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**SOME VENTILATION METHODS
FOR THE HIGH DENSITY OF HOUSE
IN CHINESE CITIES**

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Now, the density of city house in inhabitant section is more than before and higher than a set quota in law in South China. The high density house is a problem which can't be said in one sentence. It has some advantages and also some shortages. The most important thing about the house is to deal with ventilation problem. We have already had some experiments from traditional houses to solve these problems. Meanwhile, some ideas about ventilation had to change. This paper tries to suggest some new methods and ideas about enhancing the indoor air quality.

1. The trend and condition of the high density of houses

1) The concern of the high density population and land in China

As compared with the population of China, Chinese territory is not bigger than people think. The condition of Chinese territory make it's people to be full of worries: the tilled land for per capita area of China has only 1.5 mu, it is inferior to one third of per capita area of the world. By contrast with 76 countries which has land area more than 10 square kilometres, China is located in 8 from the bottom. For many years, 1/4 population of the world had been feeded in China, but the land area was only 7.5 % of the world. It is said by nutriologist on average volume of fresh water of the world, Chinese land could only supported two hundred fifty million people, on an average tilled land area, it could supported three hundred thirty million people. Condition research group of China Science Academy claims that now the suitable economic population was about eight hundred million, the population for reasonable natural resources which could be supported was nine hundred fifty million in China. As compared with the supporting ability of China land the area which can be used in cities is more scarce. This is one of the reasons that the high density houses can be developing now.

2) A paid for use land and the high density of houses

With the reform and opening to the world, a paid for use land was begins in China. Using and developing land makes the city areas become more valuable. In this way, the use rate of land can be enhanced, the value of cities land would be more valuable, the

speed of using and developing city area would be more quick. By contrary, the low density houses isn't economical in the use of land area and municipal facilities.

A rational high density is critical a technical policy of the plan and design of cities and towns in China now. "It is a national policy of our country use land rational and thrifty land, the rational high density must be implemented in dwelling design whether in large or small cities and towns." "The rational high density consists of a rational building stories and a rational building density." We must advocate "Multi--story and high density" or "Low stories and high density" (1) Since the reform and open-door policy, new of construction inhabitant quarters is mainly the opening up commodity dwelling which is submitted a tender and the opening up by the house property company. As good, except for a general character--to meet the basic living need of people, commodity houses also have goods characters: it not only satisfies the needs of the client but also ensure the benefits of the selling party. The price of commodity houses, was stipulated by the Guangzhou city government (1988), which consist of five core contents: the compensate fees for lose of levy area and demolished houses (25.95 %); the construction and installation fee (42.64 %); the administration facility fees and the facility fees form a complete set with public building (up to 15--25 %) and the various tax (7.78 %). It was counted with some building works, there the cost of these five items would amount to 90.73 % in its total. This high cost land price would be reflected in commodity houses. But, the people's public power is not so strong in China now. Considering of the purchasing power and the own benefits of company, the only thing for the house property company can do is to build as many units as possible in a limited area and high building density.

3) The reappearance of history

At the beginning of urbanization of China, a large of rural population went into cities for many reasons. At that time, the building density in living quarters was very high, the density of population in the most condensed area in the city was as high as today's in those area in Guangzhou downtown section. (In 1985, an average building density of city block in Guangzhou was about 60-75 % (2). In 1928, an average building density in center of this city was above 61.48 % (3)). It showed Guangzhou city was a very crowded city at that time. When the most dense section of China was in Qingdao city, the density of section of Chinese living area was about 75 % . In the large cities of South China, there were a lot of houses built in lanes and alleies, they were crowded together in high density. Except of the social reasons, the development of economy must make the land rise in value, especially in the center, commercial section and old inhabitant quarters. So, the building of merchandise houses in high density was an inevitable phenomenon of the economical development or the reappearance of history in some means.

4). The altitude limit for cities and towns building

In a lot of cities and towns of China, the altitude of houses was limited, it often was three or six--story for the limitation of administration facilities, water and electric facilities and

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construction factors, especially in the famous historical and scenery cities. Of course, this altitude limits action for houses had a reasonable character. The research information proves: the best height of houses was five--stories, thinking over people's health, energy conservation and safety for people.

In short, many reasons brought about the high density building of new inhabitant quarters. In the province of Guangdong, the building density had been over 30 % in 1989, some had over 33 %. The interval among houses was also from $L=1H$ which was set by the government documents to $0.8--0.6H$, some were not as good as $0.4H$ (figure 1). Then, how to think over the high density and narrow interval of the houses in new inhabitant quarters?

2. The predicements and problems of the high density of houses

We can't say that the high density of houses only has shortcomings, it also has own advantages:

1) The high density of houses have a good property in fight wind calamities. In the coast area of South of China, especially in the provinces of Guangdong and Fujian, often be hit by typhoon. As in the area of Chaoshan, When a typhoon came, the wind power was over 10 leveles, it is a disaster to the people and animals. The layout of building in low story and high density were employed in the ancient Chinese building which had a good property in fight wind calamities building. Baijiao village of Lianjiang county, Fujian province, which lies in the edge of Huanqi peninsula with three sides faces to sea, is a place which often has a strong wind calamities in this area. Buildings were crowded together to form a compact block, the lane only one or two meter wide, the building density was very high and brick is the most common one structure material, the damages by typhoon were very small over years.

The building in crowds shelter from each other, high density has a strong protective function for the building in the crowds. Urbanization and the building layout in low story with a high density are a measure which has important economic result.

2) The high density house has a high explore rate in city and administration facilities. It is a result of collecting benefit.

3) The high density houses have a strong ability against sunlight. The interval between buildings is a hygiene measure using sunshine for a standard in stringent mean in China. The strong need and use of sunshine interval measure were in cities of North of China. Since the winter times is very long, people have a special need of sunshine for the physiological and psychological action there. The statistics, made by the planning bureau of Beijing city, stated that the sunshine dispute was constituted 70% in all construction disputes. But in the South China, especially in Guangzhou, the capital city of Guangdong Province, the condition is very different from that in the Northern cities of China.

Guangzhou is in sub-tropical region, the average yearround temperature is 22 centigrade. August is the hottest month, with an average temperature of 28 centigrade. January is the coldest, with an average of 13.4 centigrade. If in average temperature 22

centigrade for summer, below 10 centigrade for winter, then, there are 6--7 months of summer season, but there is no winter at all. The climate of this area, has these characters: a great amount of rain, high relative humidity, much sunshine times, a strong sun radiation and, a long time of high temperature round a year. The people's need for sunlight is easily satisfied in winter. The first thing people need for living in this area is the largest keeping out of sunshine and the smallest heat content. Ventilation is one of basic term of heat-proof in house.

According to the survey [4], 80 % inhabitants didn't care whether their house had sunshine, 30 % are no idea about it, 40 % thought the sunshine was not important. But almost all people paid close attention to the good condition for against sunlight and ventilation of dwellings. The high density houses sheltered from each other, had a strong action for keeping out sunlight in summer. There is a folk adage in Guangzhou, "Where there's a shade, there should be the cool".

Then, the weakness of these high density house is also obvious. The main problem of the houses is short of sunlight in room in North of China, but in South, it is as follows:

- 1) The air of house is not good for people, because of the lack of through ventilation.
 - 2) The interference of sound and vision effect the private life.
 - 3) The Lack of a space for greenery and public space for neighbourhood association.
3. Some methods of improving the ventilation condition of the density house

- 1) the ventilation measures in history

To study the traditional houses, we would find some good experiences: A bamboo house which was built two hundred years ago in Guangzhou city had a large depth of about thirty meters, a narrow in width of four or eight meters and side by side together. In the house, a patio was used as the main way of ventilation. Sometimes, there is a outdoor activity space. The only problems is that some rooms of first floor may be overmoist. Another example is the bamboo huts of Dai nationality in the Yunnan Province. The huts there were all built on stilts. This way is suited to local condition where there's the sweltering heat and full of rainfall.

- 2) Some proposition about the design of house

Now, the through ventilation of room is very important for the natural ventilation condition of China now. In the past, the position of window was designed beneficially to form through ventilation (figure 2). But, there's something wrong with the idea which is not a good choice for human health.

It was said the through ventilation is harmful to one's health by the Chinese traditional medicine. The wind was list for the first to be affected among wind, fire, moisture, hot and dry and cold of six harmful things to health in nature. It was said by an

ancient book (5): "Wind is the reason of many illness." "Where there's wind, there is illness like rain." "All of illness are caused by wind." According to the tenet of Chinese medicine, through ventilation is not good for one's health, especially for children, pregnant women and the aged. Except, even a man is very strong, if he locates a place where there is a strong wind after he just takes a bath or exercise, he will be in danger of illness. It was said by Chinese old saying: one must flee from wind like flee from arrow.

In the light of a design of routine, the window is located in the middle of the room in height, when the wind goes through the room from South to North, it happens to through the main part of one's body (figure 3), the way is not good for people. How can it make the room has a good ventilation as well as the condition is good for health? We can change the position of window in design. The window can be designed above 1.8 M and below 1 M (figure 4), then, the wind in the room could form cross ventilation. In this way, people can control the area of ventilation for entrance and exit of wind at any time (the area of wind for exit is larger than the entrance would be benefit for ventilation). It is a way to improve air quality. Of course, the form and way of opening and closing of windows have some problems. It is suggested that movable shutter can be used below 1 M and glass window still be used above 1.8 M. The best way of controlling these windows is to use some mechanical device. Meanwhile, these windows can enhance the privacy of house. In the condition of natural ventilation, the interference of sound can't be improve. The change of window position may improve the problem of vision. The interference of vision in high density houses is mainly in a scope of one's vision, but the new window just be beyond the scope of vision. The window can be designed in bedroom as well as in living room where it will have larger wall for hanging some pictures than in old window. A new house shape may be formed for the change of window position.

3) Some proposition about the design of houses in crowds

In the planning of high density houses, the important work is the way of layout houses for ventilation. After some experiments, a good way had obtained in a narrow interval between the houses is 0.7 H (figure 5). It will be used in a design of houses. Meanwhile, 0.7 H may be the most narrow interval for high density houses.

In addition, the houses can be built on stilts. The area of first floor of houses can be used for planting trees or public space. In this way, the condition of ventilation of houses will be improved, and all houses can't be effected by moisture.

It is a trend to building high density houses. This problem concerns many technical fields. The paper tries to suggest some methods and ideas for enhancing the indoor air quality of houses in some preliminary studies.

FOOTNOTE

- (1). << The technical policy of China >>. National blue book 2.
- (2). It is from a survey by the Guangzhou municipality, 1985.

- (3). << The reports of construction in Guangzhou, 1928 >>
 (4). It is from a paper by Huangyiqi, 1985.
 (5). << The explanation of Huang Di Lei Jing >>, 1985.

REFERENCE

1. Zhou HW (1985) The explanation of Huang Di Lei Jing. The Shangdong publishing house of tech. Jinan, p.26-36, p.213-345.
2. Lin PY (1988) The study of natural ventilation in the area of Guangzhou It is the Master tech. thesis of him, no publish. p.11-17.
3. Zheng LP (1988) The experiments and measures in cost of Southeast China It is the Master tech. thesis of him, South China University Of Tech. p.8-9.
4. Liu Y (1989) The analyses and reference of the Dai nationality house in Xishuanbanna, New Architecture, 2. 47-50.
5. The Technology Of Housing, 55(1985)-114(1989)

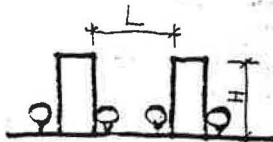


FIGURE 1. A SIDEVIEW OF INTERVAL BETWEEN BUILDINGS.

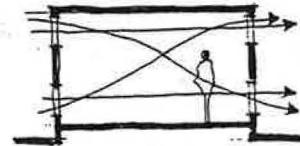


FIGURE 4. A SECTION OF VENTILATION IN USE A NEW WINDOW.

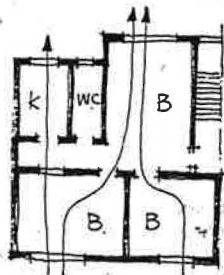


FIGURE 2. THE VENTILATION IN PLAN.

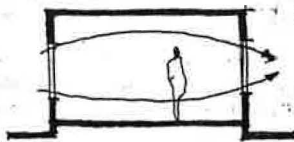


FIGURE 3. A SECTION OF VENTILATION IN USE A OLD WINDOW.

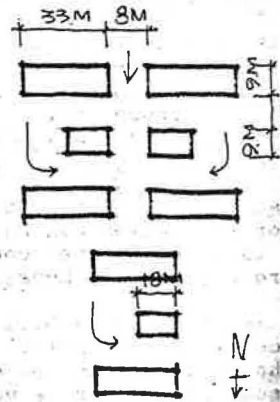


FIGURE 5. A GOOD LAYOUT OF BUILDINGS BY WINDOW HOLE EXPERIMENTS.