was authorized by relevant departments could inspect and supervise the drawing of fire safety design. The basis for fire safety design to the designer and the supervision standard for the third-party agency comes from the Fire Service Act, Building Standard Act, and local regulations.

The United States' law system structure is in between. At first, the technical standards were drafted and published by relevant association or institute, it would be updated every three years, and it has no legal validity and mandatory. However, the local government according to parliament' vote to choose one technical standard as their designate standard, it started has legal validity and mandatory. For inspection and supervision, it is quite similar to China, the fire laws and regulations authorized fire department to inspect and supervise the drawing of fire safety design. (Table1)

2-1-3 Evaluation

For China's law system structure, from the designer, the content of technical standard and the administrative clause was separated is much more convenient to use. Because most of the administrative clause has no relationship with fire safety design. And drawing of fire safety design. The basis for fire safety the technical standard was separated based on its professional scope is convenient to reference, and

Table1. The comparison of the content of fire safety law system

<table>
<tr><th colspan="2">Fire safety and evacuation related content</th><th>China</th><th>Japan</th><th>The United States</th></tr>
<tr><td rowspan="3">Technical standard</td><td rowspan="2">Fire safety design</td><td rowspan="2">・Fire prevention design code</td><td>・Building Standard Act</td><td rowspan="2">・Building code
・Fire code</td></tr>
<tr><td>・Fire Service Act
・Building Standard Act</td></tr>
<tr><td>The oblige of fire safety equipment setting</td><td>・Any other professional code
・Fire prevention design code</td><td>・Fire Service Act
・Building Standard Act</td><td>・Fire code</td></tr>
<tr><td rowspan="2">Administrative clause</td><td>Fire safety design's inspection and supervision</td><td rowspan="2">・Fire Prevention Law,
・Fire Prevention regulations in each level government</td><td>・Fire Service Act
・Building Standard Act</td><td rowspan="2">・Fire Prevention Law and regulations in each state</td></tr>
<tr><td>The administrative clause about fire safety management</td><td>・Fire Service Act</td></tr>
</table>

content's extension in the future. If put all these content gets together in one or two laws just like Japan, the content is too massive to use easily[4], and if the content was extended in the future, the content may cause confusing the users. However, authorizing the third-party agency to execute inspection and supervision could be a trend in the tide of "Small government". And in Shanghai, let the third-party agency execute inspection and supervision to the architectural plan is in the test. It has a possibility that the fire safety designs inspect and supervise by the third-party agency in the future as well.

On the contrary, codes lack of legal validity and mandatory may cause the issues in law enforcement. It may cause the designer lack of enough awareness of fire safety in the fire safety design. And then, it may cause peril risk in the fire safety. The whole process just relies on the fire department's inspection and supervision is unreliable. To improve the codes' legal validity and mandatory in fire safety law system is necessary like the United States.

2-2 The specific content of <Code for fire protection design for buildings>

In this part, the research would combine the change of new code, according to make comparative research with Japan and the United States' code and take residential buildings' fire safety design as the main body, to evaluate the advantages and disadvantages of related content.

2-2-1 Fire resistance class's classification

In new code, the classification of the building was separated into three categories only has accordance with the building's heights. The heights took twenty-seven meters and fifty-four meters as the limit, the residential building that the heights over fifty-four meters was defined as Type one building, the residential building that the heights over twenty-seven meters and no more than fifty-four meters was defined as Type two building, the residential building that the heights no more than twenty-seven meters was defined as single/multi-storey residential building. This is a great difference from the former codes that the

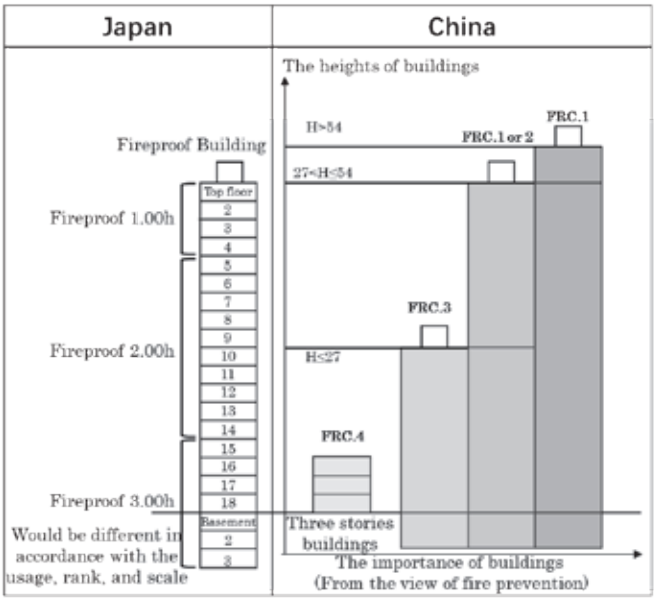

Figure1. The classification of the building

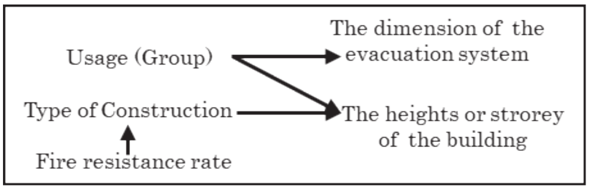

Figure2. The classification pattern of the building in the United States' code

building's classification has two types, story type, and height type. Then, the fire resistance class was defined based on the buildings' type. It has four classes that from high to low. The code prescribed that the fire resistance class of Type one building is Class one, the fire resistance class of Type two building was no less than Class two, the multi-storey building's fire resistance class was Class three, and based on the <Code for residential building>, the fire resistance class of the residential building with no more than three stories was Class four (Because of <Code for residential building>'s new version has not published, it is still classification the buildings through the story of the building).

(1) Comparative research

Compared with Japan's or the United States' classification of buildings, Japan's <Building Standard Act> classification method is according to building's story, the law prescribed the calculation from the top floor, the main structure's fire resistance rate of the building that has four stories is one hour, the main structure's fire resistance rate of the building that has five to fourteen stories is two hours, the main structure's fire resistance rate of the building that has fifteen to eighteen stories and basement is three hours. And in these building, the standard's difference would exist in accordance with the buildings' usage, rank, and scale. (Figure 1)

Compared with the United States, take the <International Building Code> (short as IBC) 2015 version as an example, the classification of the building would be different in accordance with building's usage, the buildings were separated into ten groups. In these group, the residential building was defined as R Group. The high-rise residential building in China's definition belongs R-2 Group in IBC. Correspond to this classification, these buildings' heights or the number of stories was limited and fire prevention request was defined as Construction Type I to V, this request is similar to China's code. (Figure 2)

(2) Evaluation

Compared with Japan and the United States, China's classification more like from the aspect of fire extinguishing and rescue's difficult, to classify the building's type and define the importance of buildings. From the classification method, China's method was similar to Japan's method much more, both countries' method is according to buildings' vertical indicators. However, because of classification by the number of stories may exist the possibility that designer or real estate seeks to profit by using the height of each floor to avoid relevant requests. the building's total height is an objective data, there is no operation space for related personnel. Compared to Japan's method, China's method is much more efficient, objective and scientific. And decrease the chance that let the real estate avail themselves of loopholes.

2-2-2 The fire resistance rate of building element

In the new code, most of the building element's fire resistance rate did not change, the classification and indicator still use the old code that inherited from the Soviet Union's code. The floor slab's fire resistance rate of the buildings that the heights over one-hundred meters were increased from 1.5 hours to 2.5 hours. Because the high-rise residential buildings that the heights over one hundred meters are quite rare, the research still concentrate on the Class one residential building, Class two residential building, and single/multi-storey residential building.

The fire resistance rate of the building's element as the table shows (Table 2), in the non-bearing wall

Table2. The fire resistance rate of China

China's fire resistance hour			
Member		Fire Resistance Class	
		Class 1	Class 2
Wall	Firewall	Incombustibility 3.00h	Incombustibility 3.00h
	Bearing wall	Incombustibility 3.00h	Incombustibility 2.50h
	Nonbearing wall (EXTERIOR WALL)	Incombustibility 1.00h	Incombustibility 1.00h
	・The wall of stairs-room and front-room ・The wall of elevator shaft ・The splitting wall for the residential unit and household	Incombustibility 2.00h	Incombustibility 2.00h
	The wall of passage	Incombustibility 1.00h	Incombustibility 1.00h
	Room partition wall	Incombustibility 0.75h	Incombustibility 0.50h
Column		Incombustibility 3.00h	Incombustibility 2.50h
Beam		Incombustibility 2.00h	Incombustibility 1.50h
Floor slab		Incombustibility 1.50h	Incombustibility 1.00h
Roof load-bearing member		Incombustibility 1.50h	Incombustibility 1.00h
Stairs		Incombustibility 1.50h	Incombustibility 1.00h

Table3. The comparison of fire resistance rate

Building Element	China		Soviet Union[5]		Japan			America
	Fire Resistance Class		Fire Resistance Class		Floor (From the top floor)			Type of construction
	Class 1	Class 2	Class 1	Class 2	Over 15	5~14	1~4	Type 1
Bearing wall	3.00h	2.50h	3.00h	2.50h	2.00h		1.00h	3.00h
Column	3.00h	2.50h	3.00h	2.50h	3.00h	2.00h	1.00h	3.00h
Beam	2.00h	1.50h	2.00h	1.50h	3.00h	2.00h	1.00h	3.00h
Floor	1.50h	1.00h	1.50h	1.00h	2.00h		1.00h	3.00h
Roof	1.50h	1.00h	0.50h	0.25h	0.50h			3.00h

Table4. The fire separation distance of China

Building category		High-rise civil building	Podium and any other civil building		
		Class 1/2	Class 1/2	Class 3	Class 4
High-rise civil building	Class 1/2	13m	9m	11m	14m
Podium and any other civil building	Class 1/2	9m	6m	7m	9m
	Class 3	11m	7m	8m	10m
	Class 4	14m	9m	10m	12m

Table5. The fire separation distance of America

The fire resistance rate of exterior wall (Non-bearing wall)		
Fire separation distance	Type of construction	Occupancy Group R
X<1.524m	ALL	1h
1.524m≤X<3.048m	IA, Others	1h
3.048m≤X<9.144m	IA, IB	1h
X≥9.144m	ALL	0h

parts, the building element was classified further in accordance with its usage. And the classifications and some indicators quite as similar to the Soviet Union. Therefore, it may have a relationship with learning from the code of the Soviet Union in the past. All the members based on their chemical property was defined as incombustibility, flame retardance, and flammability.

(1) Comparative research

The comparative research chooses the building elements those were defined as primary structural frame by IBC. It means column and any other parts that having direct connecting with columns including beam, floor, roof. Because high-rise residential building that using bearing wall take a big part in China, the bearing wall was added into the comparative research as well.

In IBC, the definition process is opposite from China and Japan, the code confirms the building's usage and fire resistance rate first, then prescribed the building's height. In Type I, with the situation that installed the sprinkler system, the residential building (R-2 Group) has no heights or number of stories' limit. According to making a comparison, the research determined that the United States' code is stricter than China's and Japan's, and if considered with America's code has no heights or number of floors' limit; such request cannot say overkill. In addition, although the fire wall's fire resistance rate is not listed in the table, based on the content of SECTION 706, its fire resistance rate in R-1 and R-2 group is three hours. It is as similar as China's code. China's request as strict as Japan's, if considered with China's bearing wall type's high-rise residential building's ratio, the request of China's code is stricter than Japan's. The comparative as the table shows. (Table 3)

(2) Evaluation

Through the comparative research, China's high-rise residential building's relevant request is equivalent to Japan. Especially the bearing wall type high-rise residential building's request is stricter. However, compared with America, some of China's indicators that inherited from the Soviet Union may need to be strengthened based on experience from the fire cases and practice.

2-2-3 Fire separation distance

In new code, the fire separation distance used the old content. The fire separation distance's purpose is to prevent the fire from spreading among the buildings. Based on the building's fire resistance class and the classification rules the distance between the buildings. However, if the building has additional structure design or fire equipment, based on the determination conditions, the request could be arranged. (Table 4)

(1) Comparative research

Compared with Japan, because of some objective conditions, Japan has no enough space for setting fire separation distance. Japan's building standard act prescribes that if the distance between two buildings could not meet the request, the relevant part would be designated as spreading fire risk existed part and be strengthened in accordant with building's usage, structure, and any other conditions to promote the performance of fire spreading prevention.

Compared with the United States, the IBC prescribes that the fire resistance rate of the exterior wall (non-bearing wall) depends on the fire separation distance. From the specific, with the situation that

Table6. The fire partitions of China

Maximum allowed floor area for fire compartment			
	Fire Resistance Class	Maximum allowed floor area	Separation method
Single/ Multi storey civil buildings	Class 1/2	2500m²	Fire wall, sprinkler, fire roller shutter, fire resist water curtain, fire door and fire window
	Class 3	1200m²	
	Class 4	600m²	
High rise civil building	Class 1/2	1500m²	

the exterior wall' fire resistance rate is the same (one hour), the request of fire separation distance in IBC is shorter than China. However, if considered with China's arrangement clause, China' request is equivalent to the United States. (Table 5)

(2) Evaluation

For the purpose of fire spreading prevention, increase the fire separation distance like China would be much more effective and simpler. However, from the actual practice, it is not economical because of wasting the space of using. From the objective condition, Japan just relies on promoting the fire prevention performance because it has no such wide space for arranging buildings on a site like China. Therefore, combined the performance of single building's fire prevention and ensure the fire separation distance like America would be a much more effective method in normal condition.

2-2-4 Fire Partitions

In new code, the relevant request did not change. Fire Partitions' purpose is that quarantine the ignition source, prevent the fire from spreading in the building. The relevant request as the table shows. For the unit type's residential building, the fire partitions are in accordance with the unit. For the corridor type's residential building, the fire partitions still follow the request in the table. (Table 6)

(1) Comparative research

Compared with the United States, the separation method of residential building (Group R-1, R-2, R-3, and R-4) is quite the same, walls separating dwelling units in the same building shall be constructed as fire partitions.[6)]

(2) Evaluation

According to comparative research, the principle of fire partitions for residential building in China and the United States is quite the same, the separation wall for dwelling units constructed as fire partitions is the most effective and economical choice in current condition.

2-2-5. Evacuation

In new code, for high-rise residential building, a new request was added that the building should set a

Table7. The number of the exit in China' s code

Building Height (H)	Condition	Safety exit (N)	Remarks
$H \le 27$	・The floor area of one floor in each unit over 650m² ・The distance between any door and the nearest safety exit over 15m	$N \ge 2$	・The distance between two safety exit (side by side) should be over 5m ・If it has difficulty in set evacuation stairs separately, and The distance between any door and the nearest safety exit below 10m. The scissor stairways could be used
$27 < H \le 54$	・The floor area of one floor in each unit over 650m² ・The distance between any door and the nearest safety exit over 10m	$N \ge 2$	
	・The floor area of one floor in each unit below 650m² ・The distance between any door and the nearest safety exit below 10m	When one evacuation stairs are installed in each unit, the stairs should be connected to the rooftop, and each evacuation stairs could be connected with each other through the rooftop.	
$H > 54$	—	$N \ge 2$	

Table8. The width of the passage in China’s code

The width of passage		
Object (Just for residential building)	The minimum width (W)	Remark
Door	W≥0.9m	Still need calculation based on the evacuation time and the flow of people
Safety exit		
Evacuation passage	W≥1.1m	
Evacuation Stairs		
The safety exit on the first floor		

room that could be used for refuge room when the height of the residential building is over fifty-four meters. And the request for scissor stairways was improved further as well, the pressurized air supply system of the stair-room should be installed independence as far as possible. If there is no room for two more pressurized air supply systems, the blower and pipe could be shared use, the terminal should be installed independently. The front room of the scissor stairways should not be shared, if shared, the area of the front-room should be over six square meters. The stair-room and the elevator shouldn’t share same front room, if shared, the area should be over twelve square meters and the length of the short side should be over 2.4 meters. (Figure 3)

For the evacuation method of residential building, based on the request of code, China’s idea is much more like Japan’s two-way evacuation route type. All the building with the relevant condition should set more than two separately safety exit, one safety exit corresponds to one evacuation route. In some condition, the designer should ensure more than one way of evacuation through designing the rooftop evacuation route or scissor staircase. (Table 7)

The evacuation distance means the distance between any room’s door and safety exit. It is in accordant with building’s height, floor plan, and fire resistance class, the evacuation distance is different. And the width of the passage as the table shows.

These requests are quite general because it is the minimum request, the specific number need calculation based on the evacuation time and the flow of people. (Table 8)

(1) Comparative research

Through making a comparison with <International

Table9. The number of the exit in America’s code

OCCUPANT LOAD PER STORY	MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS FROM STORY
1-500	2
501-1,000	3
More than 1,000	4

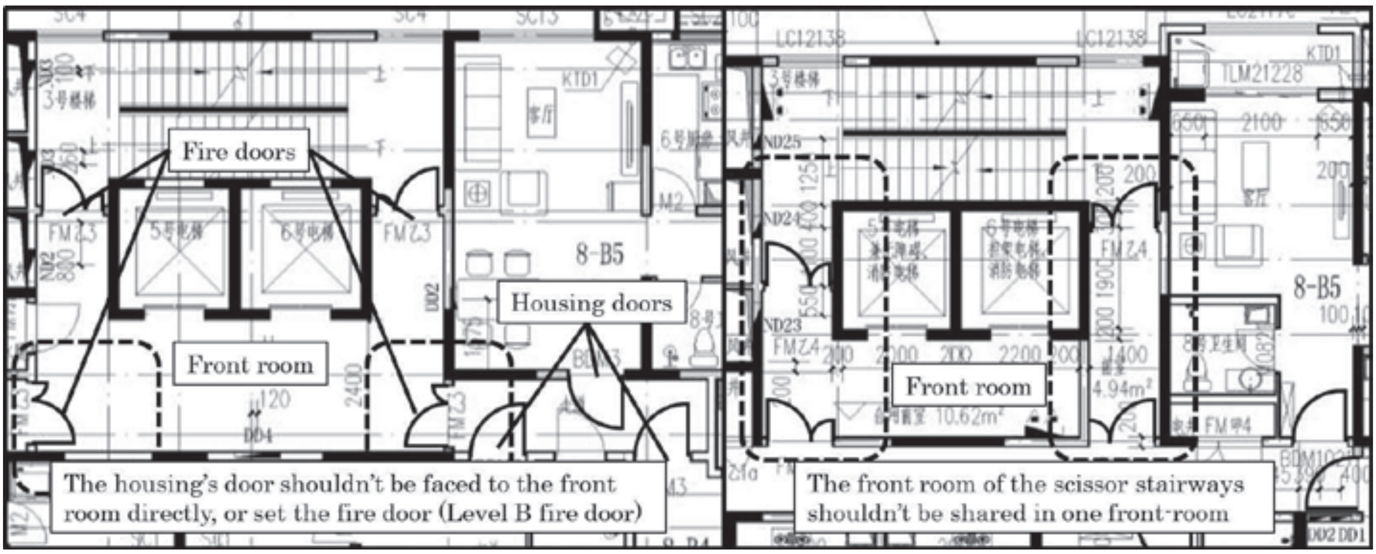

Figure3. The comparison of high-rise residential building’s transportation core design[7)]
(Left: old code’s request; Right: new code’s request)

Table10. The comparison of the evacuation distance

The evacuation distance							
China	Building category	The door between two safety exits			The door at the sides or end of a dead-end		
		Class 1/2	Class 3	Class 4	Class 1/2	Class 3	Class 4
	Single/ Multi-storey civil buildings	40m	35m	25m	22m	20m	15m
	High-rise civil building	40m	—	—	20m	—	—
America	OCCUPANCY	COMMON PATH LIMIT		DEAD-END LIMIT		TRAVEL DISTANCE LIMIT	
		Unsprinklered	Sprinklered	Unsprinklered	Sprinklered	Unsprinklered	Sprinklered
	Group R-2 (Apartments)	22m	38m	15m	15m	61m	76m

Fire Code> 2015 version (short as IFC), for the number of exits, IFC's request is based on the occupant load per story, to prescribe the number of exits. Considered with the residential building, the occupant load per story should at the level of "1-500", the number's request of the exits is similar to China's code. (Table 9) For the evacuation distance, in IFC, the request is in accordance with the passage's form, the sprinkler's installed situation. The evacuation distance's form has two types, common path, and dead-end. It is as same as China's code. In addition, it prescribed the total distance as well. For the specific indicators, the IFC's request is stricter than China's code. For the dimension of evacuation passage, the width of passage and exit. In common condition, the passage's width is 44 inches (equals 1.12 m), with the condition's change, the width could be decreased. The stairway's width is not less than 44 inches (equals 1.12 m). The width of exit is as same as the request of door's size is 32 inches (equals 0.81m). From the indicators, the IFC's request is as same as China's code. (Table 10)

(2) Evaluation

Through the changing of the code, the request for scissor stair-room that the most common in China's residential buildings becomes much stricter than old code, especially from the aspect of smoke spreading prevention.

Through comparative research, in the field of High-rise buildings evacuation system's design, although the form of China's request is quite different from America's code, the other specific indicators of two countries' code about the same except the evacuation distance, it is stricter than China's code.

3-1 Conclusion

According to make comparative with China's <Code for fire protection design for buildings>, Japan's <Building Standard Act>, the United States <International Building Code> and <International Fire Code> in the field of fire safety law system and high-rise residential building's fire safety structural design (the general layout and the floor plan), the research determined the fire safety system and specific request' s advantage, disadvantage, and made an evaluation for each part.

3-1-1 Fire safety law system

Compared with Japan's and the United States' fire safety law system, the separation of China's technical standard and the administrative clause is convenient for the user and good for extending in the future. However, China's technical standard lack of legal validity and mandatory. although the Fire prevention law ensures the technical standard could be executed effectively through authorized the fire department to inspect and supervise the fire design drawing, for the designers, it is unhelpful to establish a fire safety awareness in their mind. In addition, from the experience of Japan, in the tide of "small government", it has a possibility that the drawing's inspection and supervision could be executed by the third-party agency in the future.

3-1-2 The specific content for fire safety design

The research makes a comparison with Japan and America's technical standard about the request of fire safety structural design, the content includes the building's classification, fire resistance rate of the main structure, fire separation distance, fire partitions and evacuation system. All this content is the most important process in a building's design and the main component of passive fire safety system.

For the building's classification, China's classification method adopts building's heights as the standard, the building's total height is an objective data, there is no operation space for related personnel. And compared with Japan, building's height is much more efficient, objective and scientific.

For the fire resistance rate of the main structure, China's high-rise residential building's request is equivalent to Japan, especially the bearing wall type high-rise residential building's request is stricter. However, compared with America, China's content that inherited from the code of the Soviet Union needs update based on the latest experience of the experiment and practice.

For fire separation distance, China tends to increase the distance of buildings to prevent the fire spread. Japan tends to improve the performance of the single building to prevent the fire spread. America tends to combine both methods to prevent the fire spread. However, considered with China's arranged clause, China's request is equivalent to America.

For fire partitions, in the field of residential building, China and America's requests are quite the same, using the separation wall for dwelling units constructed as fire partition is the most effective and economical choice in current condition.

For evacuation system design, the content includes the number of exits, evacuation distance, and dimension of passage. According to make the comparison with IFC, some request of China's Code is not lower than international advanced level.

However, there is still have room for improvement, such as improve the determination condition for each specific request, transfer the experiment and practice experience to actual request timelier and efficiently.

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