A study on the slum clearance redevelopment project and the community design project for disaster in Koto-delta

Motoki Fujisaki*, Joseph Thomas Reyes**, Saikaku Toyokawa***

* *University of Chiba, zaqplmjf@gmail.com*
** *University of Chiba, joe528judo@gmail.com*
*** *University of Chiba, Associate Professor, toyokawa-s@chiba-u.jp*

The paper puts it focus on the activities of university researchers to organize the top-down urban planning and bottom-up community design with the theme of disaster in Koto-delta. Moreover, comparative and analysis of statistical data of Koto-delta for half a century show the necessary conditions for considering the disaster prevention planning. Koto-delta is the most dangerous area for disaster in Tokyo. Takayama presented the Koto Cross Disaster Prevention Belt Conception, after studying his laboratory, became the foundation of the current planning. While disaster prevention bases and public facilities have increased the disaster prevention performance of the area, the aging and unused facilities are now a problem. Otani and Sato aimed to improve the community by cooperative rebuilding of residents, but the discussion was difficult, and maintenance did not proceed. The statistical data shows that the safety of the area improved, but in addition to the failure of social mix due to large-scale development, the loss of regional landscape and diversity due to the promotion of detached rebuilding, the resilience is decreasing.

Keywords: Koto-delta, disaster prevention, slum clearance redevelopment, community design.

Introduction

A century has passed since Japan enacted the City Planning Act of 1919. During the last century, Japan has suffered great damages from the frequent disaster such as earthquakes, typhoons, floods, sediment disaster, fires, volcanic eruptions and tsunamis. For example, the Great Kanto Earthquake (1923), the Typhoon Catherine (1947), the Typhoon Ise-wan (1959), the Great Hanshin-Awaji Earthquake (1995), the Great East Japan Earthquake (2011). Furthermore, there is a high probability of the Nankai Trough Earthquake and the Tokyo Inland Earthquake soon. Therefore, the disaster prevention is important issues regarding Japanese city planning.

Koto-delta is located at a close distance from the center of Tokyo, but it is known as an area where serious damage has occurred because of the Kanto Earthquake and the Tokyo Air Raid. Additionally, Tokyo Metropolitan General Risk Degree Map[1] explains that it is a region with particularly high risk still now.

To cope with such dangers, Tokyo metropolitan government has implemented a large slum clearance represented by Shirahige East district. Contrastly, the residents have practiced community design mainly with renovation in collaboration with university researchers. Koto-delta is positioned as a rare area where top-down urban planning and bottom-up community design for disaster have developed simultaneously.

In this study, the history of the disaster prevention urban planning of Koto-delta is overlooked by activities of university researchers, and the change of this area over half a century is evaluated by objective index such as population density. This aim is to obtain knowledge to think about the disaster prevention city plan suitable for the 21st century.

Organizing Previous Studies and Materials

Previous studies on planning in Koto-delta can be classified into three categories. First, it is a study to evaluate disaster risk in Koto-delta from a physical and engineering point of view. As a representative study of urban earthquake engineering, it is pointed out that earthquakes, flood disasters, fires etc. occur complexly. Thus, besides urban earthquake disaster mitigation engineering, various fields such as geology and landscape science have made proposals. From the field of urban earthquake disaster engineering, Kimiro Meguro et al. established evacuation plan when flood occurs.[2] From the field of geology, Iware Matsuda is conducting a verification of the vulnerability of natural disasters in Tokyo.[3] From the field of landscape science, Ryosuke Shimoda studies improvement method of land use condition in block-development urban collective housing focusing on embankment and geologic columnar section of Koto-delta.[4] These researches have played a major role in making disaster prevention city planning of the administration. For example, research on radiant heat by Shozo Uchida and Minoru Hamada in the 1950s have allowed Tokyo to determin the size of the large evacuation center in Koto-delta.

Second, it concerns community-based disaster prevention town development belonging to sociological research or action research.

Yukio Otani's district planning in Kyojima (1974) is the perfect example of sociological research. Otani investigated in detail what the residents of the Kyojima area in the non-hygienic environment (800 people / ha) live. As a consequence, Otani acknowledged the merit of the alleys in downtown and the mixed area of residence, commerce and industry. Moreover, he appealed the recovery of the residents' ownership and creativity through concrete construction proposal.[5] Otani's research was handed over to Shigeru Sato et al, which seeks improvement of the living environment by thorough residents' participation and joint rebuilding method by the administration, experts, residents' discussion.[6] Nevertheless, contrary to the thoughts of Otani and Sato, co-rebuilding did not progress in the Kyojiima area. The researchers of the university, are suggestive in criticizing top-down urban planning and seeking bottom-up community design through laboratory activities. However, sometimes the efforts by the Tokyo Metropolitan Government are completely denied and the risk of disasters are underestimated, as idealizing the discussion of citizens and evaluating the old community too much.

Third, it is a historical study on the disaster prevention planning which the Tokyo metropolitan conducted at Koto-delta. Akira Koshizawa's research is widely known about the disaster prevention city planning history that the Tokyo government has been working on. Koshigawa highly appreciates the Tokyo Metropolitan Government's "10-Year Wooden densely area incombustible Project " (2012),[7] but little study has been done to study on the disaster prevention planning in Koto-delta in a bird's-eye view. In addition, Kaga conducted research on the transition of disaster prevention base planning in Shirahige East District,[8] but it handled only part of the Koto Development Basic Concept.

This paper belongs to the field of the disaster prevention urban planning history and reveals two major items.

First, by focusing on the university researcher's activities, it would be reconstructed the history of disaster prevention city planning in Koto-delta. In general, disaster prevention city plan tends to be mentioned as a binomial confrontation between administrative and inhabitants. In this thesis, problem of Koto-delta can be explained by the viewpoint of researchers who are away from regional interests. Furthermore, it deals with survey reports in engineering fields such as Uchida and Hamada's "Investigation of the Great Earthquake Fire Damage in Tokyo" (1961) or Takayama's the Koto Cross Disaster Prevention Belt Conception (1966) and Shirahige East disaster prevention center (1972). It also takes up sociological studies, for instance Otani's "Survey report on the Kyojima district in Sumida-ku: Essay on District Planning" and Sato's "Kyojima town development, Status survey report".

Finally, in this paper, indicators such as population density that changed in Koto-delta during the half century will be organized objectively.Therefore, the problem of modern Koto-delta would be clarified. This area has the highest risk of disaster in Tokyo from 50 years ago to present, but the Preconditions for planning have changed. Thus, it is necessary to compare and analyze by statistical data.

Activities of University Researchers: Engineering simulation and slum clearance

(1) 1960's: Surveys on the Earthquake Fire Damage and the Koto Cross Disaster Prevention Belt Conception

In 1955, Yoshikazu Uchida (1885-1972), Professor of Tokyo University, served as the chairman of the Fire Prevention Committee of the Tokyo Fire Department. He and his subordinate Minoru Hamada (1902-1974), Professor of Tokyo University, studied about radiant heat and examined the earthquake fire damage at Tokyo. According to the simulation results published in 1961, if an earthquake occurred during summer noontime like the Great Kanto Earthquake, almost all fires in the direction of Yamanote can be blocked. On the other hand, in the downtown area, there are 8 cases in Koto city, 8 in Sumida city, 1 in Edogawa city, 1 in Katsushika city and 3 in Adachi city, totaling 21 of fire damages could not be blocked[9].

In June 1964, the Niigata earthquake occurred. The mid-rise RC houses collapsed due to liquefaction phenomenon in the coastal area, also causing a large fire to the petrochemical complexes. At the Tokyo Metropolitan Assembly, which was near the holding of the Tokyo Olympic Games, there was a concern that complex disasters caused by a major earthquake could also occur in the Koto-delta region. After the Niigata earthquake, seismologist Hiroshi Kawasumi (1904-1972) presented the 69 years annual theory of the southern Kanto earthquake in the House of Representatives. He said that “If the Great Kanto Earthquake occurs again and a fire happens, it will almost be unable to save such areas as the Koto district, Mikawa island and Oku".[10]

Furthermore, in 1965, Eika Takayama (1910-1999), Professor of University of Tokyo, published “The search report about establishment of disaster prevention center in zero-meter area” at the request of Ministry of Construction. According to the report, most of areas in Koto-delta was destroyed by fire after the earthquake, and the survival rate is pointed out that 3% in the Mukojima and Terashima area, 45% in the entire Koto area (410,000 deaths), especially low in the northern part of the Koto-delta.[11]

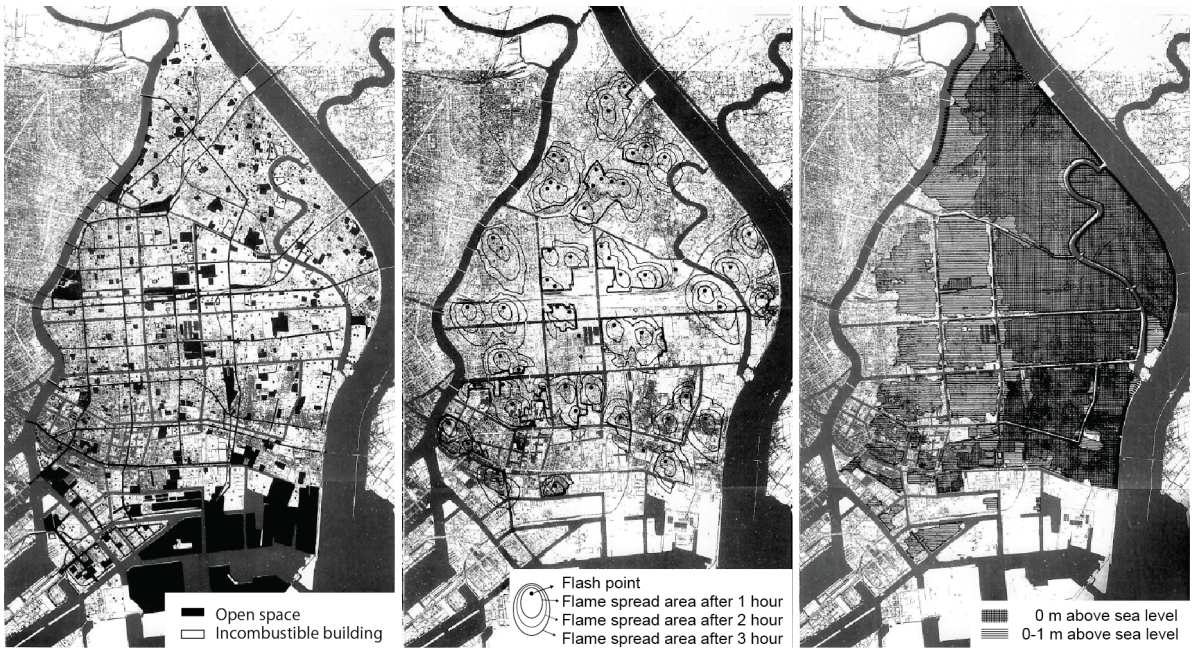

Figure 1:Open apace and incomustible building, Flame spreading model and Flood area in Koto-delta researched by Takayama laboratory.

Following this situation, Takayama said, "Until now, the Olympics or the World Expo have been used as a means of urban development, but from now on, city redevelopment based on disaster prevention may be option”.[12] Under this idea, he insisted on the construction of disaster prevention center.

Takayama's first plan was to construct 16 disaster prevention centers at 3 km intervals in the Koto-delta. One such disaster prevention base was a site size of at least 500 meters square, and it was intended to evacuate the residents of the Koto district there. In this case, it became a question whether residents can secure the actual evacuation route.

In 1966, He announced the Koto Cross disaster prevention belt concept. This initiative was to maintain a 500 meters wide open space which ran east-west and north-south. By guaranteeing the free operation of emergency vehicles at the time of emergency, this safety belt expected to improve the safety of urban fires greatly. Moreover, this safety belt functions not only as an evacuation site, but also collected public facilities such as schools, hospital parks for citizen recreation, and furthermore, it is necessary for the daily car traffic and commuting measures. It also became an axis of infrastructure improvement necessary for future development of cities such as water and electricity.

To bring the concept closer to commercialization, Takayama and the students of his laboratory, including Suenao Murakami (1935-) and others, further examined and the results of the examination were summarized as "Disaster prevention city construction survey report in Koto district No.1-6"

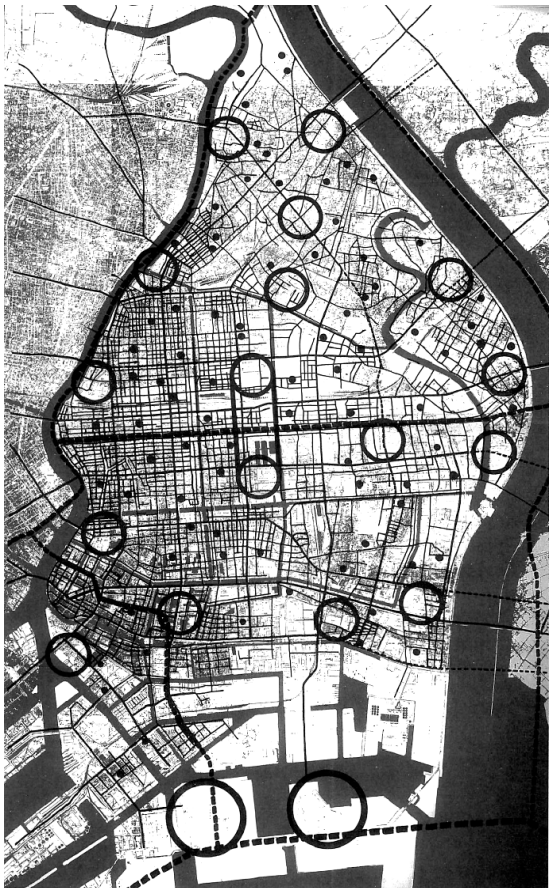

Figure 2:16 disaster prevention bases concept

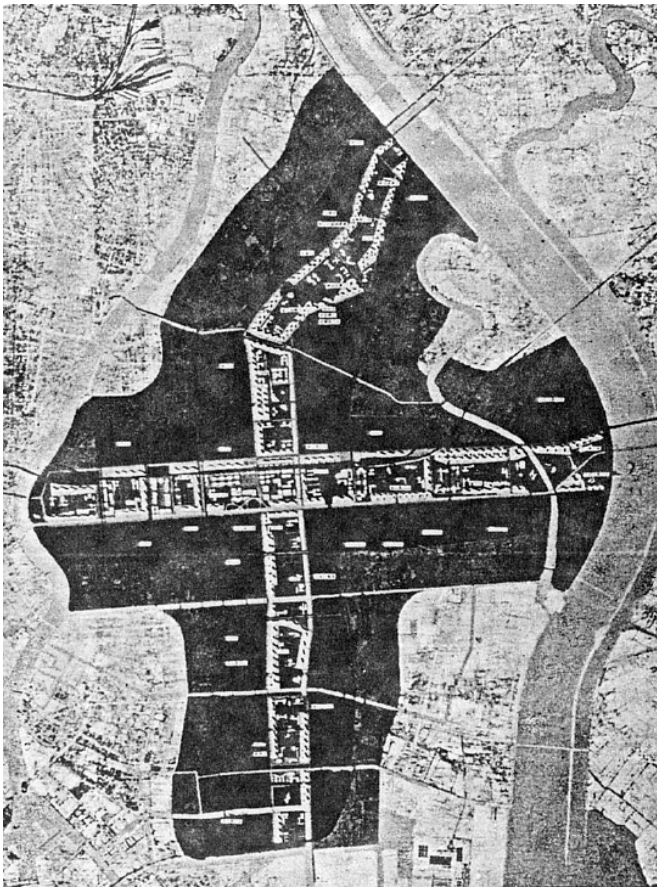

Figure 3:Koto Cross Disaster Prevention Belt Conception.

(2) Progress of the disaster prevention base development in the six districts from the 1970's to the present

In 1969, Based on the plan of Takayama, the Tokyo Metropolitan Government formulated the Koto Development Basic Concept, which is the first implemented disaster prevention city plan after the war and planned to develop disaster prevention centers in six areas, Shirahige, Yotsugi, Ryogoku, Chuo, Kiba and Ojima/Komatsugawa. It is expressed about regular and emergency usage as conditions to be considered on planning the disaster prevention base as follows.[13]

In conditions of regular, first, the lives of neighbors must not be harmed and should be even more comfortable. Second, it needs to ensure smooth urban activities integral with bases and peripheral areas. Third, ensuring a satisfactory living environment in bases. Finally, Fire prevention regulations and road projects that integrate buildings and cities that allow residents to escape to disaster prevention centers are essential.

As a condition of emergency, first, the base must have strong structure and facilities that can be escaped safely by the residents of the targeted evacuation zone. second, it must have enough food, clothing, shelter and health equipment that can maintain evacuated people lives for several days. Third, it must prevent the fire expansion from outside the site as a firewall of the city. At last, it is a place where can be the base of restoration after disaster.

In 1972, the Shirahige Higashi apartment constructed under the supervision of Takayama and Murakami, which was the first project in the Koto Renovation Basic Concept strongly reflected the above-mentioned conditions.

For example, a high-rise residential building (building No. 1 to No. 18) with a height of 40 meters was placed over the 1.2 km distance to act as a firewall, and was equipped with fire shutters, water guns, and gigantic water storage tanks. in addition, 9 hectares evacuation plaza was set with stock up drinking water, food, medicines, etc. necessary for a stay of about one week to accommodate about 80 thousand people.

Murakami Suminao, who was involved in designing Shirahige Housing development, said, "Before learning from real disasters, it is necessary to raise awareness of non-flammable disaster prevention in cities by clearance development".[14]

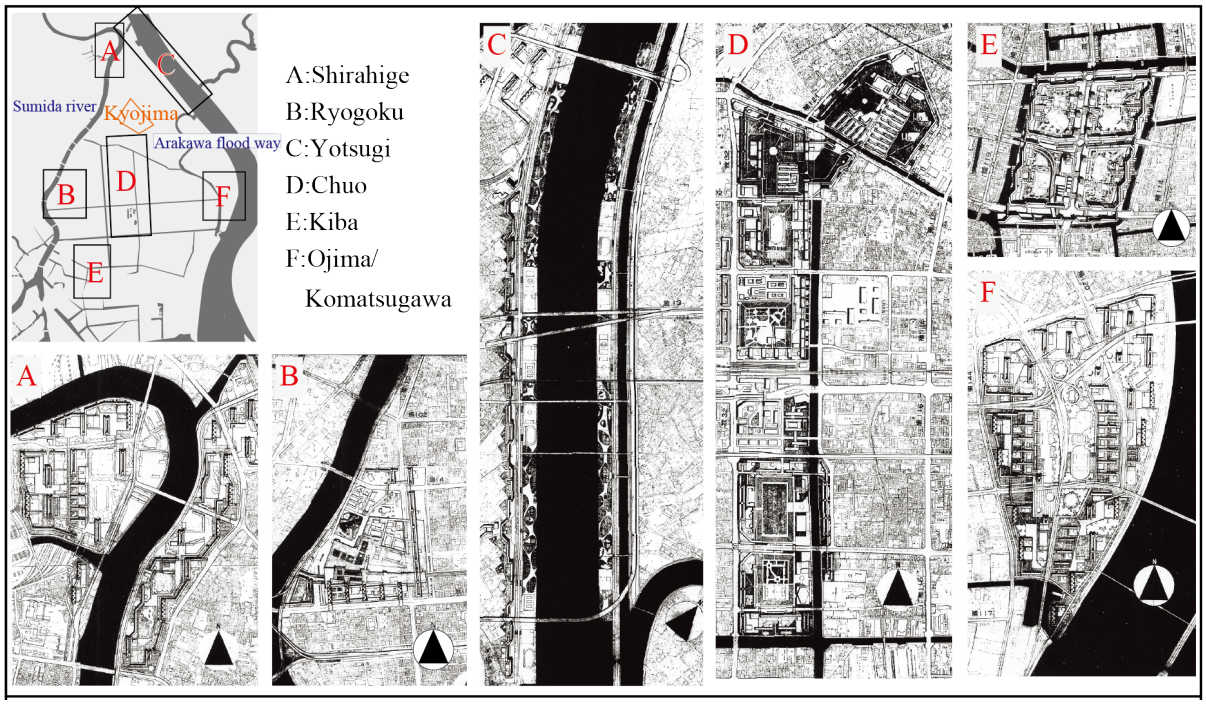

Figure 5: Conceptual Drawing of 6 Disaster Prevention Bases Made at Takayama Laboratory

Tokyo metropolitan continued the projects in other areas and public facilities and parks were located. For example, Yokokawa 5-chome apartments in Chuo district, the Ryogoku-kokugikan (1984) and the Edo-Tokyo museum (1993) in Ryogoku district and the Museum of Contemporary Art Tokyo (1995) in Kiba district. In Yotsugi district, High-standard embankment was maintained. In Ojima and Komatsugawa district, New town development have been done. Not all idea plan haven't been excuted, but some facilities and parks that have been developed take root in the area. However, they also have problems such as the aging of the building, renewal of facilities, and an increase in the number of empty shops in lower shopping streets.

Sociological Studies: Community Design and Action Research

In the Kyojima district located next to Shirahige East district, old building densely, low earthquake resistance, unsanitary living environment was formed from the process of its formation. It also featured townscapes mixed with residential, commercial and industrial sectors that continued from before the war. In 1971, Tokyo Metropolitan Housing Authority published the Kyojima district development project to reconstruct the whole district into a high-rise complexs. However, residents strongly againsted the development project. Sachio Otani (1924-2013) took some surveys to find out the actual living situation there. He and his students placed importance on local community, and proposed a living environment improvement model that have less impact on people's lifestyles. This series of research is summarized in the "Survey Report on the Kyojima Area in Sumida-ku, Essay on District Planning"(1974).

In the 1980's, Tokyo metropolitan government came to consider that it would be hard to consult with people about redevelopment , and began supporting local residents' town planning in Kyojima. Even so, owing to the difficulty of exchanging of rights and building consensus with local residents, They did not realize rebuilding and improving incombustibility rate.

In response to this situation, Shigeru Sato (1949-) promoted cooperative rebuilding in areas with high concentration of wooden houses and actively engaged in workshops involving local residents. Such research style is considered as action research, and researchers were directly involved in the area, and aimed at improving the poor living environment by closely communicating with local residents.

However, discussion among residents for construction of cooperative houses did not go well either. Toshiya Yamamoto (1959-) mentioned the cause of not advancing collaborative rebuilding in densely built area are contiguous small scale sites, poor contact road sites, and rights relations. On the other hand, it shows that rebuilding detached houses is relatively easy even in densely built urban areas because of its low business risk, likely expected earnings, and it's high negotiability.[15]

At present, the Tokyo Metropolitan Government promotes "10-Year Wooden densely area incombustible Project" from 2012. Within the noncombustible special zones, dispatched experts and subsidies heip residents to remove and rebuild old detached houses more easily, and the mentenance of urban planned roads proceed.

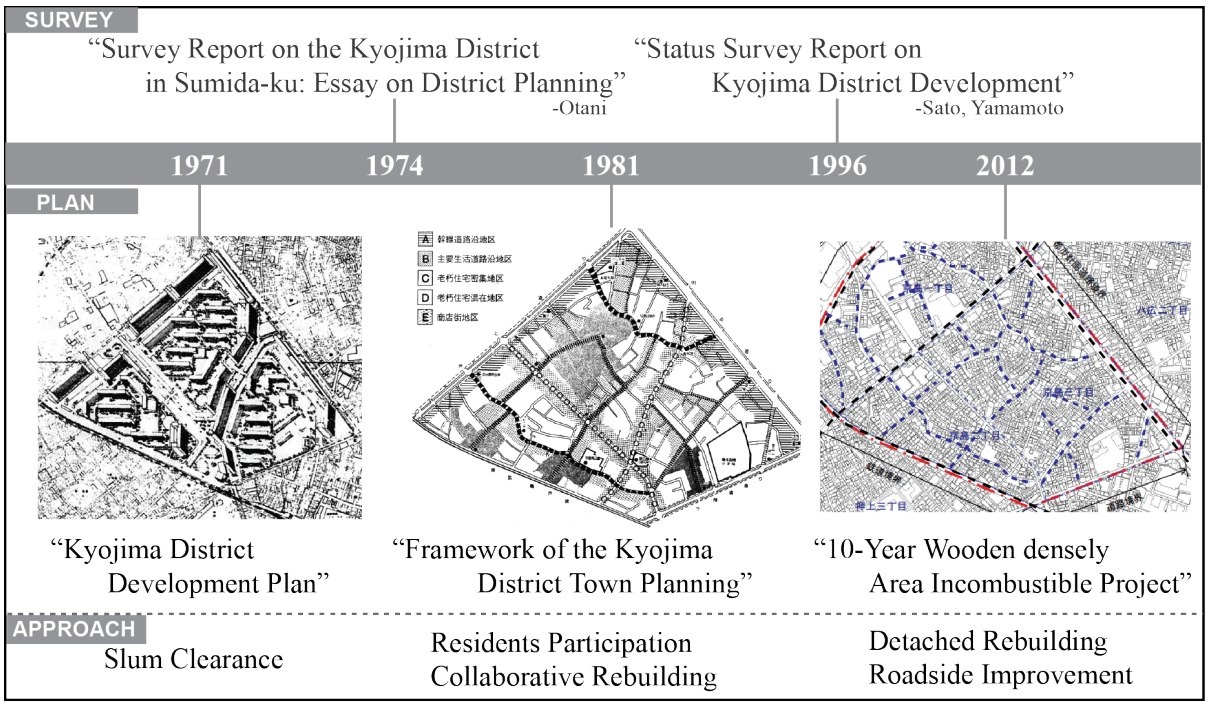

Figure 5: Transition of main plan and survey in Kyojima.

Statistical Change in Koto-delta

(1) Evaluation and analysis of indicators on slum clearance redevelopment

According to Sumida Urban Flood Hazard Map[16], in case of Arakawa flood, it is estimated that the flood depth in almost all the area is under 3.0 meters (covers the ground-level roof) or under 5.0 meters (reaches the second-floor eaves). However, in terms of the disaster prevention center in the East Shirahige District, Shirahige East Park developed with an embankment such as a high standard bank is valuable as an evacuation area estimated not to be flooded. Further, the estimated evacuation population in this area is decreased from 80,000 in 1970's to 55,000 today.[17] Taking it into account, a room is produced in the evacuation area.

On the other hand, focusing on high building houses in the Shirahige and Chuo district, in comparison with the aging rates of Sumida city (23.4%), the Tsutsumidori 2 (41.0%) and Yokokawa 5 (34.8%) where large apartments were built in 1970's are higher.[18] The cause of high aging rate is that low-income generations moved into the high apartments at the same time. Moreover, huge buildings designed on the assumption that the population doubled prevent the area from the renewal of urban functions.

These matters indicate that, although the clearance redevelopment projects in Koto-delta make some valuable parks which can be utilized as an evacuation place and culture facilities, decreasing the population, the aged huge buildings need renewal. Furthermore, from the perspective of social mix, It is responsible for the difficulty of urban renewal that the same class generations move into an area simultaneously after clearance redevelopment projects.

(2) Evaluation and analysis of indicators on community design project

In 1960's, Kyojima district was characterized by the mixed townscape of houses, shops and workshops that continued from before the war and the high population density.

The number of office in there decreased from 1,112 in 1972 to 332 in 2014,[19] in addition, regarding the percentage of a manufacturing, it decreased from 43.2% to 16.0%.[20] In this respect, most houses are only for living nowadays and the townscape was standardized.

From the approach of vital statistics, Kyojima has problems with the declining birth rate and aging population. The elderly population exceeded the number of children under the age of 14 before 1990, and the rate of aging is 33 percent today. Thus, there are social problems resulting from demographic change such as the retirement of the generation pursuing the community design projects with eagerness or lacking a young successor. Furthermore, due to an increase in single, elderly households to about one-fifth, it is essential to consider them in a plan.[21]

From another point of view, the state of declining to nearly one-third (587 persons/hectors in 1965 to 229 persons/hectors in 2015) of population density, and the active work of experts enable the administration to communicate with residents well.

In fact, in kyojima districts, the rate of fireproof buildings increased from 8.1% in 1980 to 52.3% in 2015.[22] Owing to its comparatively favorable location in the Tokyo Metropolitan area and less friction among the neighbors, a continuous increase of rebuilding detached houses is expected. Rebuilding makes a substantial contribution for to the increasing percentages of fireproof buildings. However, owing to rebuilt highly airtight and highly heat insulating houses, former wooden townscape and emotions of a traditional working-class neighborhood have been disappearing.

Conclusion

In this study, the activities of university researchers instead of the conflict between residents and administration show the history of disaster prevention planning of Koto-delta. From the 1960's, it has widely known that Koto-delta is the most dangerous area for disaster in Tokyo. Therefore, Uchida and Hamada examined the size of the evacuation facilities based on the research on radiant heat. After that, Takayama announced the Koto Cross Disaster Prevention Belt Conception using their research, and supported the slum clearance in the Shirahige East region. Slum clearance have also developed in other areas, but after half a century passed, aging of facilities became noticeable.

By contrast, in kyojima district located next to Shirahige East district, residents objected to redevelopment, and Otani investigated the ways to sustain the community by renovation. Further, Sato promoted co-rebuilding and emphasized discussion among local residents. However, due to various reasons, joint rebuilding did not proceed, and disaster communities dreamed of by Otani and Sato haven't come true.

In addition, if statistically evaluating Koto-delta, the population density decreased compared with half a century ago, and the individual rebuilding progressed, so the risk of fire drastically decreased. On the other hand, the slum clearance caused huge housing complexes lived by many elderly people, and the community liveliness was reduced. Consequently, it can be presumed that the resilience of the region is declining compared with half a century ago.

Acknowledgements

I should like to express my gratitude to Mr. Toyokawa, carefully considered feedback and valuable comments. I would also like to express my gratitude to members of the laboratory for their moral support and warm encouragements.

Disclosure Statement

No potential conflict of interest was reported by the author.

Endnotes

[1] Bureau of Urban Development Tokyo Metoropolitan Government, *Regional hazard level measurement survey report on earthquakes,* 2018.
[2] Kouhei MAKINODAN, Makoto FUJIO, Miho OHARA and Kimiro MEGURO, *A Study on Appropriate Human Evacuation Plan in Koto Delta Area during Large-scale Flood,* Journal of Study on Industrial Science (Seisan Kenkyu) 64 (4) 557-563 2013.
[3] Iware MATSUDA, *Verifying Vulnerability to Natural Disasters in Tokyo*, Journal of Geography (Chigaku Zasshi) 122(6)1070-1087 2013.
[4] Ryosuke SHIMODA, Shunsuke MIYAGI, Kenta SHINOZAWA, *Improvement Method of Land Use Condition in Block-development Urban Collective Housing in Koto Delta Area*, Study on Landscape (Landscape Kenkyu) 73(5) 625-630 2010.
[5] Tokyo Metropolitan Planning and Coordination Bureau, *Survey report on the Kyojima district in Sumida-ku: Essay on District Planning,* (Tokyo: 1974).
[6] Satou Shigeru, *Text of Town Development*, (Tokyo:Kashima, 2017), 21.
[7] Akira KOSHIZAWA, *Legacy of Tokyo City Planning, Disaster Prevention, Restoration, Olympic*, (Tokyo: Chikuma, 2014), 230-266.
[8] Makoto KAGA, Toshiya YAMAMOTO, *History of the planning and design of the Shirahige East district disaster prevention base*, (The City Planning Institute of Japan, 2008), 1127-1128
[9] Tokyo Fire Division, *Study of damage caused by the earthquake fire in Tokyo: materials for countermeasures [1st report]* (Tokyo, 1961) ,62.
[10] Secretariat of the House of Representatives, *The 46th Diet House of Representatives the Report of Disaster special committee No.13* (Tokyo,1964.7.3).
[11] Tokyo Metropolitan Government, *City plan outline*, (Tokyo, 1979), 271.
[12] Yomiuri shinbun, (Tokyo, 1968.6.25) 7.
[13] Tokyo Metropolitan Capital Development Bureau, *Disaster prevention city construction survey report in Koto district,:Plan condition setting report No.1,* (Tokyo, 1969).
[14] Suminao MURAKAMI, *Urban disaster prevention planning, Urban Planning from the view point of Time and Space Concept*, (Tokyo: Dobun, 1986), 112.
[15] Toshiya YAMAMOTO, *Reconsideration of Densely Built Area*, (The City Planning Institute of Japan, 2008), 4-8.
[16] Sumida Government, *Sumida City Flood / Urban Flood Hazard Map*, 2018.
[17] Sumida government, *Sumida Ward Demographics Table,* 2018.
[18] Ibid.
[19] Sumida Town Planning Authority, *commercial statistics survey:Current status of the Kyojima district (Kyoshima 2.3 chome)*,2018.
[20] Sumida Town Planning Authority, *The transition of the Kyojima district (Kyoshima 2.3 chome) seen by the census*,2018.
[21] Ibid.
[22] Sumida City Urban Development Department, Kyojima Community Desigin News, 1980.
Sumida Ciity Disaster Prevention Planning Section, Sumida-ku non-combustibility rate survey, 2015.

Bibliography

Bureau of Urban Development Tokyo Metoropolitan Government. *10-Year Wooden densely area incombustible Project,* 2012.
Koshizawa, Akira. *Legacy of Tokyo City Planning, Disaster Prevention, Restoration, Olympic.* Tokyo: Chikuma, 2014.
Manu Urban Architecture Institute. *Kyojima town development, Current status survey report* Tokyo:Sumida-ku, 1996.
Murakami,Suminao. *Urban disaster prevention planning, Urban Planning from the view point of Time and Space Concept.* Tokyo: Dobun, 1986.
Satou, Shigeru. Aiba, Shin. Utchida, Naomi. *Text of Town Development.* Tokyo:Kashima, 2017.
Secretariat of the House of Representatives. *The 46th Diet House of Representatives the Report of Disaster special committee No.13.* Tokyo, 1964/7/3.
Sumida Town Development Public Corporation. *commercial statistics survey:Current status of the Kyojima district (Kyoshima 2.3 chome)*. 2017.
Sumida Town Development Public Corporation. *The transition of the Kyojima district (Kyoshima 2.3 chome) seen by the census*. 2018.
Tokyo Fire Division. *Study of damage caused by the earthquake fire in Tokyo: materials for countermeasures [1st report]*. Tokyo, 1961.
Tokyo Metropolitan Capital Development Bureau, *, Disaster prevention city construction survey report in Koto district No.1-6.* Tokyo, 1969.
Tokyo Metropolitan Government. *City plan outline.* Tokyo, 1979.
Tokyo Metropolitan Planning and Coordination Bureau. *Survey report on the Kyojima area in Sumida-ku: Essay on District Planning.* Tokyo, 1974.
Yamamoto, Toshiya. *City Planning Review 273: Reconsideration of Densely Built Area.* (The City Planning Institute of Japan), 2008.
Yomiuri shinbun. *Yomiuri Shinbun.* Tokyo, 1968/6/25.

Image sources

Figure 1: Ministry of Construction. T*he search report about establishment of disaster prevention center in zero-meter area*, 1965. Plan drawing 1-3.

Figure 2: Ibid, Plan drawing 5.

Figure 3: Murakami Suminao. *Urban disaster prevention planning: Urban Planning from the view point of Time and Space Concept,* (Dobun, 1986), 21

Figure 4: Tokyo Metropolitan Capital Development Bureau, *Disaster prevention city construction survey report in Koto district: Formulation of regional development plan and project cost No.5.* Tokyo, 1969

Figure 5: Created from Manu Urban Architecture Institute. *Kyojima town development: Status survey report* (Tokyo: Sumida-ku, 1996) and Sumida-ku. *"10-Year Wooden densely area incombustible Project " Non-flammable Special Zone System Priority Implementing District Improvement Program,* 2013.