Title: **The Depth, Width and Floor Height of a Unit of Super High-rise Residences in Japan**

Authors: Hiroatsu Fukuda, Graduate Student, The University of Kitakyushu
Yuko Kuma, Associate Professor, The University of Kitakyushu

Subject: Architectural/Design

Keywords: Design Process
Residential

Publication Date: 2004

Original Publication: CTBUH 2004 Seoul Conference

Paper Type:
1. Book chapter/Part chapter
2. Journal paper
3. **Conference proceeding**
4. Unpublished conference paper
5. Magazine article
6. Unpublished

The Depth, Width and Floor Height of a Unit of Super High-rise Residences in Japan

Yuko Kuma[1], Hiroatsu Fukuda[2]

[1] Graduate school, the University of Kitakyushu
[2] Associate Professor, Department of Environmental Space Design, Faculty of Environmental Engineering, the University of Kitakyushu

Abstract

Recently, construction of the super-high-rise residences in Japan has increased rapidly. It is clear that a forest of super-high-rise residences will be apparent in Japan in the near future, and there are already similar symptoms in the central areas of big cities in China and other Asian countries. Although there are a lot of actual achievements of the construction, we cannot say that it is adequate to guarantee comfortable residential environment in natural lighting or breeze ventilation, which is to introduce comfortable breeze in a room by opening windows on each side of the room. The purpose of this thesis is to grasp the actual situation of natural lighting of units in super-high-rise residences by measuring the depth, width and floor height of about 280 cases which have already been constructed and will be constructed in the near future in big cities.

Keywords: super high-rise residences; depth; width; floor height; lighting

1. Introduction

Recently, construction of the super-high-rise residences in Japan has increased rapidly. Especially in metropolitan areas, such as Tokyo and Osaka, the construction of the super-high-rise residences has escalated; with the number of the super-high-rise residences (20 or more stories) which is planning completion in 2003 and afterwards exceeds 449 in the whole country. 325 buildings are in Tokyo is metropolitan area, 51 buildings in Kinki area and 73 buildings in other areas. Planning of super-high-rise residence buildings is being increased in the center of Tokyo and Osaka. It is clear that a forest of super-high-rise residences will be apparent in Japan in the near future, and there are already similar symptoms in the central areas of big cities in China and other Asian countries.

There are several reasons for the increase in supper-high-rise residences in Japan. Many people desire to live in the central city because of its convenience, increase in empty land which used to be factory, storage, company houses, etc, and companies recently sold, deregulation of construction floor ratio and land-use regulations because of designation as urban renewal special area, and decrease of the unit price of high rise residences by supply increase. Other reasons for people buying super-high-rise residences are said to be a beautiful view and a feeling of openness.

Although there are a lot of actual achievements of the construction, we cannot say that it is adequate to guarantee comfortable residential environment in natural lighting or breeze ventilation, which is to introduce comfortable breeze in a room by opening windows on each side of the room.

In this report we pay attention to natural lighting as an indicator of residential environment of super-high-rise residences. The usual condominium in Japan is side corridor type in which each unit can face two air-opening sides. On the contrary in the case of super-high-rise residences, even if a unit faces two open sides, the one side is usually a void side, in which natural lighting cannot reach the unit effectively. Especially the lower the story is, the less the light reaches. On the super-high-rise residences a building constructor tries to make a unit depth as deep as possible, to increase selling floor space par unit. If a unit is dozens of cm deeper, total amount of accumulated floor area becomes enormous. But if the depth is too deep, a room which cannot obtain natural lighting sufficiently may exist in the unit which faces only one open-air side or the unit on low stories. Then, the purpose of this thesis is to grasp the actual situation of natural lighting of units in super-high-rise residences by measuring the depth, width and floor height of about 280 cases which have already been constructed and will be constructed in the near

Contact Author: Yuko Kuma, graduate school, the university of kitakyushu, 1-1 Hibikino Wakamatsu-ku Kitakyushu-shi
Tel:093-695-3242 Fax: 093-695-3343
e-mail: uyamuk46@hotmail.com

future in big cities.

2. Outline of research

2.1 Item of research

We chose four items as the indicators of residential environment, which are depth, width, floor-height and direction of super high-rise residences. Registration is required before construction for the check of structure plan and disaster and fire prevention plan.

2.2 Target of research

We focus on more than 25 storied residences as surveyed super high-rise residences. The sample number is 304 buildings in Japan which were registered to The Building Center of Japan (BCJ) between 1995 and 2003.

2.3 Way to research

We measure depth and width of each unit from the plan on the data sheet of Building Letter published by Building Center of Japan. As the scale of the plan is not printed, we measure the length of width and depth according to the dimension line of the plan. The standard floor height is on the data.

2.3 Type of High Rise Building

High-rise buildings are separated into three categories. Void type is the type which has void space at the center of building. Each unit can get light and open air from two sides.

Center core type is the type which has core utilities such as stair case and elevator at the center of building. The unit can get light and open air only from one side.

One side corridor type is the type which has a corridor at one side of the building. Each unit can get light and open air from two sides.

3. Result of research

3.1 The width and the depth

Fig.1 shows the histogram of width of units depending on type. There are a large number of units in which width is between 5m and 9m. Some of the units of center core and void type are less than 5m wide.

Fig.2 shows the histogram of depth of units depending on type. There are a large number of units in which depth is between 8m and 12m. Some of the units of center core type are more than 11m deep. According to the developer hearing which we have done two years ago, it emerged that the limitation of depth is 11m of depth of units of void type. 11m depth is depended on mechanical air ventilation all day and may require artificial lighting. The type of one side corridor shows a tendency to be deeper because it is able to gain natural lighting from both sides of building.

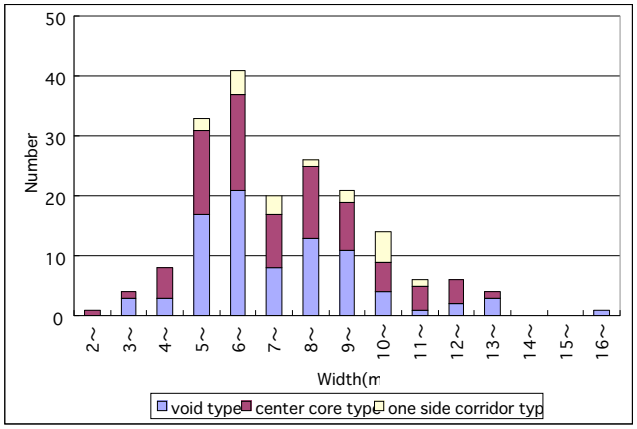

Fig.1 Histogram of width of unit depending on type

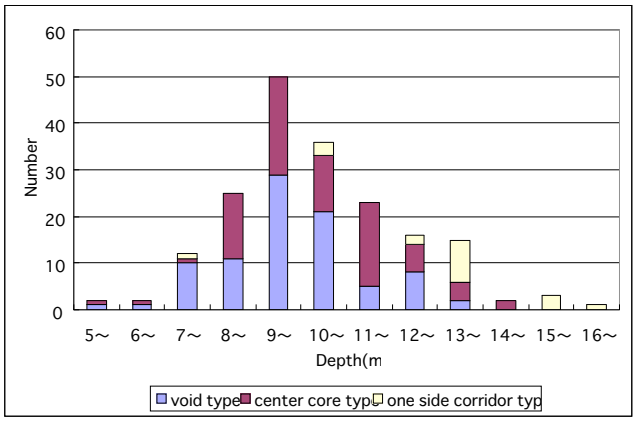

Fig.2 Histogram of depth of unit depending on type

3.2 Relationship between depth and floor height by type

3.2.1 Void type

Fig.3 shows a relationship between depth and floor height of a void type. The average floor height is 2.99m and depth is 9.65m.

Figure.4 shows the plan of case. A. In this case the building is odd shaped so that each room will have balconies on at least two sides of it, though which light can come in.

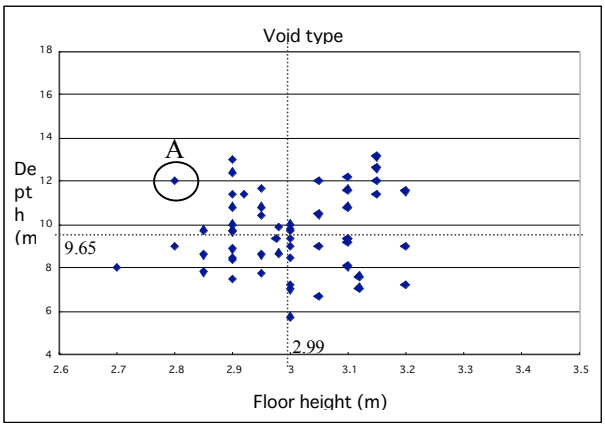

Fig.3 Relationship between depth and floor height depending on type

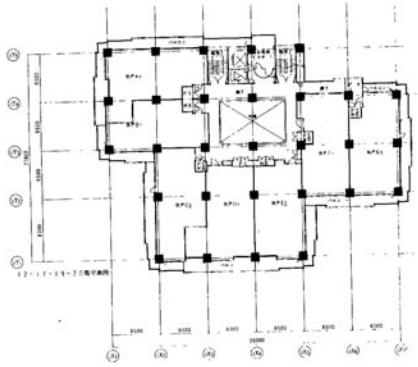

Fig.4 Plan of case. A

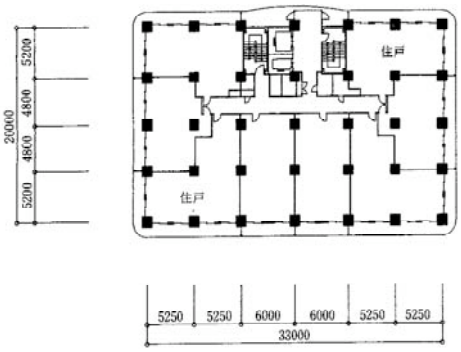

Fig.7 Plan of case. C

3.2.2 Center core type

Fig.5 shows a relationship between depth and floor height of a center core type. The average floor height is 2.94m and depth is 10.11m. In the case of center core it is impossible to gain natural lighting from two sides, though it has a tendency for depth to be deeper than the case of void type and the floor height to be lower than the case of others.

Fig.6 shows the plan of case. B. and Fig.7 shows the plan of case. C.

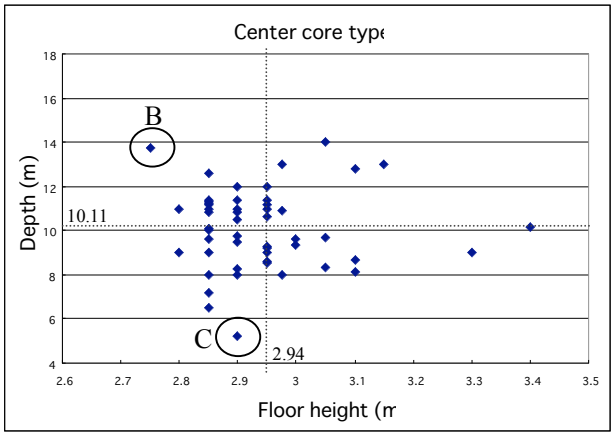

Fig.5 Relationship between depth and floor height depending on type

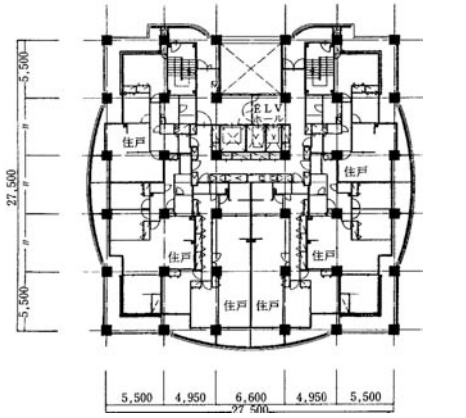

Fig.6 Plan of case. B

3.2.3 One side corridor type

Fig.8 shows a relationship between depth and floor height of a one side corridor type. The average floor height is 2.99m and depth is 12.45m. In the case of one side corridor there is a tendency for depth to be deeper, because it is possible to gain natural lighting from two sides. Fig.9 shows the plan of case. D. Each unit is designed to enable natural lighting from two sides.

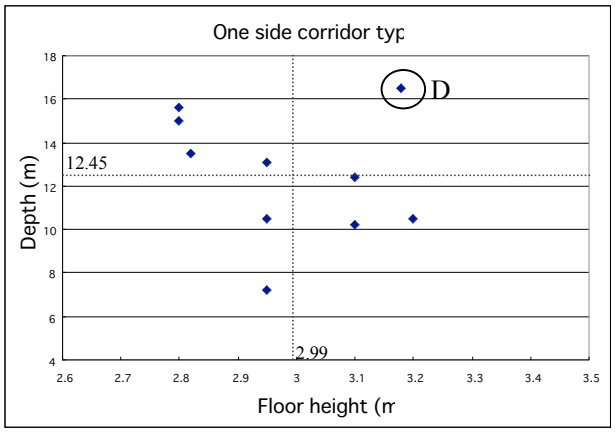

Fig.8 Relationship between depth and floor height depending on type

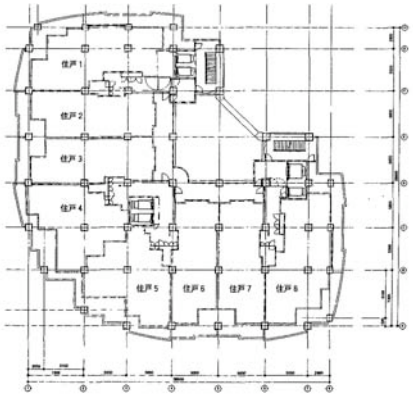

Fig.9 Plan of case. D

3.3 Relationship between depth and width by direction of window opening

Fig.10 shows the relationship between depth and width in the case of windows opening to the east.

Fig.11 shows the relationship between depth and width in the case of windows opening to the south.

Fig.12 shows the relationship between depth and width in the case of windows opening to the west.

Here is the list of comparison of average depth of each type and direction case.

In the case of void type units with windows facing…

- East are 9.42m deep.
- South are 9.31m deep.
- West are 9.34m deep.

-thus showing minimal difference.

In the case of center core type units with windows facing…

- East are 9.99m deep.
- South are 10.71m deep.
- West are 9.86 m deep.

-units with windows facing south allow more depth.

In the case of one side corridor type units with windows facing…

- East are 12.99m deep.
- South are 9.3m deep.
- West are 11.77 m deep.

-units with windows facing east and west tend to allow more depth.

Of those with window openings facing south average width of void type is 7.62m wide center core type is 8.84m wide showing a difference of 1.22m.

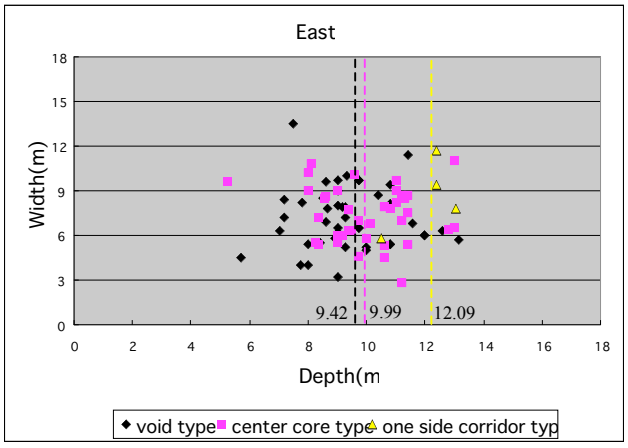

Fig.10 Relationship between depth and width by direction of window opening

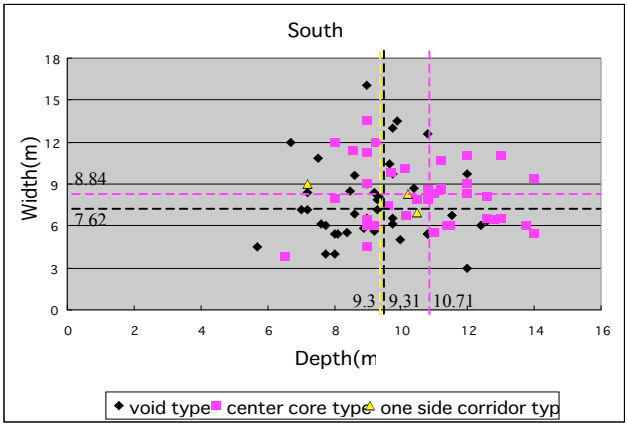

Fig.11 Relationship between depth and width by direction of window opening

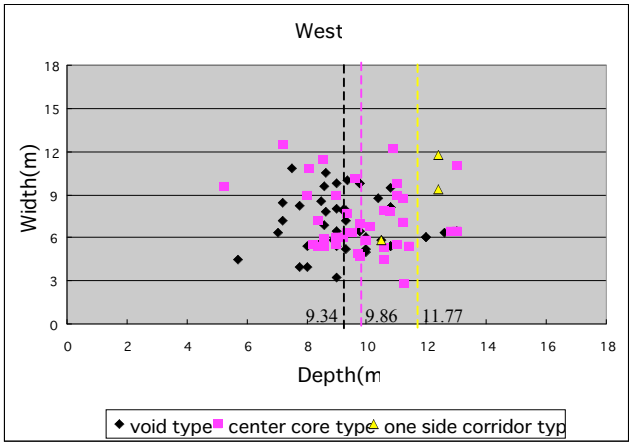

Fig.12 Relationship between depth and width by direction of window opening

4. Conclusion

There are more void type high rise residences in Japan. In the case of low ceiling and deep depth it is difficult to gain natural lighting from the balcony. Moreover in the case of low stories is difficult to gain natural lighting from the void side.

In the case of center core it is impossible to gain natural lighting from two sides, though it has a tendency for depth to be deeper than the case of void type and floor height to be lower than the case of others. There are three reasons for this.

1. Structurally it is easier to gain more depth
2. On the super-high-rise residences a building constructor tries to make a unit depth as deep as possible, to increase selling floor space par unit. If a unit is dozens of cm deeper, total amount of accumulated floor area becomes enormous.
3. Constructer want to gain more depth since the units facing sell better.

But according to the developer hearing which we have done two years ago, 11m is the limitation of depth of units of void type. In the center core type it may create a living environment dependent on artificial lighting and mechanical air ventilation. This means there are parts of the unit where natural lighting can not be gained. Since 11m depth is dependent on mechanical air ventilation all day. There is a tendency that such units are increasing in number in Japan.

References

1)Building Letter p/b The Building Center of Japan (BCJ) between 1995 and 2003.