The Problems and Their Technological Solutions of Supertall Living in Tokyo Area

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The supply of super-tall living units in Tokyo area in 2005 is estimated as over 10,000 household units and the total number of supertall livings equal to or higher than 30 stories will be already over 60,000. This paper will point out the problems of supertall living such as the difficulty of evacuation in emergency, isolation of children and aged people from the surface community, some other physical and mental bad effects on the human health, and so on, and also introduce the technological efforts to overcome those problems.

1. Introduction

It is hard to get the reliable statistics of supertall living units because the database may include the medium tall units within their supertall housing project sites in the total number. And the definition of supertall is not coordinated either. Sometimes it means equal or over 20 stories and the other time 30. The definition of "Supertall" in this report is equal or over 30 stories. Database is "Wonder Construction" [1].

Table 1 shows the number of supertall housing units by the city and ward. The geographical location of Wards and Cities in Table 1 is shown on Fig. 1.

Following facts would be found by the careful analysis of Table 1 and Figure 1.

(1) Supertall living units are mainly located in central Tokyo, Minato Ward and Chuoh Ward followed by Koutou Ward, Adachi Ward, Shinjuku Ward, Shinagawa Ward, Saitama City, Kawaguchi City, Kawasaki City and Yokohama City. The most of these areas are the project sites of urban redevelopment.

Table 1 Number of Supertall Living Units in Tokyo Area (2005)

	City & Ward	Units		City & Ward	Units		City & Ward	Units
1	Chiyoda Ward	854	13	Nerima Ward	580	25	Funabashi City	293
2	Chuoh Ward	10,209	14	Nakano Ward	310	26	Ichikawa City	970
3	Minato Ward	14,799	15	Setagaya Ward	800	27	Urayasu City	430
4	Shinjuku Ward	3,334	16	Adachi Ward	4,089	28	**Chiba Pref.Total**	**2,923**
5	Shibuya Ward	828	17	**Tokyo Wards Total**	**50,267**	29	Chofu City	286
6	Shinagawa Ward	2,024	18	Saitama City	1,790	30	**Tokyo City Total**	**286**
7	Toshima Ward	1,952	19	Tokorozawa City	217	31	Kawasaki City	2,144
8	Taito Ward	569	20	Fujimi City	530	32	Yokohama City	3,695
9	Kouto Ward	6,954	21	Kawaguchi City	2,026	33	Sagamihara City	184
10	Sumida Ward	927	22	**Saitama Pref.Total**	**4,563**	34	**Kanagawa PTotal**	**6,023**
11	Arakawa Ward	1,587	23	Chiba City	452			
12	Itabashi Ward	451	24	Sakura City	778		**Grand Total**	**64,062**

(Produced by the author based on the homepage of Wonder Construction
http://www004.upp.so-net.ne.jp/wonder/bldg.html)

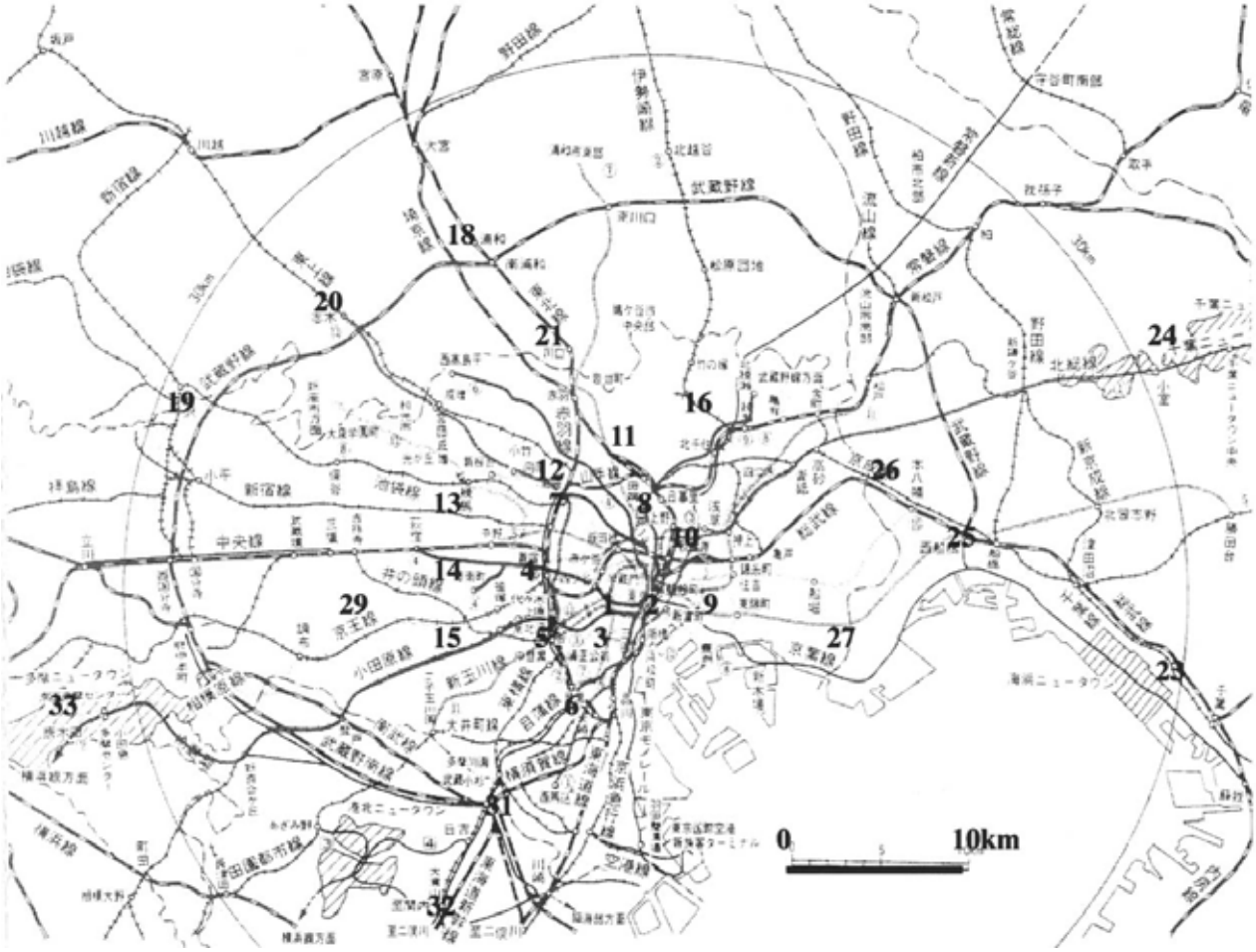

Fig. 1 Geographical Location of Cities and Wards

(2) Total number of units is 64,062 in April, 2005, and the half of them are located in the central Tokyo. While Chiyoda ward is located in the most central part of Tokyo, it has not so many supertall living units because of the lack of project sites. Most of land is used for the traditional national and private functions.
(3) The comparison of 5 sub-centers, Shinjuku, Shibuya, Ikebukuro (Toshima Ward), Ueno (Taito Ward) and Shinagawa shows that Shinjuku, Ikebukuro and Shinagawa leaded Ueno and Shibuya. This would be explained by the transportation services such as Ikebukuro and Shinjuku are the top two railway stations in terms of the number of passengers in Japan and Shinagawa is a prospected station with the new opening of Shinkansen (bullet train) Station. On the other hand, Ueno and Shibuya areas have not been changed so much. These 5 sub-center areas have 7,000 units.
(4) When we observe half an hour distance from Tokyo down town, Adachi, Arakawa, Kawaguchi, Saitama, Kawasaki and Yokohama have about 15,000 units in total. These are just in front of the railway stations.
(5) The other 10,000 units are located in one-hour distance such as Chiba, Tokorozawa and Sagamihara.

The former land use of these project sites was mainly used for factories, governmental facilities, former national railway yards (national railway was privatized in 1987), and some other sites were reclaimed land.

The main reasons why so many supertall living units are supplied would be as follows.
(1) There were large project sites as mentioned above.
(2) 3% limit of land mortgage finance caused the quick fall down of land price and finally the land price came to meet the housing project.
(3) The government promoted the tall buildings by means of the deregulation of capacity control and height regulation in city planning.
(4) Technical innovation such as building materials, high-speed elevator, special technology to control the earthquake motion, and etc.

Tokyo area has already so large stock of supertall living units and this report shows the existing problems and their technical solutions.

2. The background of the Appearance of Supertall Living

2.1. *Social and Economic Background*

In the year of 1987, the Japanese government finalized the Forth National Development Plan and promoted the renewal of inner city areas. This policy pushed the unbelievable rise of land price in urban areas and almost all of the finance directed to invest on land acquisition. But the national government changed her policy in 1990 and started to control the total amount of land investment within 3% of total lending outstanding in each bank and finance group. This policy change affected dramatically on land price and many corporations faced the difficulty with too much money borrowed for their blind and foolish land purchase and fell down into the said burst economy like a babble. As a result, over supply of office floor, zero interest policy for new investment and lower land price promoted the construction of residential floor in down town. The price of apartment type residential floor in central Tokyo, Aoyama area, was 1.37 million yen per square meter in 1990 and only 690 thousand yen in 1998 in average. Decreased by 50 % during these 8 years.

It is also pointed out that the deregulation of building height and bonus for floor capacity control brought by the revise of the building code in 1997 contributed to the development of supertall living.

The Urban Renaissance Headquarter was established in the central government in 2001 and the basic policy to revitalize Japanese economy through urban renaissance was declared. This brought following winds for comprehensive supertall building projects in central Tokyo.

The priority urban redevelopment areas were as follows.

- Areas with heavy industries and others, which led the period of high economic growth, and have the potential for large-scale conversion in land usage
- Areas near traffic junctions, such as train stations, and their surrounding areas that have the potential for being a central location for living and social exchange.
- Urban areas where the foundation, such as a main street, is maintained, and there is a potential for renewal or mixed usage of building floor.
- Areas where the construction of arterial urban road is scheduled within the built-up urban areas, and have the potential for integrated development alongside the road.
- Overcrowded urban areas with high risk in case of disasters, and have the potential for integrated and comprehensive redevelopment.
- Areas with potential for consolidation and effective usage of the segmentalized areas, such as the “worm-eaten land,” which can be seen as legacies of the bubble economy.
- Other areas with potential for large-scale, private investment towards urban development.

2.2. *Technological Background*

Technological revolution accelerated the construction of supertall living even in Japan with such big and frequent earthquakes. They are the anti-motion technology against earthquake and strong wind, the cost saving new technology and the improvement of structural and functional durability.

The new technology to absorb earthquake energy and to keep buildings stable has been developed rapidly and worked very well even at the big earthquake such as in Kobe in 1995. While many of ordinary buildings were destroyed, none of supertall buildings was damaged seriously and even their elevators did not stop in such a big earthquake.

Another technology is the super HRC structure. As solid RC structure is heavier than steel structure in weight, the super HRC structure can stand more stable against strong wind and prevent uncomfortable swing.

Once a supertall building was constructed, it is very hard to renovate. Then it is also necessary to consider functional durability carefully. In this sense, skeleton-infill method has become useful.

In addition, the technological development of RC system realized long-span structure and made it possible to design more flexible unit plan and to attract the purchasers. In most case, a housing unit in higher part of the building such as a pent house has a larger floor space and lower part has rather small in order to meet the market. From this point of view, these technological development could be said that they have played an important role for recent supertall living boom especially in higher parts of buildings. For example, one of the leading construction contractors says that these advanced technologies saved the construction cost by 30% and construction term by 4 days per floor.

3. Evaluation of Supertall Living

Followings are some trials to evaluate supertall living.

3.1. *Economic Aspects*

Economic aspect of supertall living is not so simple as usual economic analysis. For example, supertall living is still the most advanced performance of modern technology and it becomes a kind of status symbol to live there. Development benefit is usually the dependence of capacity control in high land price areas in Tokyo region, but the factor of status symbol may put an extremely high price on the floor. In the case of Aoyama area in Minato Ward, Tokyo, the top pent house

on 32nd floor was sold by the three times higher price than the area average.
This means that it is still too early to discuss the total economic aspect of supertall living because the price is decided not by the economic base but by the emotional evaluation. It may be clever to discuss on the minus effects of supertall living such as the difficulty of evacuation in an emergency, some mental bad effect for human body and etc. But the people living there will never take care for those problems as if they are Aliens.
It is also pointed out that the supertall housing suppliers are trying to put more value on those units by means of the combination with medical care, information service, luxury lobby and lounge, and so on.
Many analysts imply that the year of 2005 or 2006 would be the peak of supply and stabilized in following years. We must wait the economical analysis until the market of this field will be stabilized a little more.
Therefore, the economic aspect is one of the important evaluation factors of supertall living but we need more careful analysis on those data in order to eliminate the data of not economic but emotional transfer of money.

3.2. *Aspect of Safety*

Structural or technological safety will not be discussed here, because it should be ensured through the construction permission process.
It is reported that people who live in those supertall buildings will feel psychological or mental anxiety on uncertainty of elevator operation in case of emergency and on swings caused by earthquake or strong wind. It may be also an anxious factor that they cannot see the ground. Even though, theoretically, it is completely safe to live in supertall residence. (See the page of “Problems of human health”)

3.3. *Aspect as a Status Symbol*

Most of supertall livings in Japan are furnished luxury and have panoramic wide view as well as the well-controlled comfortable environmental condition, the convenient location, the better accessibility to the urban center and so on. In addition to those physical advantages, those inhabitants feel superiority complex as elites. Therefore, it can be said that the supertall living is very idealistic dwelling style for certain people, especially for elderly generation or DINKs (Double income-No kids) who like to live in outstanding urban atmosphere.

3.4. *Other Aspects*

There are many disputes on the evaluation of supertall living but we do not have the enough data and analysis on them. For example, the evacuation in an emergency would be not easy if the elevators were stopped. But we do not have such dangerous experiences yet and no data on the matter. Another would say that the aged people and children would have the tendency to stay longer just inside of supertall living if we compare with the behavior of the people in normal apartments. It would be true that there must be bad influences on the growth of children, but in case of adults, the people who choose to live in supertall buildings may have a different way of thinking on the neighborhood community. We do not have enough data yet on this matter. We need more time examples to make clear these problems.

4. Prospect of Supertall Living

4.1. *Prospect for Maintenance*

Supertall livings have no maintenance problem at present because all of them are constructed recently. However, it is necessary to establish some safety maintenance system in the future. Skeleton-infill system is one of the effective solutions, but it may become necessary to reconstruct the building over a long time, for example 100 years, and we will need some answers for those occasions.

4.2. *Problems on Human Health*

Many problems on human health, in both fields of physical and mental aspects, are pointed out as follows by the study group of New Town Circumstances in Hachiouji City, Tokyo [2].

- Bad effects on the growth of children such as slow reflexes, bad regulation of body temperature, increase of fall down from veranda, and etc. This shows the delay of the growth of organs and identifications.
- Increase of snappish children[3].
- Increase of mite in upper floors[4].
- Feeling of seasickness at any time.
- Appearance of psychosomatic disorder especially on women.
- Wives in upper floors become frequent drinkers[5].
- Lower air pressure may cause shallow sleep and headaches.
- Children and aged people tend to stay in upper floors all day and get various bad effects, physically, socially and mentally.

In general, it is clear that the supertall living would be so highlighted but it would be a good life style only for some limited duration of human life span.

5. Conclusion

As the share of supertall living in Tokyo region is still around 0.5% of total house holds, there are not so big social and regional problems yet. The social and economic impact is also not so big at present. Supertall living is still a status symbol for some selected groups.

The future distribution of super tall living would be hard to estimate because it is not only the problem of city planning but also the psychological problem of people's nature to feel superiority complex in such living style. It would be sure that the peak of the construction of supertall living will be in 2005 or 2006 in Tokyo region and gradually decreases after that. And the accumulation of the analysis on supertall living would reveal the disadvantages of this living style in Japan because of the climate, earthquake, typhoon, continuous small swing caused by the flexible structure, psychological problems on human health, and so on.

Many city planners are looking in anxious mind at the governmental policy of the disregard of the problems of supertall living. What we should do would be to implement the adequate environmental impact assessment study for each project site on landscape, sun-shade, building wind, reflection of electric waves, transportation, and some others.

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