Summary of Lecture “Architectural Planning “ by Professor Kazunobu Minami

Lecture Note by Students, 2016

1. Major effects of contemporary architecture, future architecture and city planning in Japan

Japanese society and urban planning have undergone several changes due to local, regional and global problems. The major challenges are summarized in the following four sections :

(1) Global environment

The observed average temperature of the earth’s surface has been increasing continuously over the past 150 years. (See Figure 1)

These global changes do not exclude Japan, where average temperatures have been increasing since the late 19th century. (See Figure 2)

Global warming is caused by several factors, one of which is the rise in CO_2 emissions caused by increasing industrialization over the years. (See Figure 3)

Japan is one of 12 countries that have the highest proportions of CO_2 emissions, accounting for 4% of global emissions. The other 11 countries and their proportions are China 22.1%, US 19.2%, Russia 5.5%, India 4.9%, Germany 2.6%, Canada and UK 1.8%, Korea 1.7%, Mexico 1.5%, Italy 1.4%, and France 1.2%.

These increases in temperatures and CO_2 levels are expected to cause more serious environmental issues. One of these issues is the rise in sea level (See Figure 4)

The largest sources of CO_2 emissions in Japan are the energy and production industries, which account for 33.1% and 28.1%, respectively, of the country’s CO_2 emissions. (See Figure 5)

However, Japan has been aiming to reduce emission levels since the year 2010, especially from the housing and facilities sector. (See Figure 6)

These emissions mainly come from electric power generation and consumption. When examining the percentages of the energy consumption in households in different areas around Japan, we notice a difference in use due to different climates. For example, in northern regions like Hokkaido, the greatest consumption is for heating systems, while in southern regions like Okinawa, the use of heating systems is minimal. Lighting, appliances, and water heating are big consumers of power in all areas. (See Figure 7)

For household units, air-conditioning, refrigeration, and lighting are the largest consumers, accounting for 25.2%, 16.1%, and 16.1% of total consumption, respectively. (See Figure 8)

After analyzing these findings, Japan has created energy saving measures for different regions for future generations. For example, the utilization of natural ventilation in the southern regions and high thermal insulation in the northern regions.

Japan is divided into 6 regions according to climate, and appropriate measures need to be tailored to each area. (See Figure 9)

Figure 1: Global Mean Estimates Based on Land and Ocean Data

http://data.giss.nasa.gov/gistemp/graphs/

Figure 2: Temperature change in Japan

http://www.data.jma.go.jp/cpdinfo/temp/an_jpn.html

Figure 3: Changes in CO2 levels: Carbon Dioxide Variations

https://en.wikipedia.org/wiki/Carbon_dioxide_in_Earth%27s_atmosphere

Figure 4: Rise in sea level

https://en.wikipedia.org/wiki/Sea_level_rise

Figure 5: CO2 emissions per sector in Japan

http://www.jccca.org/chart/chart04_04.html

Figure 6: The energy sector's CO2 emission level and the goal for 2010

http://www.mlit.go.jp/singikai/infra/architecture/energy_conservation/images/070823_3.pdf

Figure 7: Levels of household energy consumption in different regions

http://www.mlit.go.jp/singikai/infra/architecture/energy_conservation/images/070823_3.pdf

Figure 8: Household consumption levels per type of appliance

http://www.jccca.org/chart/chart05_11.html

Figure 9: The six different climate regions in Japan

http://ees.ibec.or.jp/cal/p02.php

(2) Aging population

There is currently an issue with low birth rates, especially in urban areas such as Tokyo which ranks 41st out of Japan's 47 prefectures in total fertility rate. There is a noticeable difference in birth rates between different prefectures. (See Figure 10)

However, due to what can be called the "social increase" of population from rural areas into metropolitan areas, the population is stabilized in areas like Tokyo and Kanagawa, while it is on the decrease in other prefectures, especially in rural areas. (See Figure 11)

Aging in rural areas around the country is more serious than in urban centers. When comparing the distribution people aged 65 or over in different prefectures in the years 2005 and 2010, it is clear that the elderly population increased in rural areas to more than 26% of the local population within only 5 years, along with an overall increase in all areas to more than 20% of the population.

The prefectures most affected by the aging of the population are Saitama, with a more than 5% yearly increase in aged population; Chiba, with a little below 5% increase; and Kanagawa, Ishikawa, Osaka, Nara, Toyama, Aichi, and Kyoto, all with a 4% or greater increase in their elderly populations.

This increase in the elderly population in prefectures like Saitama, Osaka and Kyoto has an influence on professional services. For example, architectural offices and firms now need to design appropriate facilities to

cater to and accommodate aged people, such as hospitals, nursing homes, and private homes equipped for elderly people's needs. And as a result, various jobs associated with elderly care services have increased in Japan. Some companies have even transformed themselves into elderly care businesses.

The population density in rural areas is not so high but the ratio of elderly people in the population levels is high and is increasing, which is a problem for such areas. The large metropolitan cities contain large numbers of aged people even though future predictions show the total number of their population is on the decrease. For now, the population of aged people is expected to increase and there might be a shortage of facilities for them in the future.

Figure 10: Ranking of birth rates by prefecture

http://www.chusho.meti.go.jp/pamflet/hakusyo/h18/H18_hakusyo/h18/html/i3140000.html

Figure 11: Rates of population increase by prefecture

http://www.stat.go.jp/data/jinsui/pdf/2006-3.pdf

(3) Rural areas

Another challenge in Japan is the decrease in rural populations. One possible way out at the moment is the merging of smaller municipal governments into larger ones. When the population in rural areas declines, the budgets of municipal governments also decrease, so merging becomes an efficient solution to funding issues. About 15 years ago, Japan had more than 3000 municipal governments; however, since then their number has been reduced through mergers to 1795. (See Figure 12)

By merging these municipal governments, they became stronger economically and more efficient in governance. Japan has experienced the same thing several times in the last 100 years in conjunction with the modernization of Japanese society.

In the past, the Japanese government convinced municipal governments to merge by giving them tax incentives if they approved of merging. This resulted in the existence of large municipalities in a short time.

The background of this merge is related to the budget and the power of decision from the central government upon municipal governments. This is considered as one part of the democratic process where instead of decisions being made by the central government in Tokyo, the opposite happened where every community got the opportunity to decide on its own. This is the case with Japanese urban planning, where each city can make its own city plan.

The importance of the municipal government mergers lies in adapting to an ageing, low birthrate society.

Because of the development of transportation and communication technology, the delivery and access to public services have become easier than ever before. Hence, fire and police services, drinking water supply, and other public services can be delivered to wider areas than before. As a result, these services can now be centralized in local areas and be more efficient.

The huge deficits of municipal governments caused a deficit in the central government. Therefore, by merging the local governments they were able to reduce the number of elected officials and public servants. In addition, they rearranged public facilities to reduce the number of governmental facilities too, such as offices, hospitals, community centers, elementary and secondary schools, etc. This rearranging automatically reduced the costs of constructing and operating these facilities imposed on the government.

Tokyo has very old sewage pipes dating from the time the city started building the sewage system several decades ago, but the continuous need and use of the sewage system made it difficult to replace the existing pipes. Hence, a new covering system was developed for the interior of the sewage pipes where they can be repaired and maintain the flow simultaneously. The covering is a coating that allows the sewage to flow more smoothly without enlarging the pipes.

The same thing happened with the waste water piping in residential buildings-- the interior of pipes was coated with a substance which should lengthen their usable age.

Figure 12: The number of merged municipalities

http://www.soumu.go.jp/gapei/pdf/080616_1_2.pdf

(4) Tokyo's population

The graph in Figure 13 shows the percentage of the capital's population to the total population of several countries. As we can see, 65 years ago the population of Tokyo was less than 15% of the total population of Japan, about the same proportion as Paris and London. However, London and Paris maintained almost the same percentage for the next 50 years while Tokyo's population jumped to 27.1% of the Japan's total population, concentrated on only 3.6% of the country's total land area.

This increased population came from rural areas. As a result, Tokyo absorbed a lot of in-migrants, economic change, and cultural activities.

The social movement population is the population moved from rural areas to the center of Tokyo. The peak was in the year 1987, which was the era of the bubble economy in Japan. However, other urban areas such as Nagoya and the Kansai region did not see much change in their population numbers. (See Figure 14)

According to a German insurance company, the disaster risk index in Tokyo and Yokohama are very high compared to other cities and capitals in the world. (See Figure 15)

Figure 13: Changes in the population of various countries' capitals over a 50-year period

http://www5.cao.go.jp/keizai-shimon/kaigi/special/future/0718/shiryou_07.pdf

Figure 14: Changes in Tokyo's population density

http://www.soumu.go.jp/johotsusintokei/whitepaper/ja/h24/html/nc112130.html

Figure 15: Munich Reinsurance Company's disaster risk index for various cities around the world

http://www.fdma.go.jp/html/new/pdf/1512_tiiki_2.pdf

2. City planning for the next 200 years and how to increase the life of buildings

Japan's population increase has recently peaked and now it is declining due to decreases in the populations of young and elderly people. By 2050, the population structure will likely be the reverse of what it was in 1930.

The definition of a building`s life span is the number of years it would survive before it no longer serves the purpose for which it was built. Buildings in Japan have been demolished not only due to physical reasons, but also due to functional and economic reasons. If the original function of the building changes, it may get demolished in order to give more return on investment.

The average life span of office buildings in various areas in Tokyo (Chiyoda, Chuo, Minato, and Shinjuku) is 42.49 years (RC). For small buildings less than 500 m2, the average life span is 39.54 yrs. This is based on the research results of Professor Yukio Komatsu of Waseda University.

http://www.f.waseda.jp/ykom/aijtran2003.pdf

Owners demolish their buildings because they want to build larger structures on the same plot in order to meet the requirements of office buildings due to the fast development of Tokyo's economy. So far, there is no law against demolishing a building early. When buildings are demolished, the materials are recycled and are used in other projects. For examples, some parks in the Yokohama area contained recycled building materials that had been salvaged from the debris of the Kanto earthquake in 1923.

The relationship between Environment and Architecture has been a topic for discussion in Japan ever since the year 2000. The five main points are: Longevity, Symbiosis, Energy conservation, Resource conservation and Recycling, Succession- thinking of future generations. A question frequently asked by clients is, What is the profitability of demolishing and rebuilding compared with renovating and rehabilitating?

There is a long-life span thinking process involving the idea of "back casting", wherein we establish a future goal and think of the measures to be taken in the present to accomplish it. For example, 200 years from now, what kind of house and neighborhood would I want to live in? Thinking of what will become of the environment and population problems. Also studying and reflecting on city planning over a 200-year period is also important.

3. Examples of long life span buildings in Japan and around the world.

(1) Back Bay, Boston (Massachusetts, USA)

Back Bay was constructed at the beginning of the 20th Century and has been preserved, giving us an insight of the history of the place as well as the lifestyles of its inhabitants. The buildings were made out of red stone and aligned to follow a Victorian planning system. Designed on a grid system, the individual buildings all feature a front courtyard allowing light to enter the lower floor and providing a semi-private space in front of the building.

The sufficiently high ceiling and the small amount of wall divisions have permitted inhabitants to rearrange the interiors as their lifestyles changed through the years. The basement was used mainly for housekeeping. Recently most of the courtyards have been converted into rented spaces that could eventually be used as shops. The flexibility that this layout allows is necessary for designing buildings for the long run.

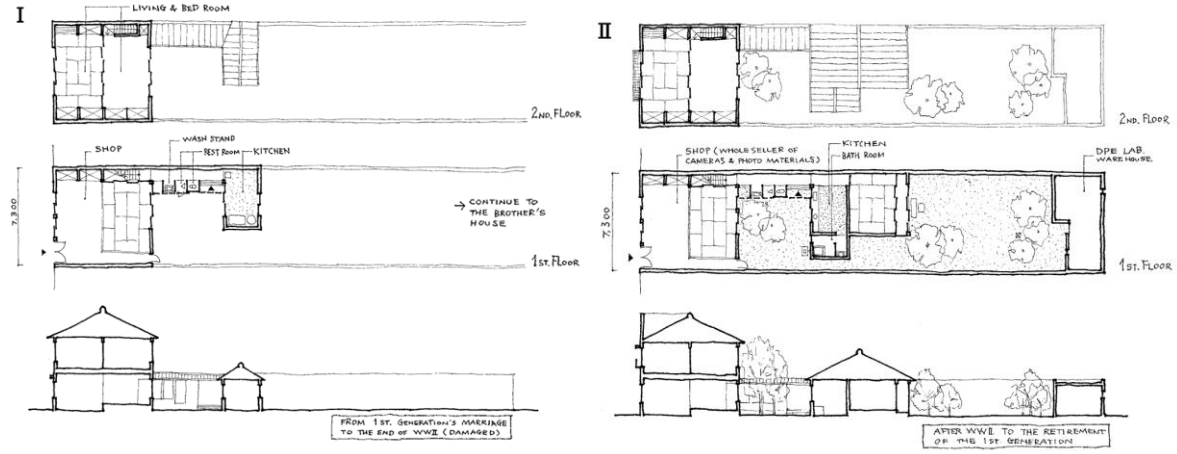
(2) Royal Crescent, Bath (England, UK)

Royal Crescent is a group of terraced houses laid out on a curved pattern in the city of Bath, England. It was built from 1767 to 1774 by John Wood the Younger. The original use of these houses was to host Ministers and Members of Parliament during their holidays with King George III. Most of the houses were built in the Georgian style with courtyards up to 6m long. The town has unique round open squares and is famous for its geometrical parts. The extra ceiling space created for the rich owners has enabled the constant reconversion of the interior space without affecting the overall structure of the building or its outside appearance.

(3) The Japanese Machiya

Typical Japanese merchant houses, called *machiya*, were mainly built along narrow alleys, which created a strong sense of community.

The following diagrams show Professor Minami's grandparents' house in Himeji, Japan. His grandfather was a wholesale merchant selling camera parts. The first floor of the house served as the shop. Prof. Minami's grandparents modified the house by adding an extension to the back and addition to the interior of the main building. A bridge was also added between the two buildings in order to connect them.



(4) Tokyo Central Post Office

The old Tokyo Central Post Office building was built in 1931. In 2006, the renovation and construction of a new building was completed. The initial rebuilding plan was to preserve only 15% of the original building. After complaints were made by professionals, legislators and private citizens, it was decided to preserve 30% of the existing structure which was its whole front façade. The old structure also had to be retrofitted in order to be more resistant to earthquakes. The Tokyo Station was also retrofitted with an aseismic system.

With the end of the bowling boom, a former big bowling alley in Tokyo is now being reused as a post office. The structure of the bowling alley wasn't fit for office use, but due to the scarcity of land in Tokyo, the need for office spaces, and the open plan of the building, some structural enhancements were made to the building to make it usable as a post office.

4. History of SI Technology

"SI" is commonly used to refer to Skeleton and Infill in Japan. The term may differ in other parts of the world like in America, where they say "base building" instead of "skeleton".

More than 100 years ago in Osaka and Kyoto, most people did not have their own houses. They lived in rental houses owned by rich people. The rich people constructed and rented those houses without interior furnishings and the residents were expected to install all necessary furnishings by themselves.

In 1961, John Habraken wrote a book that pointed out the problems of mass housing in the Netherlands. This book was later translated into English in 1972. Habraken organized the old SI theory and explained it in the context of modern architecture. In his book, he discussed the relationship between professionals and residents and also how the industry should be in the future. The fact that residents were not involved in the design process was also part of his criticism.

In many countries, developers commonly provide building spaces only by constructing skeleton structures and the cores so that the tenant can finish the interior. But in most cases in Japan, developers finish everything, including the interior, because Japanese building standards require that the building should be completely finished. In the case of new construction of office buildings in Japan, some developers finish the interior with cheap materials because they know that their tenants will redesign the interior to suit their own needs.

5. Experimental multi-family dwelling NEXT21, in Osaka

This dwelling is located in Osaka prefecture in Japan. It is an experimental multi-family housing project by Osaka Gas Company demonstrating new concepts of multi-family housing units that incorporate sustainable design methods and advanced technologies that are expected to be used in the near future. This structure is a 3-dimensional urban tissue which was built in 1993. It consists of one underground floor, and 6 floors above ground level and it is made up of the skeleton, infill and cladding.

The design concept incorporates what highly individualized lifestyles are expected to be in the 21st century and also looks at issues relating to high-density urban housing and how to conserve resources in its construction. The structure is an environmentally-friendly building incorporating various energy and resource conserving design strategies and construction systems.

One architect designed the skeleton, and another 13 architects designed the 18 units with no dead end corridors to give it a real sense of a city.

This structure system gives flexibility to change, even from residential to commercial functions. The building system is assembled from a series of multiple independent subsystems. This type of decomposition of the building subsystems enables the building to be technologically-flexible, where components like mechanical equipment can be easily replaced, and the reuse of each individual unit to respond to changes in lifestyles and occupancy patterns is incorporated into its design.

The only fixed part of the building is its structural element, which is made up of columns and beams of cast-in-place concrete. The concrete structure was cladded with a metal shell to protect it from wind, rain and other elements which might cause corrosion so as to give the building a life span of more than 100 years.

The project is composed of three space types, each based on a 90-centimeter grid: the house, the street, and the public spaces. The house space includes three different sizes of modules. The main modules consist of units of 7.2 meters x 7.2 meters, and the sub-modules come in two units of 7.2 meters x 3.6 meters or 7.2 meters x 1.8 meters. The street space includes stairs, corridors, and voids and are 3.6 meters wide. The public spaces have dimensions of 10.8 meters x 10.8 meters or 10.8 meters x 9.6 meters.

The house and street spaces have floor height of about 3.6m which is higher than typical buildings in order to allow for future expansions in the mechanical, electrical or plumbing systems in floor and ceiling plenums.
http://www.osakagas.co.jp/company/efforts/next21/index.html

6. Flex Court Yoshida, Osaka

The Flex Court Yoshida project is a 53-unit rental housing complex in the Yoshida area of Higashi Osaka City for moderate income people which was built by the Osaka Prefectural Housing Supply Corporation. The planning and research for the project was conducted by the Committee for the Construction of Advanced Urban Housing Complexes from October 1994, the construction started in March 1998, and the project was completed in June I999.

The floor height had to be reduced, in order to reduce the cost of the project. That meant that the spaces for equipment had to be eliminated, but this was solved using an alternative systems method whereby there was interchange in the floor height per space from beam to beam.

Another characteristic of this project is that they introduced infill management systems where infill is kept for storage in part of the building and occupants have to pay only for what infill they wish to use.

7. UR (Urban Renaissance) skeleton housing for rent

UR has provided a free planning space for the users to design and install themselves in exchange for lower rent prices in some projects in the Tama New Housing Estate and Hikarigaoka New Housing Estate. This project failed because when residents decided to move out, UR needed to buy infill units based on the initial contract with the tenants, but the next tenants usually refused to use them. UR had a hard time reselling these units, so they decided to abandon the whole system.

8. State-of-the-art technologies for Japanese housing

Houses with a movable kitchen are one type of Japanese housing that is constructed with state-of-the-art technologies. The most interesting thing about these kinds of houses is that it is possible to move the kitchen to one of 7 possible locations. The kitchen system has its own exhaust system which can clean up to 80% of emissions.

The kitchen system can be moved 180 or 90 degrees and there are waste water receiving points in different positions of the kitchen system. The points are attached either on the wall or in the flooring system.

Due to some limitations imposed by the fire code, the windows of the building are not constructed in the usual Japanese way. Windows have wooden wall frames on the exterior and metal in the interiors. Wood is used because it is easy to adjust the framing.

The construction work also used wood for the floor system and double ceiling system. The construction company (HASECO) usually uses this kind of ceiling system to easily hide the nonprecise work of the concrete floor.

9. Solids project, Netherlands

Solids is one of the recent open building projects in the Netherlands. It was built in an area of mixed residential and industrial uses. The project actually consists of housing, offices and commercial services.

One characteristic of this project is that the developer decided to select tenants by Internet auction. Any person can bid an amount of money to rent a specific space, regardless of the purpose for renting. The person with the highest bid is then allowed to rent that specific space. The only limitation for tenants is that the specified room/space cannot be used for activities that create noise.

The average floor height of the project is 3.6m. This is somewhat high for residences, but that makes it suitable for offices and industrial or related purposes.

The main target of the developers is to recover the high amount of money they invested within a short period of time. Therefore, they allocate the spaces according to the ranking of the highest bidders.

Tenants are expected to hire an architect/interior designer to work on the open spaces.

The development company believes that the building will have a longer life when the infill is renovated by the willingness of the residents and when the residents love the building itself.

10. Housing experiment for elderly people (In Japan)

The purpose of this experiment is to renovate or adapt existing facilities in a way that aged people can live easily in them. The experiment is done through collaboration between different members, architects, medical doctors, etc., in order to learn about the problems of elderly people. Professionals also collaborate with manufacturers that develop home appliances.

The collaborative team has developed something useful for elderly people.

- Sinks and hidden toilets just near their beds
- Specially designed sliding doors and special door handles
- A shelf-like structure on walls around rooms, so that elderly people can lean on them to move or walk around

http://www.ur-net.go.jp/architec/pnf/kourei/pdf/kourei.pdf#search=%E6%A5%BD%E9%9A%A0%E5%B1%85

11. Open Building Theory and Methods

(1) Solids, a new development in Amsterdam.

The project is located on the island of Ijburg in Amsterdam. Ijburg is one of the man-made islands constructed not far from the main train station.

The project is located at the entrance of the island. One of the characteristics of the project is that the developer decided to select the tenants from an Internet auction. The clients with the highest bids will be able to rent more floor space. This is the first time auction bidding was included in the design process of a building.

The project is a mixed-use building of offices and residences. The developer used the open building theory and only designed the skeleton of the building, leaving the interior design to the client. The minimum bid unit is 90m2. The average floor height is 3.6m, which is pretty high for residential uses. This was because the designer had to design a higher ceiling in order to be able to accommodate future changes. The decision to have an Internet auction was made because the developer needed clients who were willing to pay the most for a given space. In that sense, the developer could then secure financing for the construction. The costs were obviously going to be higher than usual due to the long-life features that were incorporated into the design.
http://www.baumschlager-eberle.com/en/projects/project-details/project/solids-ijburg.html

(2) Estates Renovation in Leinefelde, Germany.

This project was proposed by the mayor of the city of Leinfelde in what was formerly East Germany. Following the fall of the Berlin Wall in 1989, the city experienced an outflow of its population to the western part of Germany. The population continued to gradually decrease, resulting in a growing number of vacant apartments and an increasingly elderly population. The mayor then decided to create workshops where the residents could discuss the future of the estate they were living in. He divided the participants into 3 sub-groups following ideas of the Open Building Theory. These 3 groups were: Infill (Interiors), Skeleton (Structure) and Landscape. The mayor also created national competitions where famous architects could make proposals for the estates. These proposals were then approved and studied by the residents. This type of workflow shows how the concepts of the open building theory could be applied to renovation projects.

This picture shows the final design approved by the community. The Japanese style garden was made with recycled rubble from demolished apartments.