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Master's Thesis

SYNERGISTIC IMPROVEMENT OF HIKIFUNE NEIGHBORHOOD IN SUMIDA WARD, TOKYO CITY

submitted in fulfillment of the requirements for the degree of

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under the supervision of

DI. Dr.-Ing. Gesa Witthöft, Sen. Sc.

Department of Spatial Planning, Centre of Sociology

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Vienna University of Technology, Faculty for Architecture and Planning

by

Kalina Vankova

MN: 0928424

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ABSTRACT

Hikifune is a neighborhood with a distinct atmosphere and historical background that defy its urban tissue today. The conducted analysis of the area reveals that poor planning since the urbanization in the twentieth century on one hand, and confronting challenges in terms of disaster vulnerability, demographics, economics, and environment on the other, are posing serious issues for the future of the district. These issues are so entangled and mutually reinforcing that observing each of them separately and looking for respective individual solutions would be like curing only the symptoms of a disease. Instead, the following work will address these problems in their complex entity, discover the potentials within the system and transform the problematic interdependency into a successful urban synergy. The goal is to propose a new approach for city planning, cross over disciplinary boundaries and use knowledge and innovation as the main instruments to design the future resilient community. The connection between people and city is the engine of urban progress. In this respect, in order to increase the resilience and the livability of the neighborhood, the overall awareness of the residents about the facing issues must rise. Only then, with the locals' participation and the support of an engaged coordination institution, gradual changes would start happening. The multifunctional plan is anticipated to create only prerequisites for a synergistic improvement at district and site scale, while leaving it flexible and letting it grow organically. Finally, the objective of the chosen area is to become a pilot project and give directions for future city design in a global context.

ABSTRACT

Hikifune ist ein Viertel mit ausgeprägter Atmosphäre und historischem Hintergrund, die heute sein urbanes Muster definieren. Allerdings zeigt die durchgeführte Analyse des Gebietes, dass einerseits die schlechte Planung seit der Urbanisierung im 20. Jahrhundert und andererseits die Konfrontation mit Herausforderungen im Hinblick auf Katastrophenanfälligkeit, Demographie, Wirtschaft und Umwelt ernste Fragen für die Zukunft des Viertels darstellen. Diese Probleme sind so ineinander verstrickt und sich gegenseitig verstärkend, dass die separate Beobachtung einzelner Fragen und das Suchen nach entsprechenden individuellen Lösungen wie das Heilen der Symptome, nicht aber der Krankheit selbst, wären. Insofern wird folgende Arbeit stattdessen die Probleme in ihrer komplexen Gesamtheit adressieren, die Potenziale im System entdecken und die problematische Interdependenz in eine erfolgreiche urbane Synergie zu verwandeln versuchen. Das Ziel ist es, einen neuen Ansatz für die Stadtplanung vorzuschlagen, disziplinäre Grenzen zu überqueren und Wissen und Innovation als Hauptinstrumente für das Entwerfen der zukünftigen nachhaltigen Gemeinschaft zu benutzen. Die Verbindung der Menschen mit der Stadt ist der Motor des städtischen Fortschritts. In diesem Zusammenhang, daher um die Belastbarkeit und die Bewohnbarkeit der Nachbarschaft zu erhöhen, muss das allgemeine Bewusstsein der Bewohner über die gegenüberliegen Angelegenheiten steigen. Erst dann, mit der Teilnahme der Einheimischen und der Unterstützung einer engagierten Koordinationsinstitution, würden allmähliche Veränderungen zu geschehen beginnen. Der vorgestellte multifunktionale Plan sieht nur die Bereitstellung der Requisiten für eine synergistische Verbesserung auf der Bezirks- und Standortebene voraus, während die Möglichkeit zu Flexibilität und organischem Wachstum gleichzeitig erhalten bleiben sollen. Schlussendlich ist es das Ziel, den gewählten Ort zu einem Pilotprojekt warden zu lässen, welches später in einem globalen Kontext Richtungsanweisen für das zukünftige Stadtgefüge geben kann.

ACKNOWLEDGEMENTS

At the outset of this work I would like to express my profound gratitude to a few people whose great deal of assistance made the completion of this thesis possible.

My greatest thanks goes to Prof. Hitoshi Nakamura of the Department of Architecture and Environment Systems at Shibaura Institute of Technology without whom I may have never experienced in such depth the Japanese urban space in the context of its historical and cultural background. He introduced me to the main issues confronting Tokyo neighborhoods that are densely built-up with old wooden houses. Furthermore, his class Spatial Planning for DRR, as well as visits to Hikifune and Kyojima areas and Machzukuri meetings, familiarized me with the basic framework of disaster risk reduction methods. Certainly, there were numerous helpful resources provided to me by Prof. Nakamura such as books, historical and topographical maps and statistic data from which I could only benefit along the process of analyzing Hikifune neighborhood.

In a similar context I must thank Dr.-Ing. Gesa Witthöft of the Centre of Sociology at Vienna University of Technology not only for her intellectual critic, but also for being a constant source of advice and encouragement. Our discussions on social matters within the city and on the structure and sequence of an academic work contributed immensely to the evolution of my ideas and eventually in bringing them up together.

I am indebted to all students at the Laboratory of Planning for Urban and Regional Resilience at SIT, especially to Jun Watanabe, for their support with the translation of texts and maps. My personal thanks must be extended to my friend Kayo Moriya as well, whose engagement in my visits of the vicinity allowed me to create a genuine contact with the locals. I am particularly grateful to the staff of Fujinoki Community Space not only for their hospitality, but also for extending my knowledge on Japanese culture. I would like to thank the Arakawa-Karyu River Office for welcoming me as a part of Prof. Nakamura's Lab and providing comprehensive information on the history and the flooding risks of Arakawa River.

Last but not least, I acknowledge with thanks Prof. Dana Buntrock of University of California, Prof. Azby Brown of the Kanazawa Institute of Technology and Roberta Gratz, president of the Center for the Living City whose works have been a significant source of knowledge and inspiration.

Contents

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List of terms and abbreviations

AAL	Average Annual Loss
akiya, 空き家	vacant housing
Bashi, 橋	bridge
BSL	Building Standard Law
chōnin	townspeople
dori, 通り	street
Edo, 江戸	former name of Tokyo and main seat of the Tokugawa Shogunate
hanabi, 花火	fireworks celebration
Hikifune, 曳舟	lit. pulling boats; a neighborhood in Sumida ward, Tokyo
kawa / gawa, 川	river
kawara, 瓦	roof tiles
kōshi, 格子	wooden lattices which indicate the type of shop the machiya held
ku, 区	ward
kura	fire-protected storehouses
kyoshitsubu, 居室部	living space
LG	local government
machiya, 町屋 / 町家	traditional Japanese townhouse
machiaruki, 街歩き	walking the city
machizukuri	town-making, community development
matsuri, 祭り	neighborhood festival
meisho, 名所	*"famous place", "celebrated location", "place of interest"*, used to mark topographically or historically important landmarks (p.187)[9]
mise no ma, 店の間	shop space
omotedori	wide roads
plinth	from Durch: baseboard; the ground floors (GF) that negotiate between the inside and the outside, between the public and the private (p.10)[1]
roji, 路地	narrow alley
sakariba, 盛り場	thriving places of gathering and leisure such as market streets, theaters and entertainment districts (p.187)[9]
sharing economy	a socio-economic ecosystem built around the sharing of human, physical and intellectual resources. It includes the shared creation, production, distribution, trade and consumption of goods and services by different people and organisations [61]
soto, 外	outside

superblock	typical Japanese urban pattern of high buildings along ‘big roads‘ and interior of low buildings and narrow streets (p.138)[20]
synergy	the interaction of elements that when combined produce a total effect that is greater than the sum of the individual elements, contributions, etc [2]
tatami, 畳	mats covering of traditional Japanese houses and temples
TMG	Tokyo Metropolitan Government
toshikeikaku	large scale urban development projects
uchi, 家	family
urban resilience	the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience [3]
vernacular architecture	an architectural style that is designed based on local needs, availability of construction materials and reflecting local traditions [4]
walkability	a measure of how friendly an area is to walking [5]

Chapter 1

INTRODUCTION

1.1 Statement of problem

Japanese communities are facing numerous challenges due to rapid transformations of the urban environment intensified by the global climate change on one hand, and the aging population on the other. Confrontation with these vicissitudes requires urgent resilient planning. Commonly, single issues of natural or social essence are regarded as separate and isolated problems. As a matter of fact however, they are all connected, interdependent, and constantly influencing each other. Hence, all of these topics need to be observed as an entity and development of an ingenious approach is demanded in order to achieve multiform results not only on a regional but also on a local level [6].

Urban environments operate like living organisms. They are born, grow, evolve, get older and eventually die or transform. In order for the whole organism to be healthy and to function properly during this cradle-to-grave process, it is important that its constituent cells, or respectively the single dwellings in an urban context, *"work together, are able to regulate the internal environment and to adapt over time in response to the external environment."*[7] Being the *hallmarks of life*, each component must store and transmit the genetic information of the organism (the community) and manage to harness energy from the environment so that the whole system can sustain a resilient life. In this sense, synergy, as an approach of parts working together and an integral necessity to complete the whole, would provide the most efficient and livable environments. Collaboration between various actors, ingenious methods and multifunctional usage of existing potentials could create a resilient community and thus transform the relevant area into a pacesetter in the battle against climate change and demographic challenges.

1.2 Purpose of study

Natural disasters have been part of Japanese urban lifestyle for centuries. Japan's location - an isolated archipelago on the collision between four tectonic plates - coupled with the soil non-linearity and topography of the islands make the area extremely vulnerable to numerous natural hazards such as earthquakes, tsunamis, floods, typhoons, volcanoes,

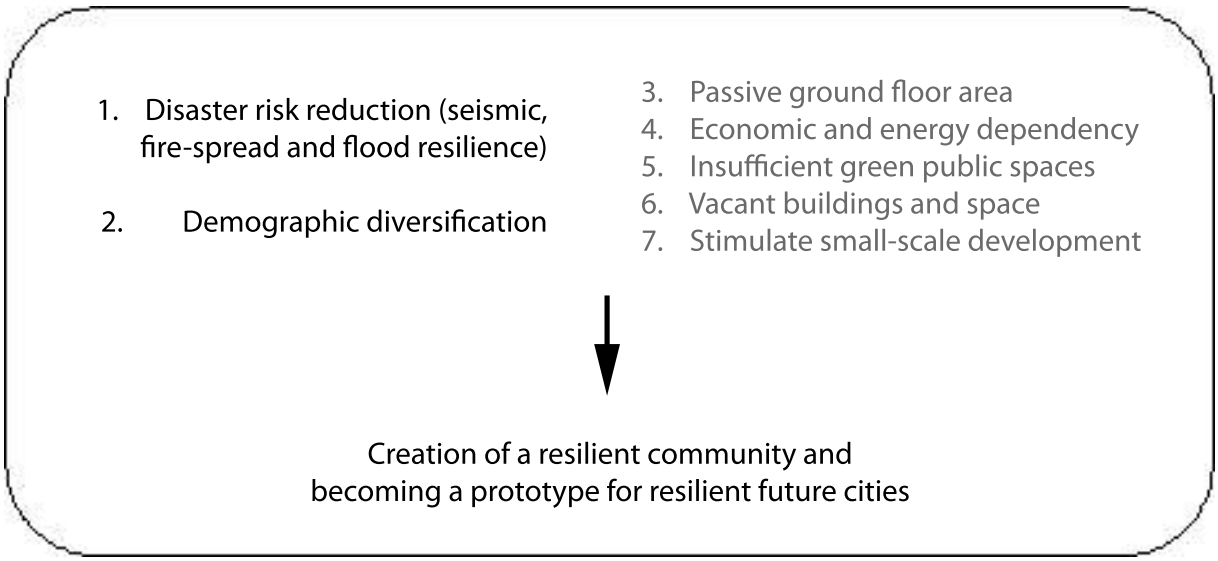
etc. Japanese cities have always been prone to sudden change and over the years the population took into account the threats of natural disasters and adapted to it. Disaster risk prevention became a traditional part of urban planning and ultimately, a way of life in the country of *the rising sun*.

If we concentrate on Tokyo as an example for rapid urban growth and modernization, we can see how drastically it has changed since it became capital of the empire. With the advent of the industrialization during the Meiji period, *"through the Tokyo Reconstruction Work after the earthquake in 1923, [...] the limitless expansion to become a mega city after the Tokyo Air Raids; and [...] the large scale redevelopment by developers who, during the bubble economy, lacked a complete vision of Tokyo in the future"* (p.11)[8] the urban tissue of the city experienced countless transformations. It has been burnt down, bombed, flooded, reconstructed, destroyed by devastating earthquakes, rebuilt and expanded by reclaimed areas, *pumped out*, reformed, densified and modernized until it turned into the largest and one of the most densely-populated agglomerations in the world. Despite the economic and demographic setbacks in Japan during the last decades, the city continues to change and evolve constantly. Tokyo will host the 2020 Olympics and 2020 Paralympics and consequently massive construction and development are going on.

Rapid environment changes are an urban phenomenon happening in many highly densified metropolises with coastal location around the world. They not only affect the intensity and frequency of natural disasters' occurrence and increase the vulnerability of cities, but also create conditions for human-made disasters and take a toll on people's lives and economy. Statistical data obtained from CRED/OFDA International Disaster Database suggests that disaster occurrence frequency in Japan and consequently the total economic damage have been rising exponentially since 1960s, being the argument why disaster prevention is one of the issues with highest priority for Japanese communities at present.

Another grave problem, which the Japanese nation has been experiencing since the end of the twentieth century, is the demographic challenge. Despite the efforts of the government to reverse the process, the population keeps declining due to low birth rates and increasing longevity. On one hand, the predominantly elderly communities affect the residential environments and hinder disaster risk mitigation activities. On the other, they follow the common for Japan in recent years tendencies of rising expenditures per head and decreasing working force, both leading to economic instability.

The following research will concentrate on the issues of disaster risk mitigation and demographics. However, there are other concomitant topics that are entangled with the above-mentioned ones. Even though staying outside the focus of this work, additional questions like the tendency of passive and lifeless ground floor areas, the traditional for Tokyo absence of physical identification pillars, the economic dependence and the high levels of energy consumption are not irrelevant to the equation of urban resilience and must be considered both by the analysis and the subsequent propositions. Therefore, these issues and their connection to the rest of the topics will be referred to throughout the work without going into excessive detail.



The conducted projects for disaster risk reduction and renovation in neighborhoods densely built-up with wooden houses and populated with predominantly elderly residents so far are proposing only incremental small-scale changes referring to retrofitting of individual buildings, widening roads and creation of pocket parks. However, they do not provide us with broad vision for long term solutions. The purpose of this work is to propose an integrated plan for synergistic improvement based on the conducted analysis. Hikifune neighborhood was chosen as a case study due to its exposure to a unique combination of different types of hazards threatening the area. With its distinctive atmosphere, topography and historical and cultural value, Hikifune presents one of the few well preserved parts of the Low City and thus an important heritage for Tokyo. Another reason for choosing exactly this area is the fact that, compared to other districts, almost no interventions or analysis have been conducted in Hikifune. This research aims to develop multiform synergistic ideas, and design strategies for disaster risk reduction and formation of a more resilient community, applicable on a global scale. The project's desired outcome is to make a headway in the issues of resilient housing, become a prototype for future city design and, ultimately, a measurement to support climate change adaptation.

1.3 Methodology of data collection and reference framework

Schulz reveals the advantages of *machiaruki* (jap.: *walking the city*) as an appropriate instrument to explore the *"multilayered, historical topographies"* (p.189)[9] of the *roji*-areas in contemporary Tokyo city. In her article *Walking the city* she emphasizes on the importance of personal contact between the *flâneur*, the city walker, and the urban reality at ground floor level for a profound understanding of the complexity of high density Japanese communities (p.196)[9]. For these reasons, the choice for main method of data collection in this work falls on personal observations, strolling through the narrow alleys, mapping the spatial characteristics and obtainment of photo documentation in Hikifune vicinity.

Additionally, the analysis leans on research works from the Department of Architecture and Environment Systems in SIT regarding data that can't be precisely obtained only by

observations. The laboratory provided fundamental background for the issues of population and occupation statistics, natural hazard risk probabilities, knowledge on cultural and environmental characteristics, local real estate market specifics and trends within the analyzed area. Prof. Nakamura's class *Spatial Planning for Disaster Risk Reduction* contributed by drawing up the general outline, prospects and problems in relation to natural hazards preparedness.

Finally, the thesis refers to the works of Shelton, Nakai, Fujita, Nakamura, Waley, Hein, Buntrock, Sorensen, and Seidensticker for a better understanding of Japanese urban space, culture and potentials; also to Tokyo city and Sumida ward related data from TMG and Arakawa-Karyu River Office concerning natural hazards and population, shedding light on statistics and prospective for Hikifune neighborhood; and to the second version of *City at eye-level* providing valuable examples of successful urban systems and substantial argumentation on the assets of *walkability* and vibrant *plinths*.

1.4 Outline

After briefly introducing the main topics, motivations and working methods in this first part, chapter II explores in detail the individual problems and their interdependence followed by chapter III that reveals potential areas for advancement based on the analysis' findings. The objective in chapter IV is to initiate a headway into the issue of synergistic improvement in Hikifune neighborhood. Based on the untapped opportunities, the proposal outlines three key vectors - district scale, site scale and provides a 50-years plan for development of those actions. A concluding chapter brings the discussion back to the question of the interconnected problems of the referred area and asks whether a multifunctional solution has been found. Additionally, the last two sections of this part tackle the contribution of this work to the global resilient urban development and identify future research directions.

Chapter 2

ANALYSIS OF THE AREA

2.1 Historical background and characteristics of Hikifune neighborhood

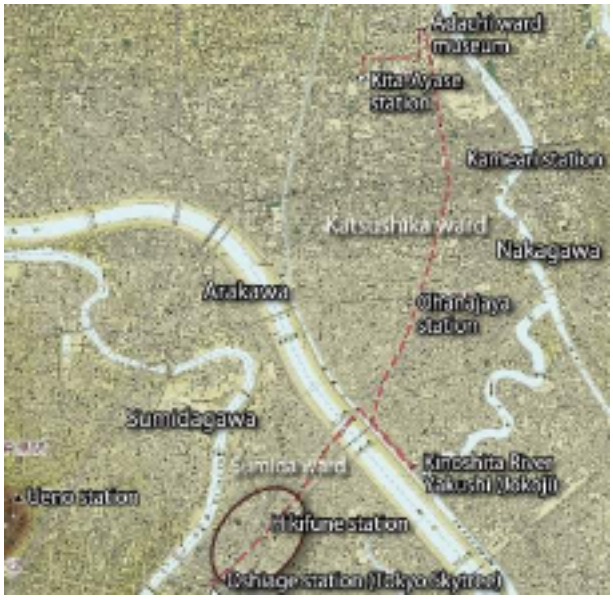


Figure 2.1: Hikifune River Path [10]

The first step towards addressing these issues is understanding the Japanese townscape urban space and diagnosing Hikifune neighborhood as a case study in its full integrity. The name *Hikifune* is not an official postal address but locals refer to the area of south-western part of 2 Chome Higashimukōjima, the north-eastern part of 2 Chome Oshiage and a one-house-narrow strip of north-eastern 4 Chome Mukōjima, between the rivers Arakawa and Sumidagawa in Sumida ward, Tokyo city as *Hikifune*. The neighborhood has a length of around 460m, 320m width in its northern part and 520m in its southern part and covers an area of approximately 1.65km^2. Even though it lays in three different administrative units, on a local cultural and social level it is functioning as one whole. Moreover, the cohesion of the residents and their ability to act effectively together play a crucial role in case of emergency and need of rapid evacuation. These are the main reasons why this work will refer to Hikifune as a complete entity.

Figure 2.2: Location of Sumida ward in Tokyo-to and of Hikifune neighborhood within the ward borders. Credit: VANKOVA Kalina

The etymology of the word says a lot about the history of the area. Hikifune literally means *pulling boats* (曳舟). In the Edo era Hikifunegawa (曳舟川 - Hikifune River) was, as a part of the Tokugawa shōgunate's infrastructure, a man-made channel connecting present day Katsushika and Sumida wards (fig. 2.1) with the purpose of supplying Edo with fresh drinking water. In the end of the ninethieth century the river was repurposed into a towpath between Nakagawa (中川 - Middle River) and Sumidagawa (隅田川 - Sumida River) for distribution of goods. The narrow and shallow waterway required small boats and human or animal force in order to transport the goods against the current or the wind (figure 2.3(a)). The river was paved for motor traffic in 1955 (fig. 2.3(b))[11]. Today the wide road along the eastern border of Hikifune neighborhood following the path of the former channel wears the name Hikifunegawa street.

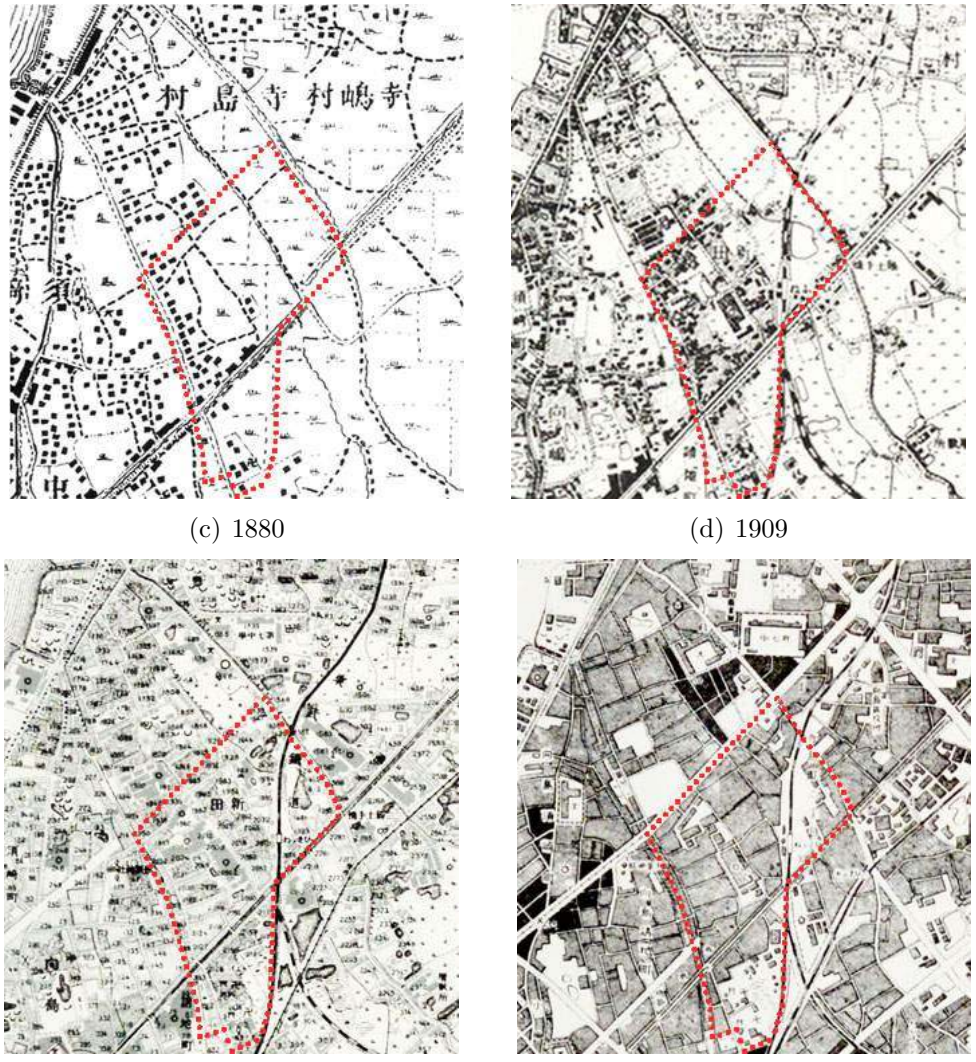
(a) Hikifune River [11]

(b) Reclamation work on Hikifune river [12]

Originally, the area belonged to Shimōsa, in the early Middle ages it became a possession of Kasai and after that of Taira clan. Since Kamakura Ashikaga era the district received a sacred status under the rule of Ise shrine. Later, in Tokugawa era, today's

Hikifune changed to be a property of Tokugawa family itself and in Meiji period became consequently a part of Musashi, Kosuge and, eventually, Tokyo prefecture [19].

The northern part of Sumida ward used to be a scarcely built-up area until twentieth century. Single one or two-storey constructions to the extreme south and rice fields in the north of present Hikifune neighborhood used to make up the rural landscape. The rapid suburban railway developments in the years between 1872 and 1903 led to an extensive expansion of urbanized areas of Tokyo region in the 1920s (p.60)[13]. The introduction of the railway system made possible the transportation of the growing population of Tokyo. On figure 2.3 it is visible how after the opening of Hikifune station in 1902 rapid urbanization followed first in the southern part of the neighborhood and by 1937 completed its limits with densely built-up dwellings. The only part which stayed relatively loose is the southern area around Shoenji Buddhist temple and a Shinto shrine next to it. Another factor responsible for the rapid urbanization of the district in the beginning of the twentieth century is the completing of the Arakawa Drainage Channel in 1917, making the area both attractive and safe for the new residents (see p.38).



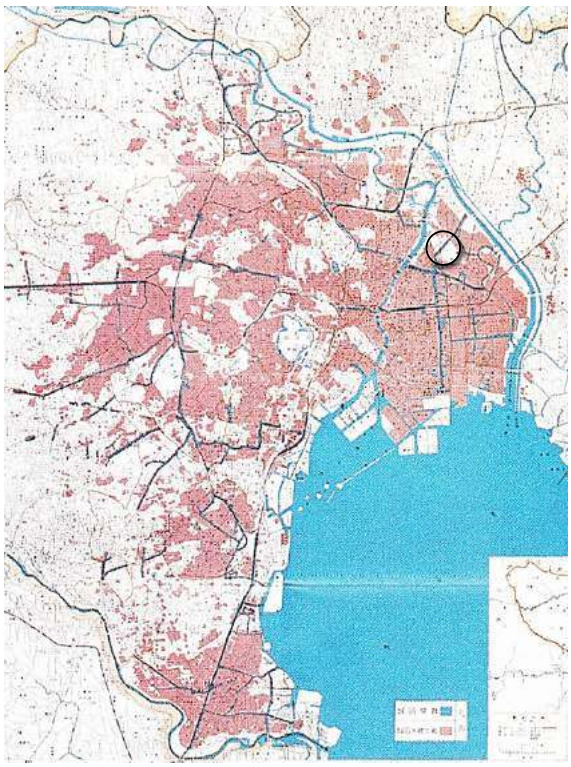
(c) 1880 (d) 1909

(e) 1925 (f) 1937

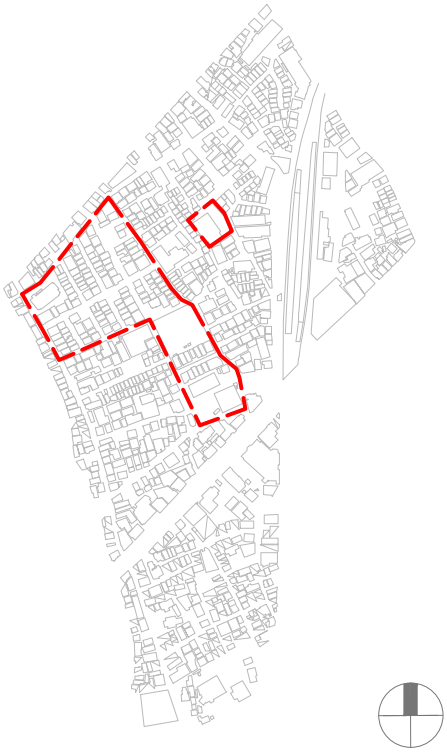
Figure 2.3: Urban development of Hikifune neighborhood [15]

The Great Kanto Earthquake which hit Tokyo in 1923 and the resulting fire destroyed above 90% of the six most affected wards laying in the Low City along the Sumida bay at the time, erasing the heart of Edo (homes of merchants and artisans) built during the Meiji era (see p.31). The already before 1923 started demographic and cultural transition from Nihonbashi area to the rising south-west was accelerated by the earthquake. The Kyobashi area, including Ginza, embarked on a modern and economically oriented urban advancement (p.5, 9, 11)[16]. Due to the low density of Hikifune at the time, the area was almost unharmed by the devastating disaster and, as a part of the more conservative district east from Sumida river, continued its low-rise densely built-up development course.

During World War II most of Tokyo-to area was bombed and destroyed. Miraculously, once again Hikifune neighborhood wasn't affected (figure 2.4(a)). In 1947, after the war, the Honjo District and Mukojima Ward merged becoming the Sumida ward. In the war reconstruction a large-scale land readjustment project of Tokyo city has been determined in the post-war time and later greatly reduced. As a result, the intact during the raids area continued its patch-like homogenous entity. In 1967 a large scale electric wire transfer factory and Fujinoki children's park opened doors (figure 2.4(b)). After the factory's relocation the urban structure of housing, land use and public facilities regained its fragmentized pattern [19]. At that time, Fujinoki children's park became the largest park in the heart of Sumida ward (about 1,800m^2). Traditional Japanese flower fuji, (フジ属 - wisteria), which has been donated and planted from local volunteers, became the name of the park (renamed to "Fujinoki park", 藤ノ木公園 in 1975).



(a) Burnt out area after WWII



(b) Old factory site [19]

In 1967 the Metropolitan streetcar, which used to run along Mito street, was abolished. 36 years later the subway Hanzomon line was opened between Suitengumae station and Oshiage station, thus re-enhancing the transportation links of Hikifune neighborhood with the city centre. At present, the two most important transportation arteries for the area are

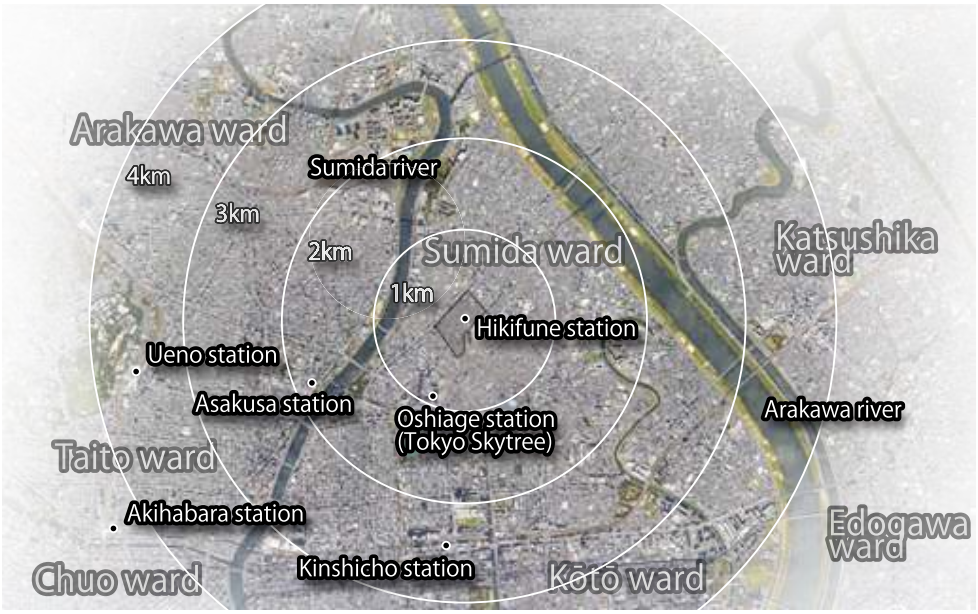


Figure 2.4: Location of Hikifune neighborhood. Credit: VANKOVA Kalina

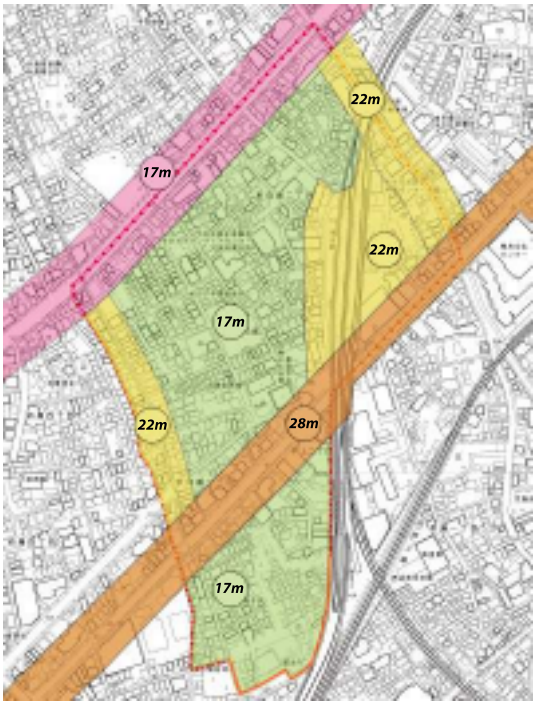
Tobu-Skytree line and Tobu-Kameido Line (figure 2.5(a)). The key location of Hikifune station provides not only an easy and quick access for people living in the surrounding area to popular commuting and commercial destinations like Oshiage, Asakusa, Ueno, Akihabara and Kinshicho stations within radius of less than 5km or 20min train ride (figure 2.4), but also performs regional transit services connecting the northern prefectures with the southern parts of Tokyo city.

Previously called *a city on water*, most of Edo's Lowland was a slough, artificially dried out under the rule of the Tokugawa Shogunate (p.263)[16]. As a result, the Low City area, *Shitamachi*, became a patchwork of islands connected by water channel grid used as a main transportation and distribution method (p.8)[8] until *"well into the Meiji period when the country made conscious effort to modernize in Western mode"* (p.90)[20]. The shift from feet and boats to wheels was among the major revolutions during the Meiji period and the demand for more space needed for the new modern transportation modes resulted in extensive infilling and paving of the channels and many rivers. This tendency was reinforced again as part of the preparation program for the 1964 Summer Olympic Games. Consequently, Hikifune river was also almost completely paved over.

Hikifune neighborhood wears the characteristics of a *superblock* urban structure consisting of high buildings along the wide streets, 28 - 35m (figure 2.5(b)), and interior of low buildings and narrow alleys. The *big* roads combine cross-city traffic movement, commercial functions and disaster prevention roles (see p.15), whereas the small-alley network maintains the local's circulation within the neighborhood (p.138)[20]. Observation of Sumida-ku urban development's historical maps on figure 4 shows that the wide Mito street was created between 1925 and 1937 as part of the Tokyo Reconstruction Work; commercial Meiji street is an ancient road existing since the Meiji era; as referred to earlier, Hikifunegawa street appeared after Hikifunegawa channel was paved over after WWII and the railway road passing through Hikifune station emerged as a consequence of the railway system introduction. The latter dissects the neighborhood in two parts and is a major factor for the functioning of the urban space.

Restricted by the building height and land-use regulations, 17m in the semi-industrial area and 22m in the quasi-commercial area (figure 2.5(b)), and sustaining the tradition of detached housing, Hikifune continues to reveal the almost uniform roofline of two-to-three storey buildings. A comparison of *Land use zones plan, Buildings elevation plan* and *Pedestrians' activity plan* (respectively figures 2.5, 2.6 and 2.7) provides an overview of the actual situation of the approximately thousand buildings and a confirmatory evidence of a correlation between the buildings' function, location and height. The data appears to suggest that most of the *superblock's* interior consists of low-rise buildings serving an exclusively residential function. Mixed use buildings with a shop or a service function on the ground floor can be found along the periphery streets, the alley leading from Hikifune station to Fujinoki park and along the railway road, or in other words, areas with high levels of pedestrian activity. The share of condominiums over seven storeys makes up around 2% of all buildings in the neighborhood. Despite this low percentage, they have a significant impact on the urban climate and the vernacular landscape.

(a) Transportation network in Sumida-ku [24]



(b) Land use and height regulations in Hikifune neighborhood [19]

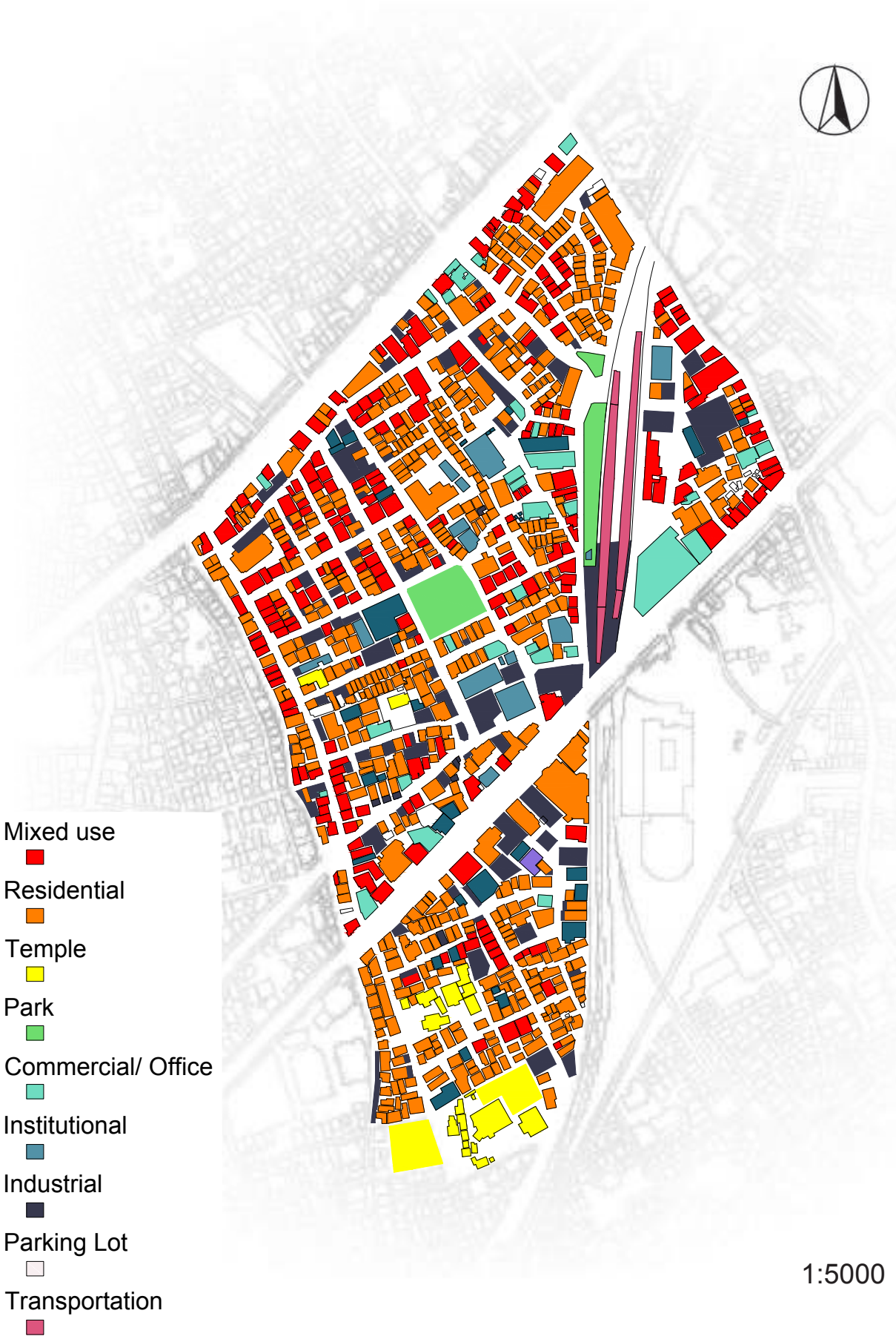


Figure 2.5: Land use zones plan. Credit: VANKOVA Kalina

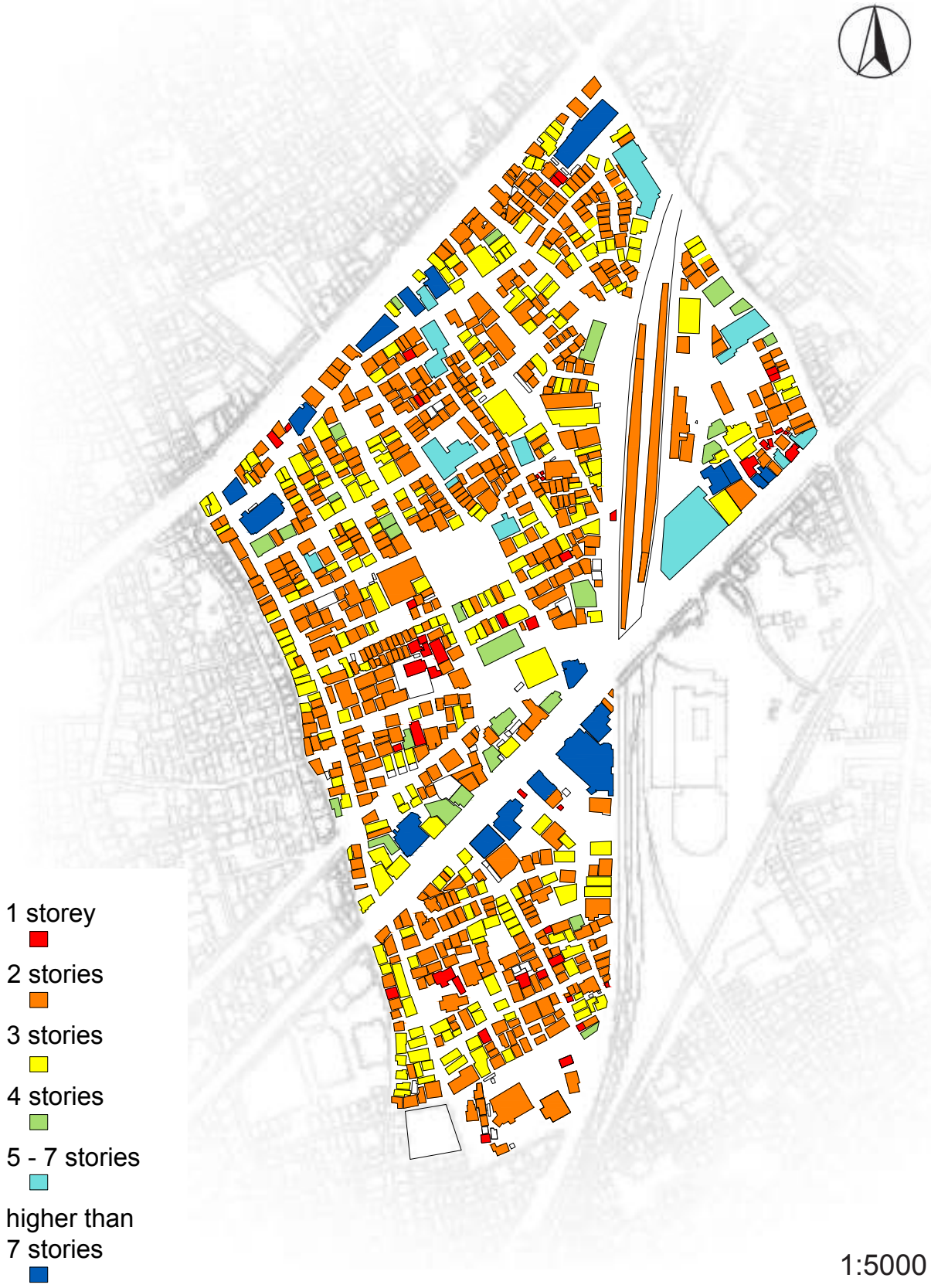
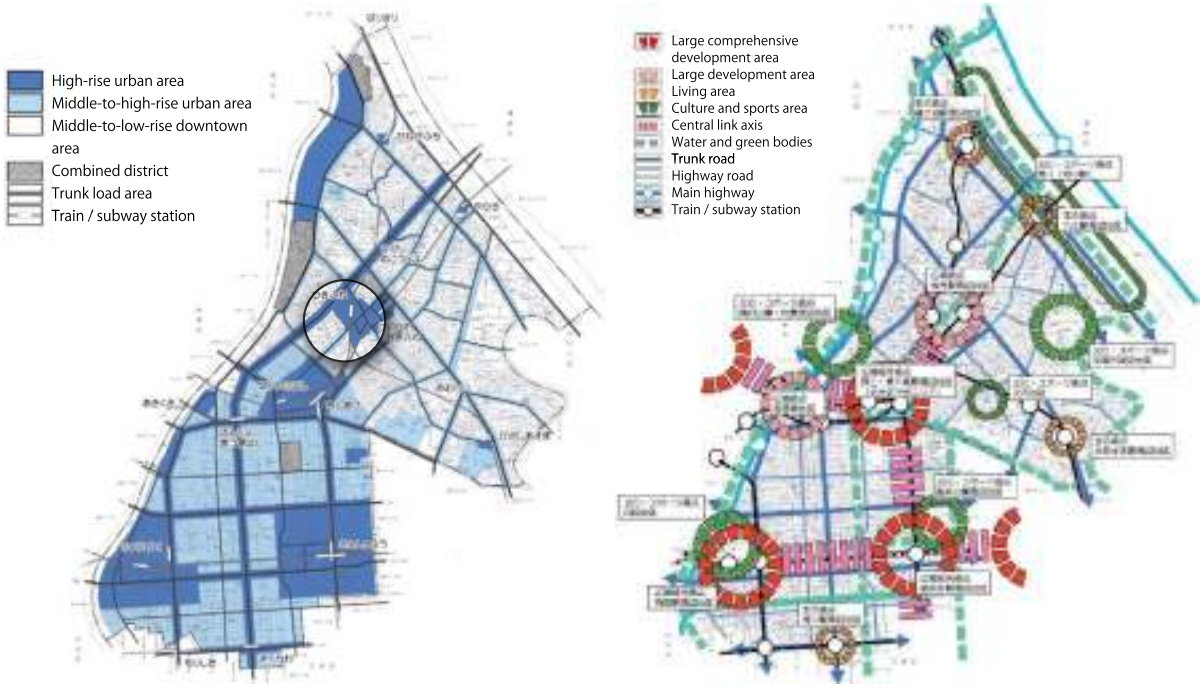


Figure 2.6: Buildings elevation plan. Credit: VANKOVA Kalina

Figure 2.7: Pedestrians' activity plan. Credit: VANKOVA Kalina

Figure 2.8: High-rise buildings along Hikifunegawa street with Ito Yokado commercial center, residential mansions and Skytree tower in the rear. Credit: VANKOVA Kalina

Since 2003 a large-scale urban re-development project is underway in the south-east part of the district. By 2016 many high-rise residential buildings and commercial facilities in the area south-east of Hikifune station have been completed (figure 2.8). Beyond doubt, the largest enterprise accomplished within the Sumida ward borders is Tokyo Skytree. Funded by Tobu Railway Corporation, the construction of the 634m high tower started in 2008 and was completed in 2012 with a two-months delay due to shortage of supplies after the 2011 Great Tōhoku Earthquake. Since then, being the tallest tower and second tallest structure in the world, Skytree serves mainly as a broadcasting centre, but also grew into a major sightseeing attraction and a commercial centre. Both observation desks provide a spectacular view of the city. The economic impact after the opening of the tower was felt not only at ward level but also nationwide. Property values near Skytree started to rise in 2011 [22] and continue to do so. The currently running Tobuline Railway Renovation Project anticipates a renewal and seismic reconstruction of the until now earthquake vulnerable route and the stations along the line including Hikifune. Apart from that, 2010 Master plan of Sumida ward is proposing a development of Hikifune neighborhood as a commercial high-rise local centre connected to the already progressing as a Sumida centre Tokyo Skytree area and further with Asakusa district. Figure 2.7 shows the distribution of buildings' elevation in Sumida-ku with dark blue referring to the high-rise (22-60m), bright blue to the middle-rise (10-22m) and white to the low-rise areas (lower than 10m). It is visible that the goal is that the north-eastern part of the ward preserves its low-rise small scale characteristics (except for the northern part along Sumida river where the main evacuation zone of the ward is located, along one of the main streets crossing the ward and the area around Hikifune station). The south-western part follows a mixed, more commercially oriented pattern, consisting of areas with high-rise periphery and middle-rise core. Finally, there are three bigger clusters of high-rise multifunctional complexes around Skytree station, Kinshicho station and Ryōgoku station and Ryōgoku Sumo Hall (fig. 2.9).



(a) Buildings elevation plan, Sumida-ku (b) City master plan, Sumida-ku

Figure 2.9: Sumida master plan, 2010 [19]

The road system in Hikifune neighborhood, except the 16m wide evacuation Hikihune-gawa and Mito streets and the 8m wide commercial Meiji street along the periphery, consists of scattered, narrow, short and meandering between the low-rise buildings streets (*roji*) of unevenly distributed width between 2m and 8m, often ceasing at dead ends. They appeared as a result of the poor planing system, extreme population density, high land prizes and preferences for a single-family housing (p.223)[57]. Figure 2.11 represents the distribution of road width in Hikifune - the majority of the most narrow streets (less than 4m) lays in the heart of the neighborhood. The *roji* are usually flat-floored, without sidewalks, hosting not only circulation of people and vehicles but also electrical poles, mirrors at many intersections and extensive vegetation. These factors and others, such as limited length of the alleys and the constant abrupt changing of directions within the *urban patchwork* restrict the view. The most narrow alleys would be potentially hazardous in case of earthquake or fire spread. The wider roads between 4m and 6m can be considered as safe routes. Theoretically, cars within the neighborhood are not restricted but are rarely used because of the speed limitations, difficulties to manoeuvre through the narrow alleys and the extreme traffic congestions and noise they cause. Most of the local people prefer to use bicycles, motorbikes, train or walk in order to reach their destination (fig. 2.12).

Pedestrians' activity plan 2.7 shows the preferable routes for locals and hotspots for local activities in Hikifune neighborhood. What is noticeable, is that residents often choose to walk along the middle-width alleys even if there is a wide-street alternative. The areas with highest circulation rates are around the train station in both directions Fujinoki park and the commercial Meiji street. These are also the areas with highest activity rates on the ground floor - workshops, markets, services etc. (fig. 2.10).

(a) Ground floor activities plan around Fujinoki park

(b) Ground floor of a detached house used as a workshop

Figure 2.10: Ground floor area. Credit: VANKOVA Kalina

Traditional place makers of Japanese streets are people's presence, personal belongings (bicycles, hanging clothes, etc.), abundant flora, opened roller shutters, ground floor workshops and services (p.69)[13]. Consequently, streets' appearance in Hikifune neighborhood depends completely on the hour and the day. The *rush hours* occur in the morning between 7:00 and 8:30 a.m. when children go to school and parents to work, and in the afternoon between 4:00 and 6:00 p.m. when people are going back home. Mornings and late afternoons are a preferable time for the elderly people, especially in the warm season, due to the high temperatures during the day. This is the reason why, in the evening, when people withdraw in their private space (all ground floor shops close, residents draw the roller shutters down and bring their belongings inside their homes), the way the narrow alleys look changes completely because most of the place makers are absent. The space outside the private area becomes quiet, plain and introverted.

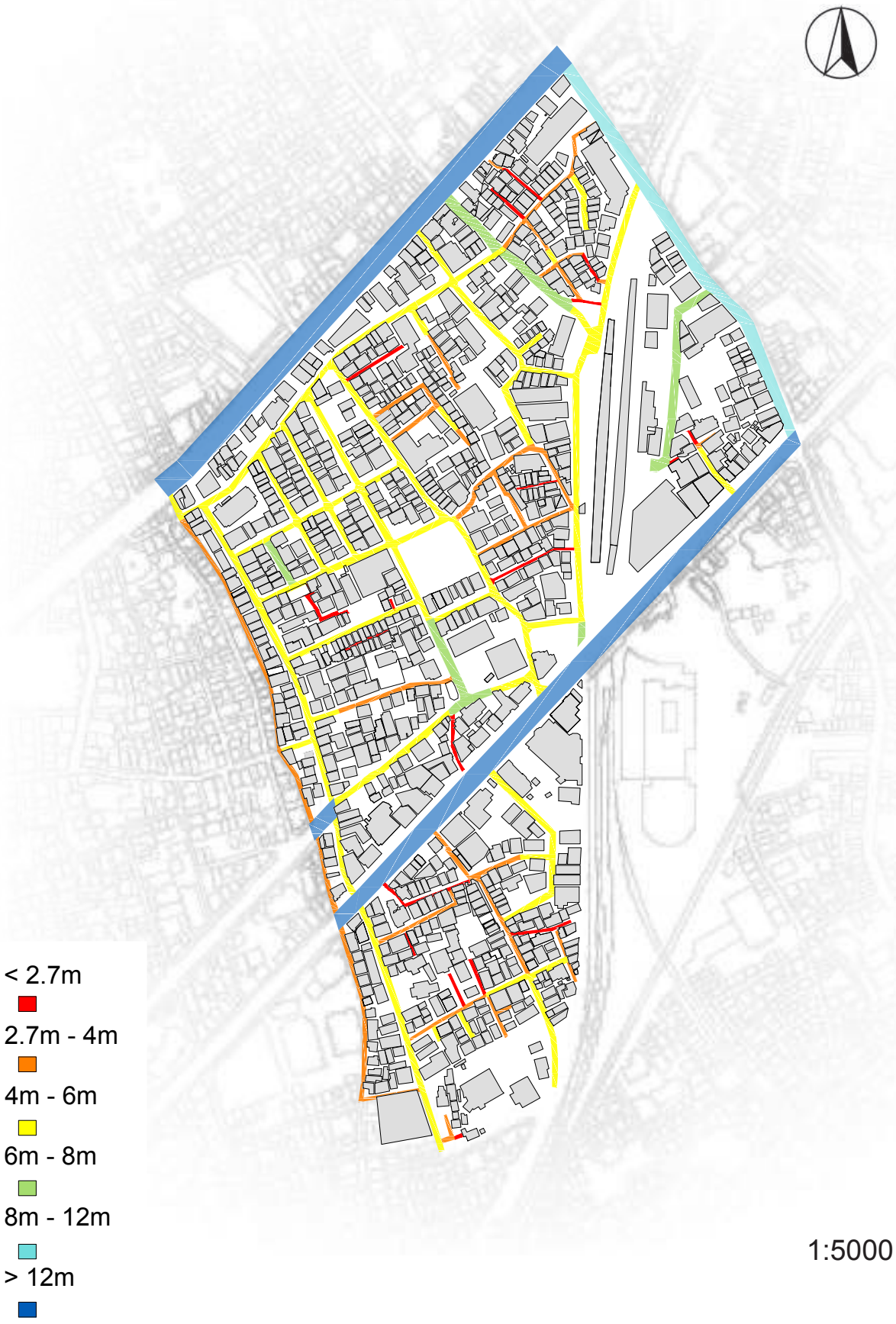


Figure 2.11: Road width plan. Credit: VANKOVA Kalina

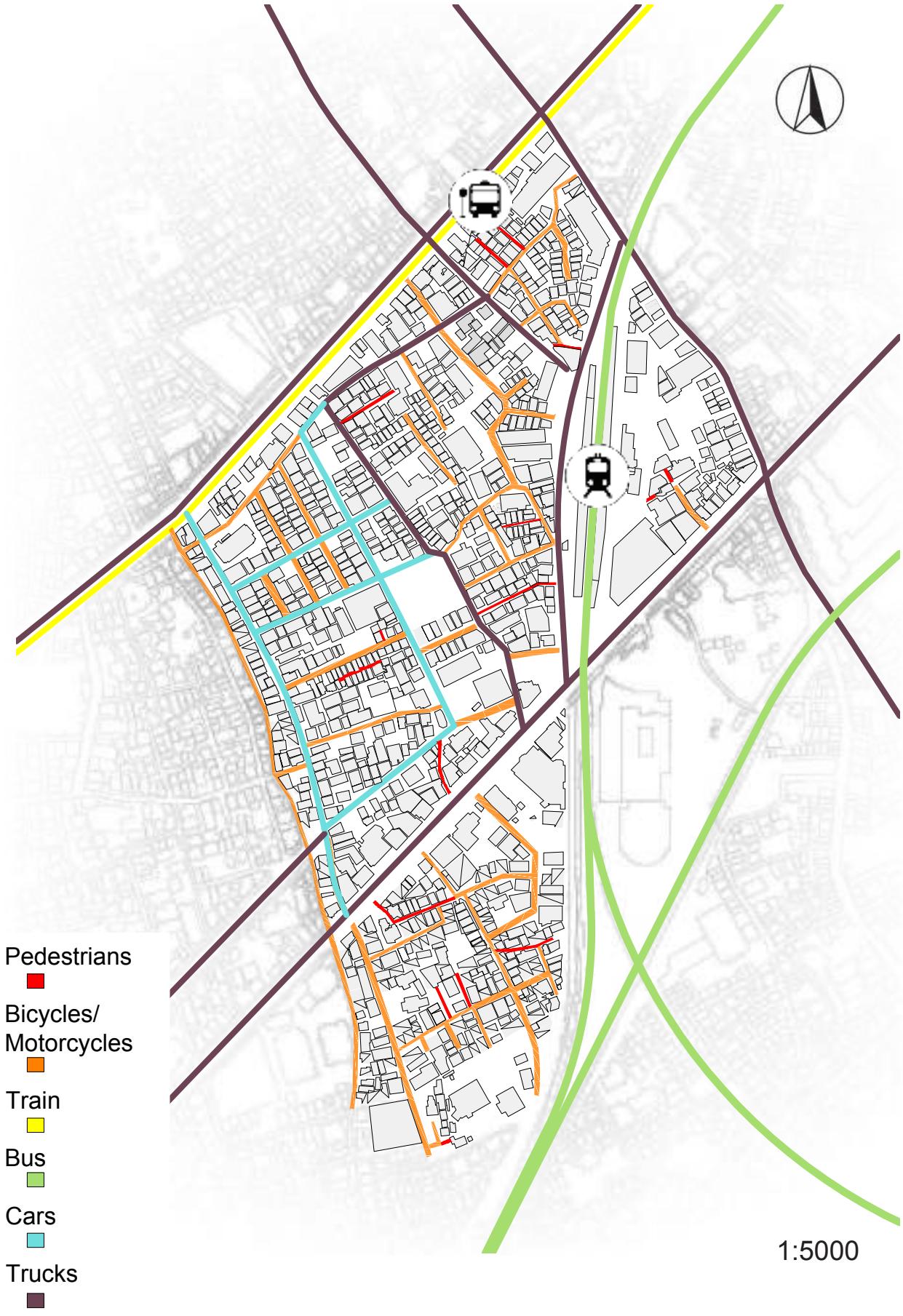


Figure 2.12: Transportation types plan.

Shelton, acknowledging Morley as his source, describes the public-private duo as an opposition of *"layers of [positive] insides and [conceptual empty] outsides"* (p.124)[20]. Respectively, the densely built-up fabric of Hikifune neighborhood constitutes of multi-layered private positive spaces (*uchi* meaning family) and everything, which is outside of the *uchi*, is a negative leftover (*soto* meaning outside). The different levels of privacy layers within the urban structure usually interfere and their merging makes it difficult for a stranger to define a clear border between private and public. Commonly, the most narrow alleys are actually no public paths, but overlapping semi-private spaces of two or more houses which provide the needed access to the private space (fig. 2.13).

(a) (b) (c)

Figure 2.13: Narrow alleys in Hikifune neighborhood. Credit: VANKOVA

(a) (b) (c)

Figure 2.14: Abundant vegetation in Hikifune neighborhood. Credit: VANKOVA

Vegetation is not the only element which lives side by side with other independent elements in the Japanese urban space. The juxtaposition of *separate but co-existing systems*

is a natural phenomenon of the landscape. Everything from infrastructures, shrines, nature, electric poles, new and old *participate equally with buildings in the imagery of urban Japan* and *result in an amorphous and more collage-like surface*(p.13)[20] (fig. 2.15(b)). Co-existence is a prerequisite for diverse activities and livable environment.

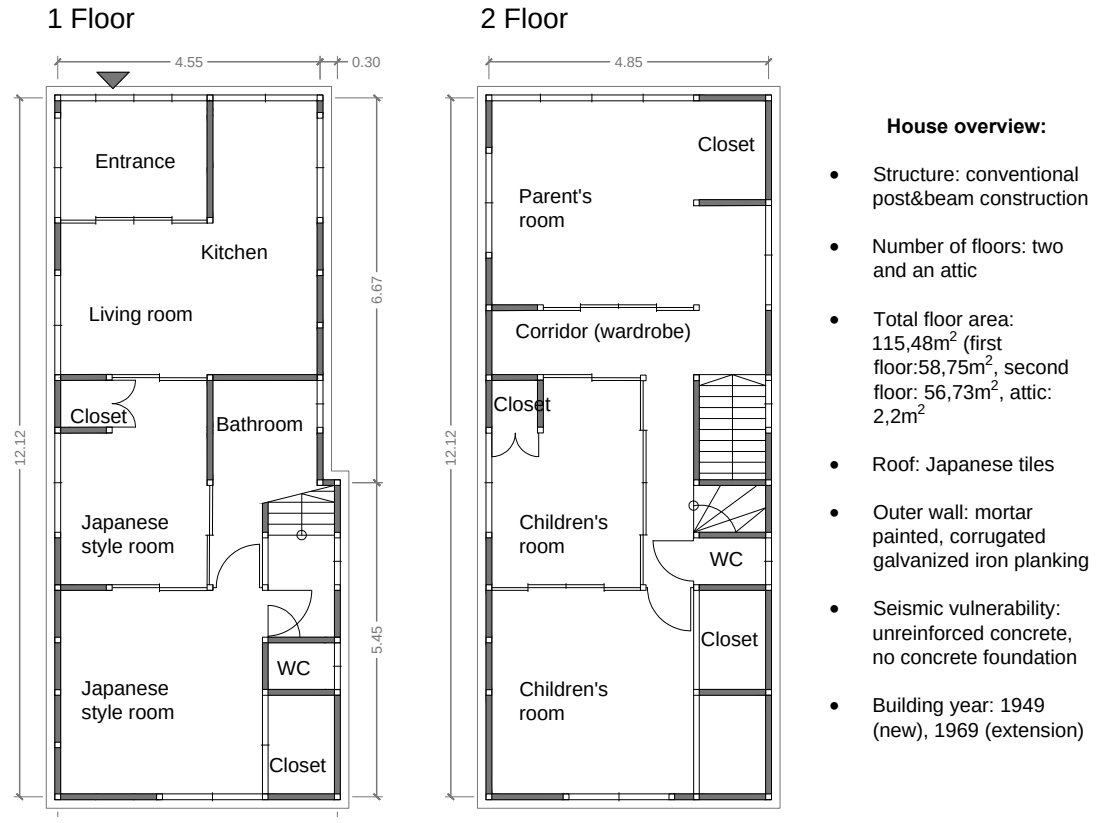
(a) Shinto tori in northern Hikifune neighborhood. Credit: VANKOVA Kalina

(b) Juxtaposition of a tori, an old two-storey residential building behind it, an electrical pole and Skytree tower in the background. Credit: VANKOVA Kalina

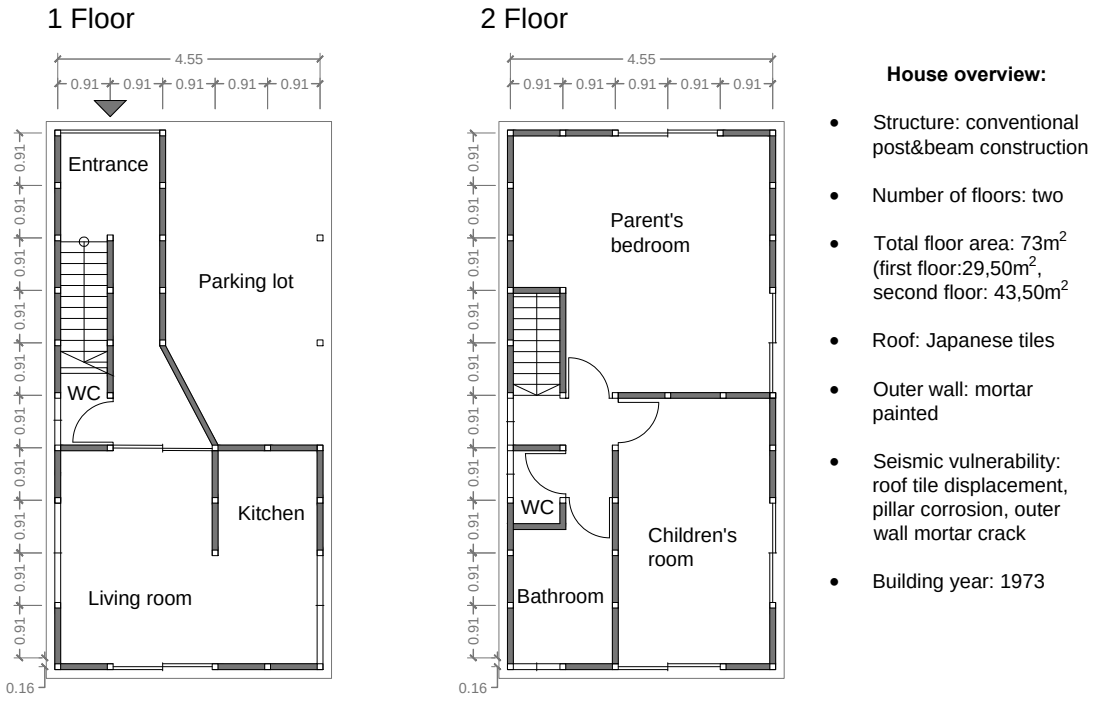
(c) House in a "billboard architecture style" at Meiji street. Credit: VANKOVA Kalina

Machiya (from Japanese.: ma - 町 'town' and ya - 家 'house' or 屋 'shop') are traditional Japanese detached townhouses of merchants and artisans or collectively referred to as *chōnin* (townspeople). The first *machiya*-s were born in the Heian period and continued to develop during the Edo and Meiji periods [23]. Since the postwar time these areas of urban vernacular started to disappear rapidly followed by a second destruction wave during the 1980s bubble economy and currently being a subject of pressure from many large scale development corporations and real estate agencies. As a result, Hikifune is one of the few surviving *machiya* areas in Tokyo.

Even though they are being erected as one-generation homes, the rebuilt on the same plot dwellings don't differ a lot from their predecessors in terms of construction and used materials. Traditionally, they are deep and narrow two to, occasionally, three storey constructions with a flexible *kyoshitsubu* (居室部, *living space*) in the rear and a *mise no ma* (店の間, *shop space*) with sliding or folding shutters in the front. That is why, the *plinth* of *machiya*-s along a narrow alley is very ambiguous. It *functions as a smooth intermediate zone between the outside and the inside, offering a system of flexible elements that allows the plinth to change openness and function* (p.161)[25]. In the recent years, the ground floor function in many cases has been changed to garage or living space. As a result, the *kōshi*, 格子 (wooden lattices which indicate the type of shop the *machiya* holds) stopped being part of the exterior and the sense of exchange between inside and outside has been largely replaced by more introverted, private and unsocial environment.



(d) With a residential function on the ground floor



(e) With a garage on the ground floor

Figure 2.15: Typical plans of old wooden detached houses [24]

Figure 2.15(d) and 2.15(e) illustrate typical plans of old timber detached houses in Hikifune of respectively 115m^2 and 73m^2 total floor area. Due to the shift from traditional service or workshop at ground floor to other functions the plinth in the first case

serves a residential function and in the second is a garage. A closer look at the plan at figure 2.15(d) reveals that the first floor accommodates the entrance, a living room with a kitchen and a *tatami* room in the deepest end, whereas on the second storey are located the bedrooms. There is no basement, only a little storage in the kitchen floor. Due to the limited space, the usual connection with nature is established within the *plinth* as a part of the (semi-) public realm. The presence of sliding doors between most of the rooms makes the space flexible and adjustable to the needs of the inhabitants. Generally, the inside of a *machiya* characterizes with asymmetry and dimness. Despite having windows on each wall, the dwelling is normally mere centimeters from the surrounding houses and thus the main source of light comes from the front facade looking at the narrow alley. The element of asymmetry goes through the whole depth of the structure emphasized by the sliding doors and the unevenly distributed light. Traditional *machiya*-s have their floors covered with *tatami*, contain very little furniture and are made only of natural materials such as wood, paper, straw and earth. During the last century with the advancement of the technology some of these features have disappeared or been replaced by new modern ones. Yet, the basic structure remains almost the same. The material set used for the building and the extension of the houses given as examples includes timber for the light skeleton construction, tamped earth for the foundations, mortar for the outer walls and roof tiles *kawara*. Despite equipped with modern technology devices such as TV-sets, air-conditioner etc., the basic outlook of the old houses remains similar to the ones constituting the landscape in Hikifune since the beginning of the twentieth century.

Post-and-beam wooden construction is the most conventional method for building of *machiya*-s (fig. 2.16). The basic system consists of a timber skeletal structure of continuous posts in the vertical direction and beam frame for each floor in the horizontal. Between the thick posts there are thinner columns supporting the outside walls. The foundation is continuous with ventilation openings. The floor consists of posts, joists and sleepers in the opposite direction at regular distance. Windows are lined with window sills at the bottom and lintels support both doors and windows at the top. At the four corners of each floor lie *hiuchibari* or angle braces to reduce the horizontal force. Moreover, *sujikai* (braces) are inserted next to openings as an additional seismic reinforcement. The roof rests on *koyabari* (tie beam) and constitutes of *sumigi* (angle rafters) and *moya* (purlins). All rafters are connected by *munagi* or the ridge beam and build the highest part of the building. *Kawara* cover the roof.

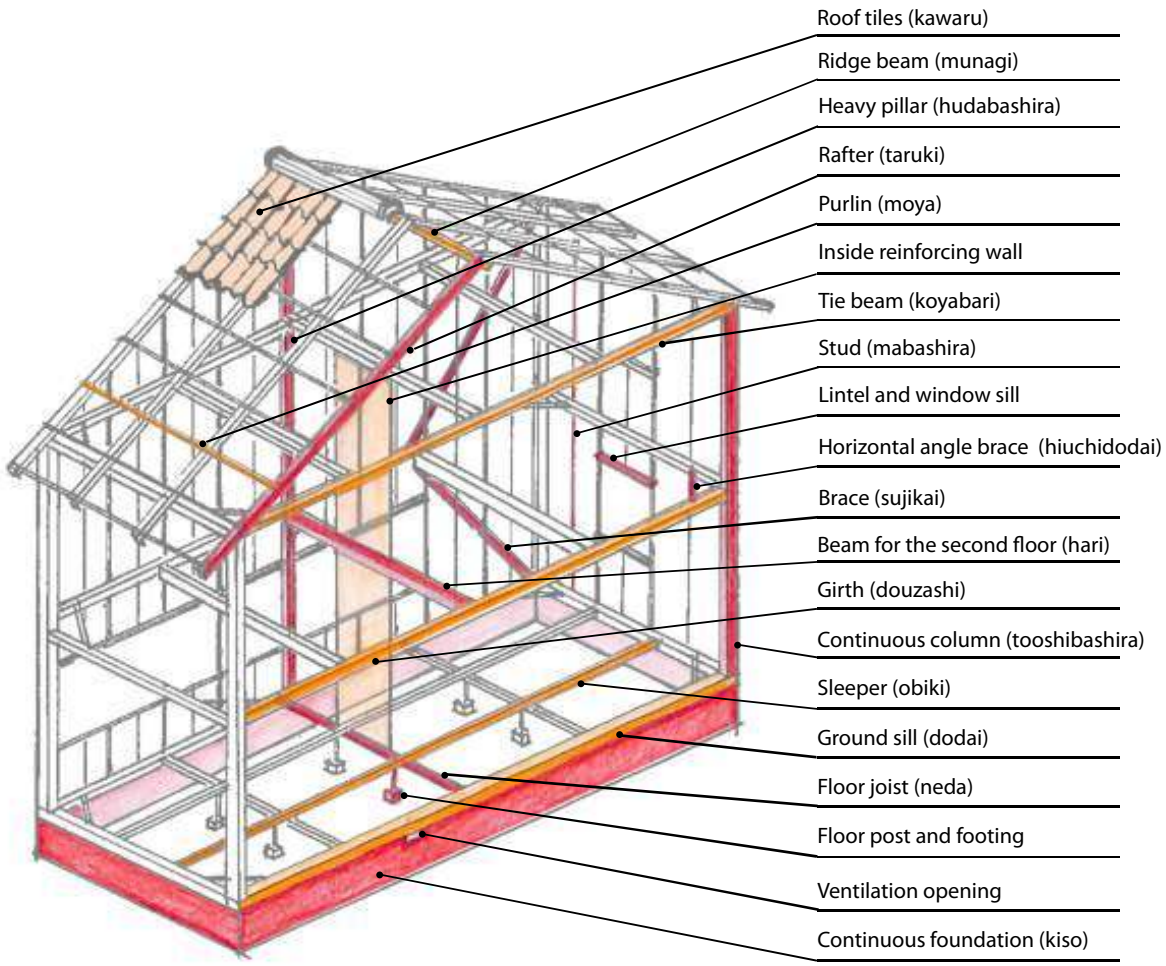


Figure 2.16: Post-and-beam wooden construction of a typical old wooden detached house. Credit: VANKOVA Kalina [32]

2.2 Issues

Significant for creating a disaster management system is recognizing the lessons from historical disasters both on a local and global scale. 1995 Kobe and 2011 Tohoku earthquakes left deep scars in the Japanese nation. Yet, they gave the scientists opportunities to generate large amount of data regarding city resilience and raised the awareness of disaster risks in urban areas. Following section will discuss the issues concerning Hikifune neighborhood, the way they interact and mutually reinforce. For the topics *Earthquakes*, *Fire spread*, *Floods* and *Demographic dynamics* the analysis will go into deeper detail.

As previously mentioned, the railway development and the creation of Arakawa river were factors which contributed for the acceleration of the rapid urbanization of Tokyo in the 1920s and 1930s. As a result, after 1923 part of the Low City areas were rebuilt following plans of the land-readjustment system, but most of the inner city was developed under a very weak planning system established by the 1919 city planning law. The *informal* settlements were generated through small developments of individual plots without any effective subdivision control. Even though Japanese houses have a traditionally short lifespan (about 40 years), the urban structure of these areas, some of them untouched

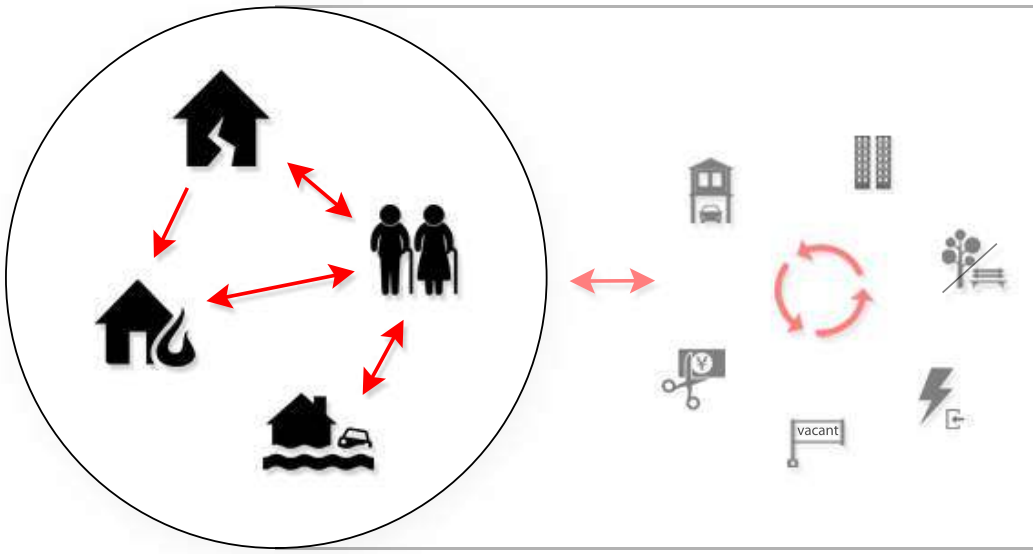


Figure 2.17: Interdependency diagram. Credit: VANKOVA Kalina

during the WWII raids, remained unchanged and destruction and rebuilding without planning beyond the individual plot was promoted along the existing small scale *patchwork* pattern. Today a siginficant part of central Tokyo area (including Hikifune district) continues to be densely built-up with a second or third generation of the same old low-rise wooden houses built during the urbanization in the beginning of the twentieth century (p.60)[13]. Consequently, a number of issues for Hikifune neighborhood arise from the weak urban planning throughout the last hundred years:

- Earthquake vulnerability due to the high density of the area, the seismic unpreparedness and deterioration of the timber constructions and the soft soil land of the area, which amplifies the shaking from earthquakes (p.8)[26]

- Conflagration vulnerability due to the high density of the area, the low fire resistance performance of the concentrated wooden housing and the presence of vacant non-maintained buildings

- Flood vulnerability due to the climate change, the proximity of Sumida and Arakawa river, the average ground level (about 2m about the sea level) and the low-rise scale of the buildings

- Homogeneous demographic profile of the neighbourhood and unappealing social environment for younger people due to the high average age of the residents, difficult community integration, common feeling of insecurity in terms of disaster risk and general lack of job opportunities

- Concomitant issues

2.2.1 Earthquakes

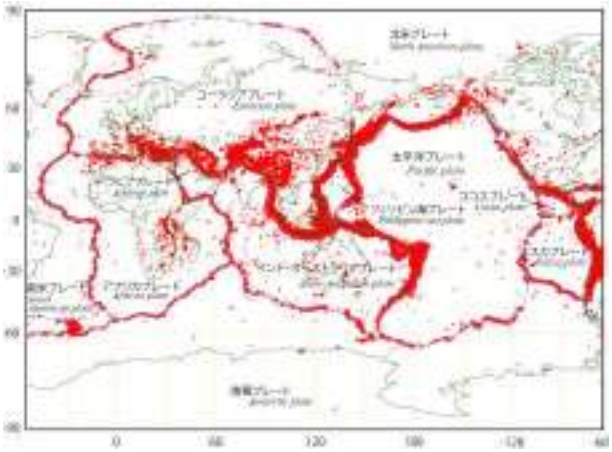


Figure 2.18: Distribution of earthquakes in the world [14]

Japan has a long history of earthquake catastrophes caused by seismic activity which can be followed back to the appearance of the first dense city dwellings during the Tokugawa period. The Japanese archipelago is located on the boundaries of four litospheric plates - the Pacific Plate, the Philippine Sea Plate, the Eurasian Plate and the North American Plate (fig. 2.18). Their constant movements release enormous amount of energy [27] and are the reason why Japan is one of the most earthquake-prone countries in the world. Some earthquakes occur on a relatively regular base and are easier to predict (Tokai Earthquake for example). However, short-term prediction of ground motion is, generally, still difficult (p.7)[28]. Furthermore, statistics prove that earthquakes in Japan have become more intensive and unpredictable since the 1970s [29] and TMG disaster prevention plan *Unbreakable and unbearable* anticipates that strong earthquake will hit Tokyo city within the next 30 years. Despite not being as deadly as other natural hazards, they can trigger other dangers - 2011 Great Tōhoku Earthquake caused a devastating tsunami along the East coast of Japan and 1923 Great Kanto Earthquake lead to a massive fire-spread which erased most of the Low City built during the Meiji era. According to the Disaster and Risk Profile of Japan for 2014 seismic activity is also the main contributor to Average Annual Loss (AAL) in the country [30]. Therefore, in order to prepare before the occurrence of a probable earthquake, reinforcement of seismically weak buildings determined by analysis of the structures is required.

One of the main concerns in building control after the Great Kanto Earthquake in 1923 was to construct buildings that can withstand earthquakes. In 1924 the Japanese Building Code required the first in the world structural calculation in considering seismic force. The Great Hanshin-Awaji Earthquake which hit Kobe city and surrounding areas in 1995 destroyed 104.906 buildings and caused 6.433 deaths. Unlike Great Kanto Earthquake, 80% of the deaths in Kobe were due to collapsed buildings or falling furniture. Most of the collapsed buildings were constructed before 1980. *"Structural reinforcement against horizontal loads [...] was rarely carried out before the 1995 Kobe Earthquake. The structural reinforcement that was carried out was for long-term vertical load."* (p.43)[31]. Rebuilding of residential, administrative buildings and even temples after an earthquake without any reinforcement was a *"common style of repair"* in Japan. After 1995 earthquake seismic reinforcement of old buildings became an urgent issue (p.13)[32]. According to BSL (Building Standard Law), however, structural calculations for two-storey buildings are not required and they only need to comply with structural specifications (p.79)[32]. Many of the *machiya*-s in Hikifune built before 1980 don't complete even these requirements.

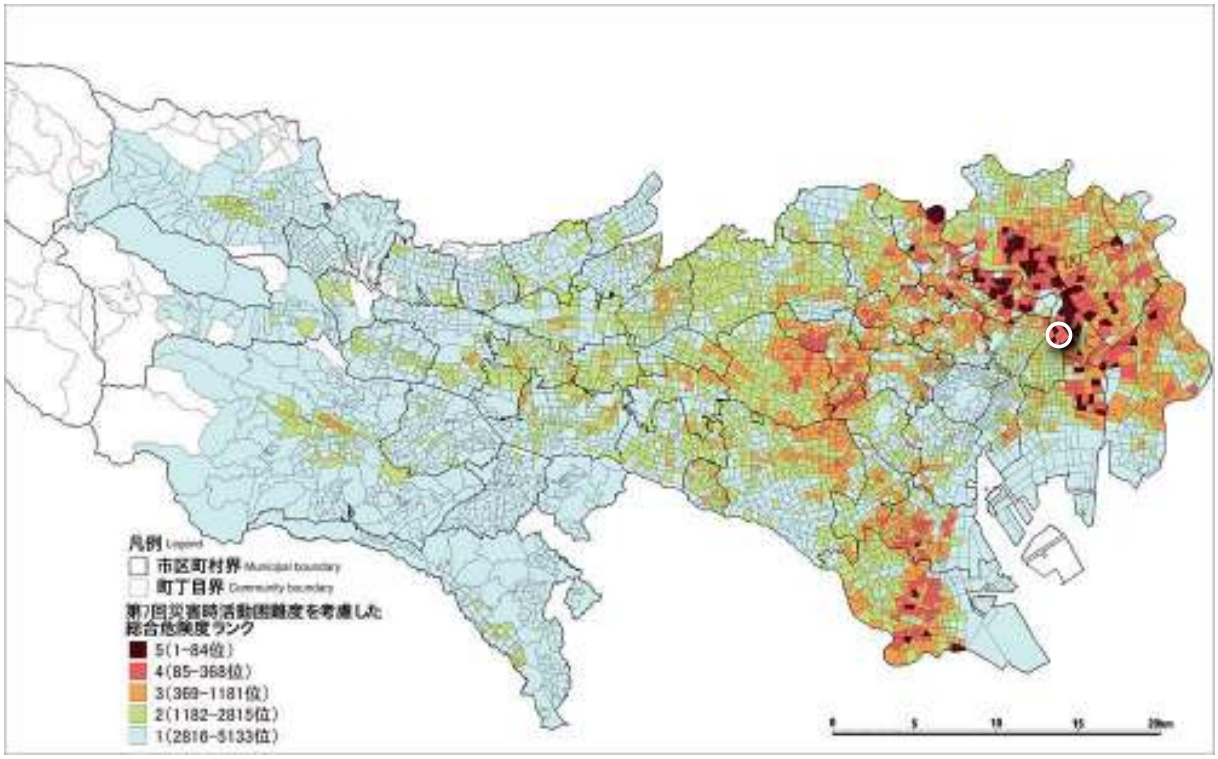


Figure 2.19: Building collapse danger rank (p. 11)[26]

Since 1975 Tokyo Metropolitan Government has been conducting series of district-based earthquake vulnerability assessments every 5 years incorporating new earthquake-related information and knowledge, and latest data on buildings and other changes in the urban landscape (p.2)[26]. The last edition from 2013 (fig. 2.19) shows that most of the regions with highest vulnerability to building collapse (in dark and bright red) are located in the densely built-up with wooden housing alluvial lowlands along Arakawa river. Among these regions are Adachi-ku, southern Arakawa-ku, eastern Taito-ku, western Katsushika-ku and northern Sumida-ku. According to the plan, the northern part of Hikifune neighborhood is colored with the highest ranking (5) and the southern with the second highest (4) estimating it as a high-risk area.

More than half of the wooden houses in Hikifune district date from before 1970 and the ones built between 1971 and 1980 make up about 15% of the rest (fig. 2.20). Most of these structures don't follow the Law for Promotion of Seismic Retrofitting of Buildings enacted in 1995, don't comply with the current seismic standard and, consequently, wouldn't be enough to sustain a serious earthquake or a fire-spread. Rebuilding after the Great Kanto Earthquake permitted temporary wooden housing [33] and some of the houses today were just rebuilt on the same plot without permission.

The most exposed to earthquake damage in Hikifune neighborhood are unevenly distributed clusters including vacant and old non-reinforced houses along the narrow alleys concentrated in the densely built-up interior. Single remote constructions or the ones close to seismic-proof buildings don't present a great danger for the surroundings. The building vacancy rate in the area is not very high compared to other densely built-up with old wooden houses neighborhoods in Sumida ward. However, their poor condition due to lack of maintenance, location along narrow streets and proximity to other constructions with weak seismic resilience increase the probability of buildings collapse and following

street blockage, inability for a fire brigade or an ambulance to reach their destination and difficult evacuation. Figures 2.23 and 2.21, representing the distribution of earthquake collapse prone buildings and vacant buildings in Hikifune neighborhood, show that in each of the high-risk zones there is at least one vacant house. The small old timber structures *"can be expected to undergo large deformation or damage if they are exposed to strong vibrations"* (p.42)[31]. Commonly, the reasons for a possible building collapse or damage are insufficient braces and other reinforcing elements, deterioration of timber material, looseness of joints, non-reinforced foundation (p.45)[31]. These components of the *machiya* construction could easily fail due to the building inclination anticipated during a strong ground motion in the years to come. Furthermore, roof tiles or unfixed furniture fall occasionally.

Figure 2.21: Vacant Buildings Plan. Credit: VANKOVA Kalina.

(a) (b) (c) (d)

(e) (f) (g) (h)

(i) (j) (k) (l)

(m) (n) (o) (p)

Figure 2.22: Vacant buildings in Hikifune neighborhood. Credit: VANKOVA Kalina.

Figure 2.23: Distribution of earthquake and fire-spread prone buildings. Credit: VANKOVA Kalina.

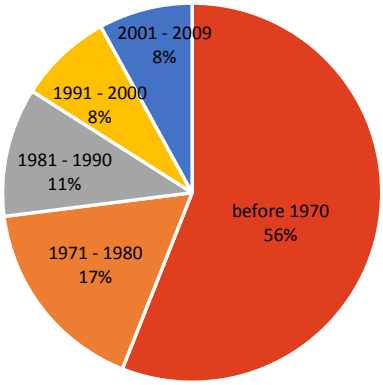


Figure 2.20: Building construction year distribution, 2010 [19]

Figure 2.24: "Do-it-yourself" seismic retrofitting activities Credit: VANKOVA Kalina

The conducted analysis reveals also that some residents carry out *do-it-yourself* seismic retrofitting activities which is usually not only illegal and insufficient but also could make the house even more vulnerable due to the lack of expertise (fig. 2.24).

2.2.2 Fire-spread

Based on the fact that the traditional Japanese building method consists of a wooden structure with paper screens and the characteristic climate of seasonal strong winds and dry winter air in Japan, conflagration has been enemy number one of the Edo city. The fires, *which were called Edo no hana, (The Flowers of Edo), occurred so frequently and burned so freely that no house in the Low City could expect to last more than two decades* (p.14)[16]. It is understandable that the highest buildings in the old towns, besides castles and some pagodas, were the fire watchtowers and the so-called *kura*, or fire-protected storehouses, where the prime structures provided an early-warning system and the latter - buildings covered with thick fire-retardant plaster coating (p.106)[20]. There were other early fire-spread prevention measures since the Edo era, such as open areas around bridges which served as firebreaks and evacuation zones, but the first fire prevention regulations were introduced only after the WWII during the US occupation (p.71)[34].

The reasons for a fire outbreak could be various but very often it is an earthquake and fires would start whenever buildings collapse in large numbers (p.7)[16]. Certainly, the greatest fire in the history of Tokyo and Edo is the fire caused by the Great Kanto Earthquake which destroyed about 450.000 buildings and took more than 143.000 lives (p.12)[32]. The majority of the citizens died due to the heat wave generated by the fire in the Low City. Hikifune stayed out of the fire reach because at the time it wasn't a densely built-up area.

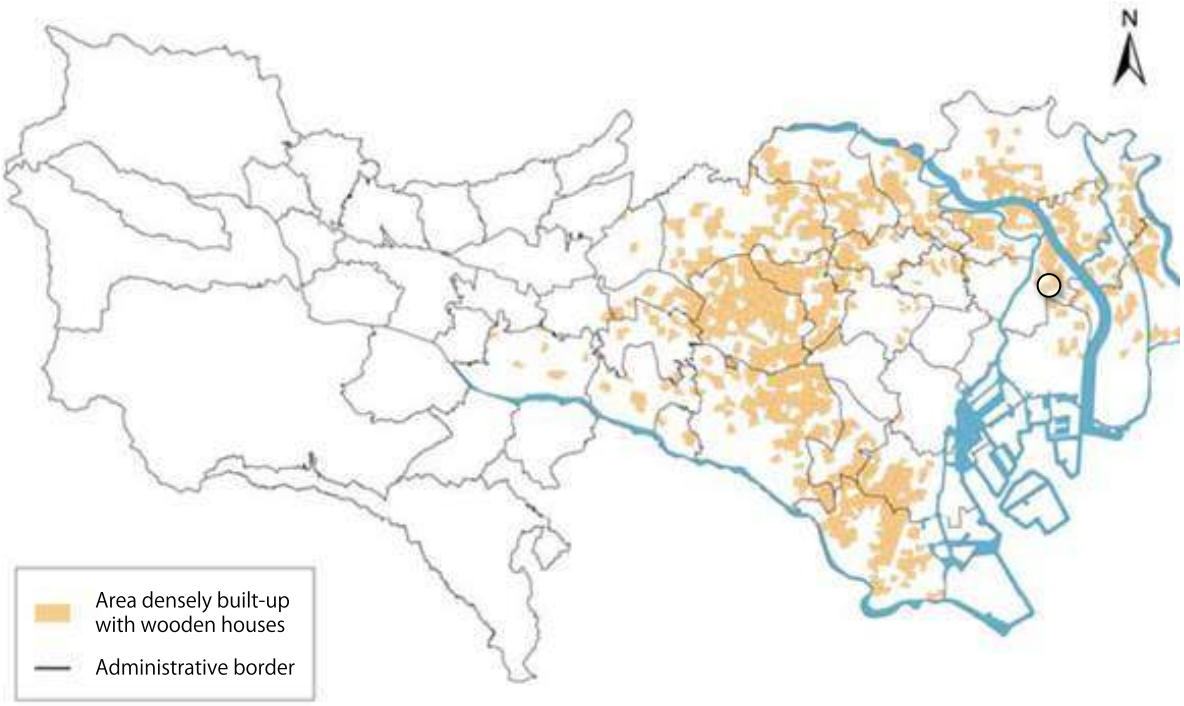


Figure 2.25: Areas densely built-up with old wooden houses in Tokyo [17]

Figure 2.26: Tokyo, Great Kanto earthquake damage, 1923, illustrating origins and extent of fire damage [18]

Nowadays, the threat of a fire spread in the central parts of Tokyo is very limited due to the introduction of new fireproof materials and the widening of the streets. Fire spread hazard in densely built-up areas with wooden structures, however, is still present. A comparison between figure 21 and figure 27 indicates that the areas with highest risk of building collapse largely overlap with the densely built-up with old wooden houses areas which comes to prove that the old wooden houses are the buildings with lowest seismic resistance and the zones of their location are exposed to a collective risk of building collapse and fire spread.

In the short run Hikifune neighborhood was lucky, avoiding damages through both 1923 Great Kanto Earthquake and 1945 air raids (fig. 2.4(a) and 2.26). These events were a trigger for a change of the urban structure in the flattened twice central parts of Tokyo. Those areas had the chance to rebuild the urban space with modern buildings and wide roads, the so called *omotedori* (p.188)[9], and apply the new disaster prevention regulations on the huge open plot.

Hikifune, however, preserved its *plot-by-plot* urban pattern of informal housing since the 1920s until present. Consequently, the neighborhood, illustrated by a circle on the map, is situated in the epicentre of both, fire spread and building collapse hazards. This zone is listed as a priority development centre from the TMG (fig. 2.27).

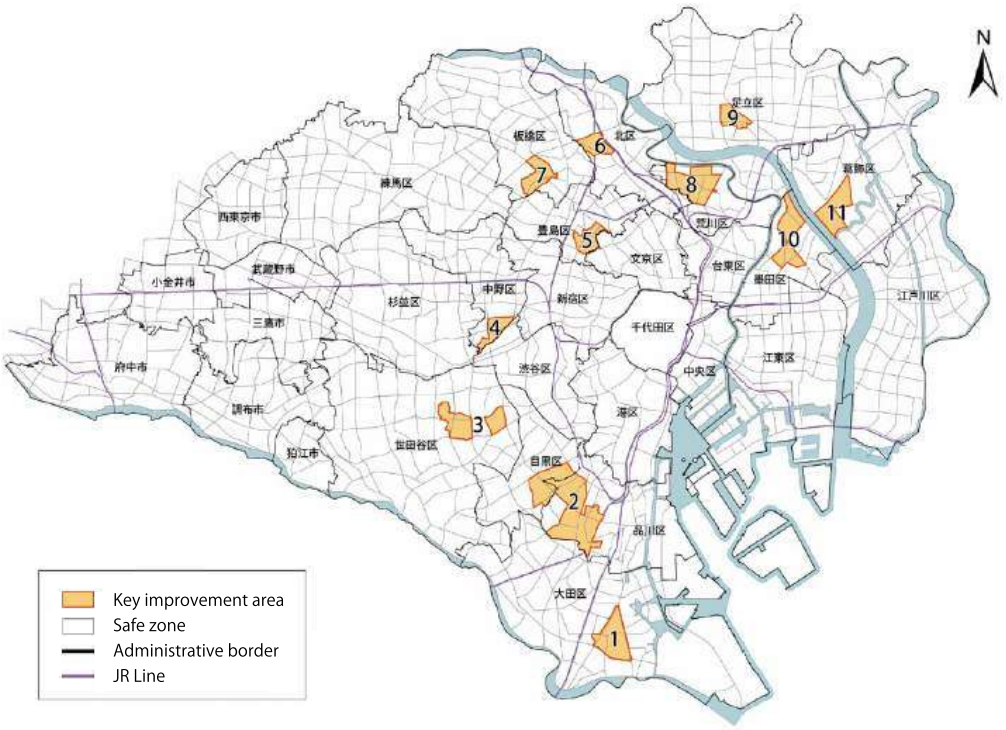
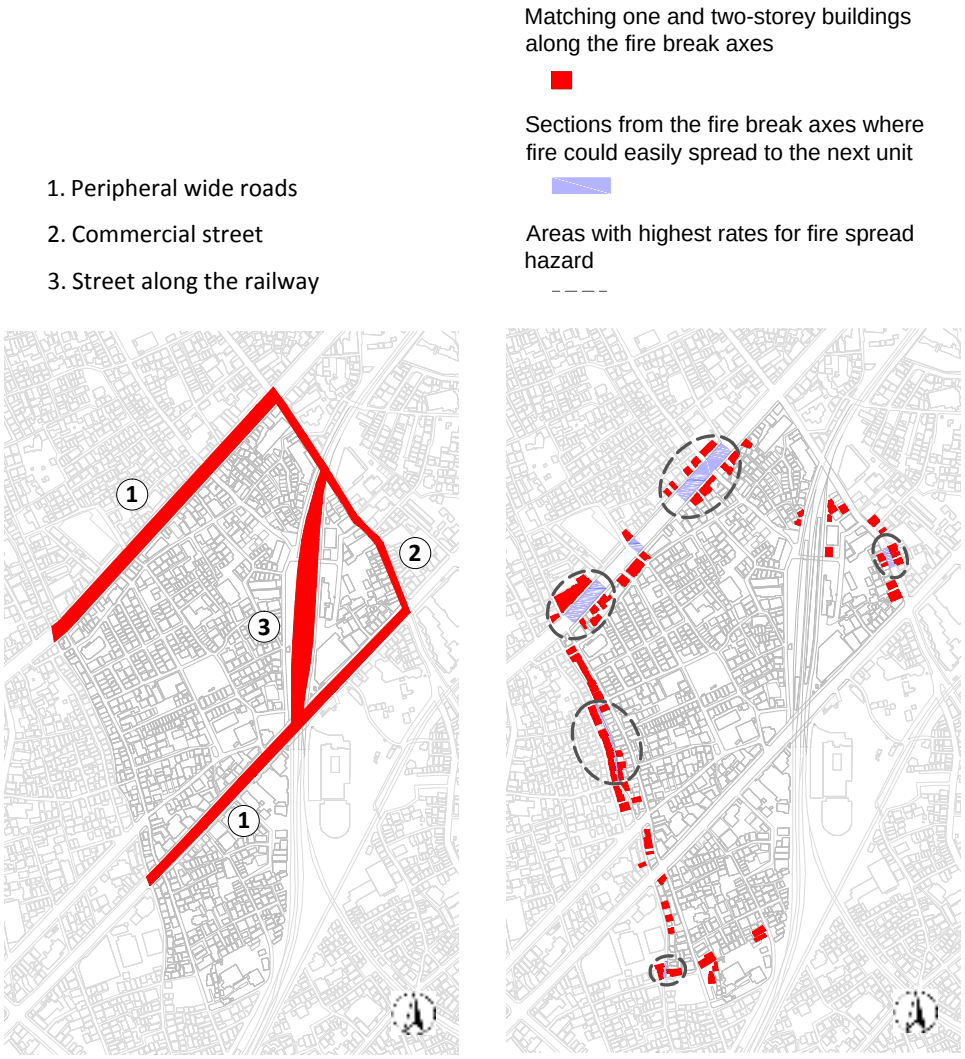


Figure 2.27: Priority development areas in Tokyo [35]

One of the main factors to be considered in both cases is the evacuation road network. Wide roads serve not only as main transportation arteries and corridors of commercial activity but also as prime evacuation paths and channels to cut the spreading of local fires (p.151)[20]. Figure 2.28(a) illustrates the firebreak axes in Hikifune neighborhood and figure 2.28(b) shows the fire-prone sections along these axes where the buildings on both sides of the street are lower than 3 storeys and could easily provide a fire bridge in case of conflagration.



(a) Firebreak axes plan

(b) Weak periphery areas along the fire-break axes

Figure 2.28: Firebreak axes. Credit: VANKOVA Kalina.

Figure 2.29: Fire-prone area along the fire-break axis. Credit: VANKOVA Kalina

Once the fire is restricted to the borders of the neighborhood due to the fire-breaks, the danger remains for the densest areas with high concentration of wooden fire non-proof houses and vacant buildings with no maintenance and low fire resistance performance. An example for a potentially hazardous area in the core of the neighborhood is the factory for automobile parts and its surroundings (fig. 2.30(a)). The building has no insulation, performs activities that could easily lead to inflammation and the tin facade could seamlessly conduct the appeared fire and heat. Its central location opposite to the main evacuation zone in Hikifune, Fujinoki park, not only makes the area extremely vulnerable to fire-spread but could threaten the

safety of the evacuation zone and hinder the evacuation process.

The second prone to easy conflagration zone is situated between the public bath and the station. A combination of high concentration of activities, presence of electric poles and old timber houses aligned along the very narrow alleys expose the area to high levels of fire occurrence and spread risk (fig. 2.30(c)).

(a) Factory for automobile parts

(b) A house with a partly retrofitted facade and preserved construction and rear part

(c) Narrow alley between public bath and train station

(d) Space between two houses used as a storage

Figure 2.30: Fire-prone areas of Hikifune interior. Credit: VANKOVA Kalina.

Besides the abovementioned problematic areas, there are other confined spaces of single dwellings with a minor impact themselves but with a major effect on the overall deterioration. In numerous cases people had retrofitted only partially their property, the facade for instance, in order to preserve the traditional look of the house or have a safe-looking frontage (fig. 2.30(b)). Another example shows how, commonly, the space between the buildings is being used as a storage for easily inflammable belongings (fig. 2.30(d)).

As already determinate, building collapse and fire spread are disasters which often occur one after another. Usually, the damage they cause is also collective. Street blockades, for example, are a typical consequence of both hazards. In order to decrease the fire damage caused by an earthquake, it is crucial that an easy access is granted for fighting activities immediately after the fire outbreak. Blocked by collapsed buildings and electrical poles, narrow alleys obstruct the use of emergency vehicles, complicate and delay the evacuation process and become extremely dangerous zones due to the concentration of gas emissions, heat and falling materials. In order to decrease the risk of street blockages, every road in Japan must follow a BSL obligation for minimal road width of 4m between two plots

(fig. 2.31). Figure 2.11 proves that very often the alleys between the individual plots in Hikifune neighborhood do not extend the mandatory 4m width. The illustrated on figure (fig. 2.32) narrow streets, for example, are extremely prone to street blockage due to their narrow (around 3m) non-linear path and surrounding old wooden seismic non-engineered two-storey houses. Nevertheless, one of these alleys establishes an important for the neighborhood connection between Fujinoki park and Hikifune station and characterizes with high levels of pedestrian and cyclist activity during rush hours, weekends or special occasions such as at *hanabi*, the day of the fireworks, or at *matsuri*, neighborhood festival, when the area gets very congested.

(a) (b) (c)

Figure 2.32: Narrow alleys prone to street blockage. Credit: VANKOVA Kalina

Figure 2.31: Road access obligation scheme (p. 166)[32]

On the other hand, however, narrow alleys, just like the old wooden houses, present a significant part of Tokyo's traditional wooden house neighborhoods' milieu and should be regarded with considerable mindfulness in the interest of avoiding gentrification phenomena. Furthermore, locals fear that conceivable widening of the streets *"would increase automobile traffic passing through the district (...) induce illegal parking"* (p.61)[13] and reduce landowner's plots. In this regard, Sumida ward master plan from 2008 promotes the conservation and renovation for the old alleys and detached houses as a main method to enhance their resilient performance [19].

Another highly urgent issue concerning the disaster risk reduction in Hikifune neighborhood is the problematic evacuation system in the area. As figure 2.33(a) depicts there are only two evacuation zones within the neighborhood in case of an earthquake or fire-spread emergency - the central Fujinoki park covering 1,88km^2 and a 0,22km^2 open space next to the Hikifune station or around 2,1km^2 total evacuation area. These spaces provide only a temporary solution, don't have the capacity to accommodate all residents in case of disaster and the most southern part beyond Hikifunegawa street would be completely isolated. The primary evacuation zone Shirahigehigashi with capacity 80.000

people, also for the surrounding Hikifune neighborhoods, is located in the north-western part of Sumida-ku at a distance of more than 1.5km along the main evacuation roads (fig. 2.33(b)). For elderly residents this span is an unthinkable walking length due to their limited mobility.

(a) Secondary evacuation zones plan.

(b) Distance between prime and secondary evacuation zone.

Figure 2.33: Evacuation zones. Credit: VANKOVA Kalina.

2.2.3 Floods

Tokyo bay is geographically protected from coastal phenomena, such as tsunamis and high coastal waves. Extreme weather conditions including intensified typhoons, severe wind, torrential rainfall and sea level rise, on the other hand, are expected due to future global warming effects on climate change (p.32)[28]. Moreover, the urban heat island phenomenon causes changes in the precipitation and wind patterns resulting in enhanced frequency and intensity of heavy convective rainfalls particularly during the warm season (p.115)[36]. Such disasters may cause breaching of Sumida river or Arakawa river and cause huge damage on the areas in Sumida ward with an altitude close to the sea level. Water would also quickly flow into Tokyo's subway network, putting many stations out of commission.

Sumida river, which was previously the path of Arakawa river, played a significant role in Edo city life for being an important part of the transportation waterway network and

providing the most concentrated social activities in the Low City around its numerous bridges. The river, however, was also notorious for causing floods repeatedly flood. As its translation suggests, 荒 ara - wild, devastating, and 川 kawa - river, Sumida river floods became such an often natural disaster in the late Meiji that the whole northern part of the Low City, eastwards from the valleys of Koishikawa submerged during late summer and autumn causing heavy damage on industrial and residential regions (p.57)[16]. The Great Meiji flood from 1910 became the occasion for the construction begin of the Arakawa Flood Diversion Channel in 1911. The new wide watercourse of total 22km length and 500m width from the Iwabuchi lock gate to the river's mouth at Nakagawa, passed mostly through suburbs of farm and fishing villages as the land was a very great expense (fig. 2.34), (p.263)[16]. *"With the completion of the channel in 1930, the lowlands in eastern Tokyo and southern Saitama [were] protected from flooding, and urbanization progressed rapidly thereafter"* (p.2)[38].

Figure 2.34: Construction of Arakawa Drainage Canal (p.2)[38]

In the years to come, the economically viable ground water in the Low City was pumped out for industrial uses. The process was ended by pumping regulation in 1975 but the ground level of great part of the lowlands subsided by maximum recorded depth of 4.5m. As Arakawa Flood Diversion Channel was planned before the subsidence and considering much milder climate conditions, the areas around Arakawa river now are facing a flood threat again. According to the Arakawa-Karyu river office estimations, 1:200 probability of large-scale inland flood and *"Considerable damages in the Arakawa lower basin areas are anticipated due to high population density"* (p.8)[39]. The creation of Arakawa Drainage Canal provides an example how making the urban tissue safe is proportional to the value of the buildings on it.

The main flood threat for Sumida ward comes from breach of Arakawa river levees due to overflow or permeation (p.14)[39]. The lower stream of Sumida river is relatively protected by Iwabuchi Watergate, whereas there is no gate to stop overflowing of Arakawa river. Its channel *"flows at a higher elevation than the land surrounding its downstream channel"* and levee breach would mean a major disaster for local residents and property (p.4)[40].

Figure 2.35 illustrates the topography of Sumida-ku. What is noticeable, is that Hikifune is located at around 0m sea level. The eastern part of the ward lays under sea level which makes a flood coming from there improbable. The existing corridor of areas with similar to Hikifune's altitude, however, might lead the overflowing water in south-western direction (fig. 2.36(a)). Since the water path is almost flat and the neighborhood is not situated at the river bank, the fluid force wouldn't be very intensive and the water level would rise gradually. Consequently, there is a minor danger for potential strong de-

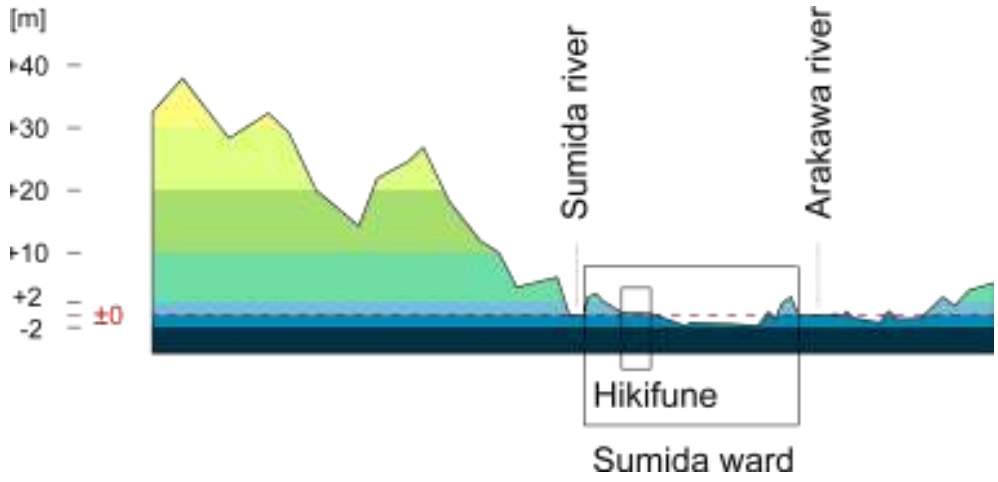
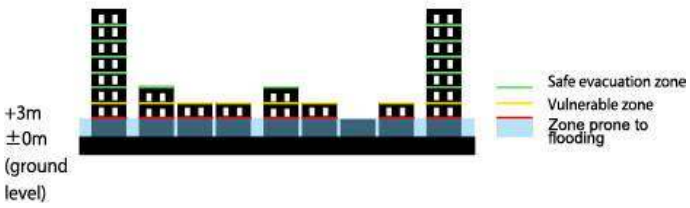


Figure 2.35: Section graph of Sumida ward area Credit: VANKOVA Kalina

bris flow and direct immediate construction damage, but the main hazard is a long-term isolation or inability to evacuate to an upper floor. The conducted simulations predict that the water level of Hikifune neighborhood in case of a levee breach would reach 3m above the ground level equivalent to the first storey of the wooden houses. When the first level is flooded, the second would become unstable. As a result, being mostly two-storey structures, the wooden houses in Hikifune would become potentially hazardous and a significant part of people's property would be damaged. Currently, local people would evacuate in the surrounding high-rise buildings (fig. 2.36(b)). However, they provide only a permanent shelter within the common areas around elevators and staircases and can't be a solution for a long-term evacuation.

(a) Direction of the overflowing water leading to Hikifune neighborhood Credit: VANKOVA Kalina; Source: SIT



(b) Building elevation by 3m flooding and flooding by 3m flooding diagram. Credit: VANKOVA Kalina

Figure 2.36: Secondary evacuation zones. Credit: VANKOVA Kalina.

2.2.4 Demographic dynamics

Japan is one of the countries with highest proportion of elderly people in the world and the workforce continues to shrink. The reasons for this phenomenon are the increasing

life expectancy, the retirement of the baby-boomers of late 1940s and the low birthrates. That is why, demographics is among the biggest challenges for the Japanese government and economy at present. The country's population peaked in 2004 and is estimated to show nearly 30% decline over the next fifty years (p.1)[41].

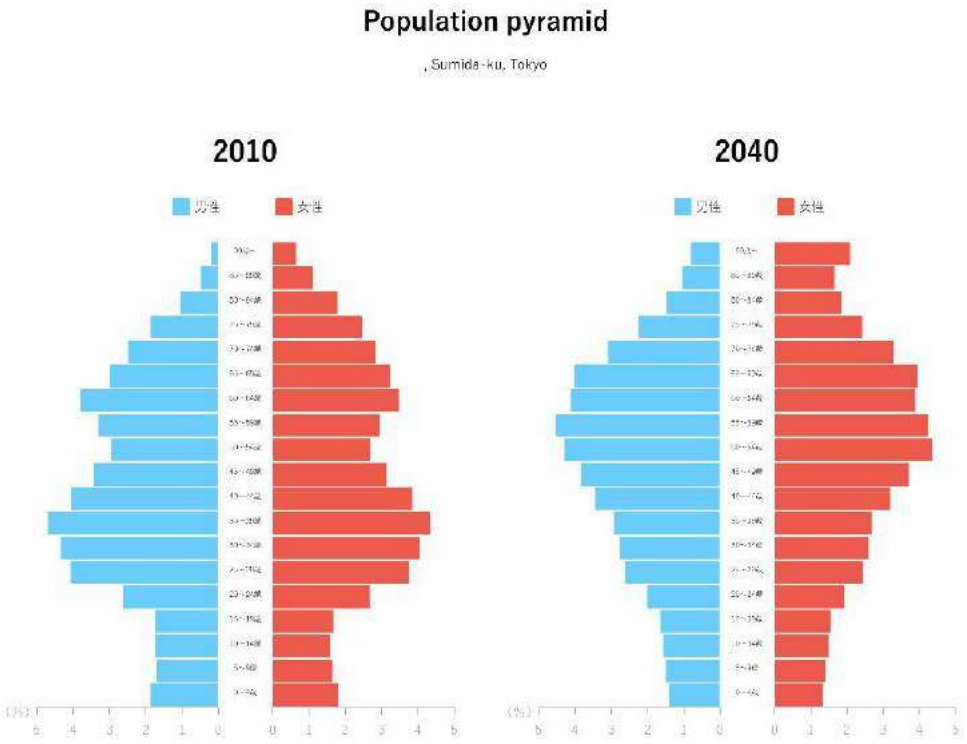


Figure 2.37: Population pyramid of Sumida ward [43]

The population pyramid of Sumida-ku compares the past situation within the ward in 2010 with the expectations for 2040 (fig. 2.37). As a contrary to statistics for Tokyo prefecture, the graph reveals that male residents in 2010 were outnumbering female in the age bracket between 25 and 45 which is the time when usually Japanese women have children. It is to conclude that this unevenly distributed gender structure might be one of the reasons for the low fertility rates now and the resulting decrease of people in working-age on account of predominantly aging population in 2040. An additional argument for that, according to the Ministry of Health, Labor and Welfare, is the late average age for first marriage - 30.9 for men and 29.3 for women in 2013 [44]. An article from The Japan Times from 2015 states *"that growing ranks of Japanese youths hesitate to marry due to employment instability and poor incomes. The outline calls for more public support for young people looking for jobs and their transition from irregular work to regular full-time positions"*[45]. The efforts of the national government, the article claims, will concentrate on encouraging *matchmaking* between municipalities and local chambers of commerce. The targeted goals are mothers retaining their jobs after maternity leave and reducing chronic long working hours.

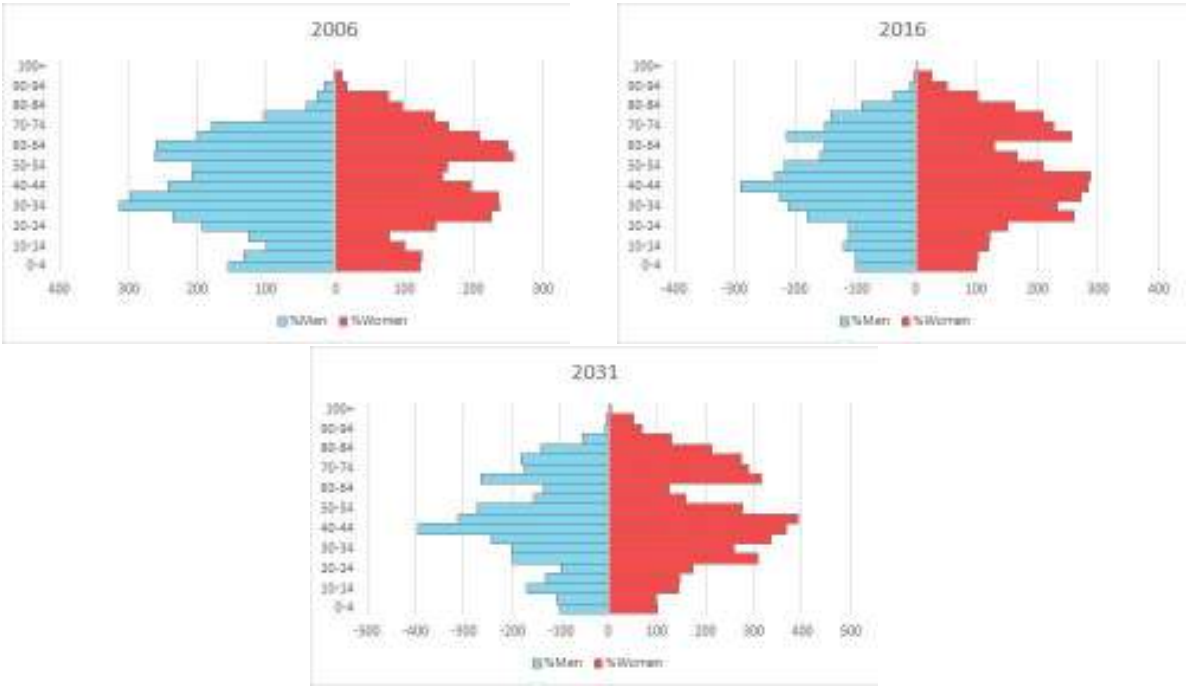


Figure 2.38: Population pyramid Hikifune - statistics and preditcions. Credit: VANKOVA Kalina [42]

Yet, on a local level the statistics for Higashimukojima look slightly different in comparison to Tokyo prefecture - the population reached its peak in 1960 of post-war Sumida-ku and declined until 1997, when it gradually started to increase again. According to data from 2010, aging rate in Higashimukojima is higher than the average for Tokyo metropolitan area with Tokyo-to, Sumida-ku and Higashimukojima respectively 20%, 22% and 24%. Besides the low birthrates, there is an additional factor in Hikifune which plays a significant role for the neighborhood's demographic profile. Since 2007 2-person households of elderly couples boosted reaching 34.4% in 2010 (fig. 2.39). Way behind are 3-member and single households with respectively 20% and 17,6%. 4-member families make up only 14.8% of the total population [19]. The predominantly aging population, the insecurity of the area in terms of disaster vulnerability and the lack of jobs and opportunities for social interactions are arguments why since the late 1990s young people progressively prefer to move to more popular and safe wards with higher concentration of economic and commercial activity (fig. 2.40). Furthermore, after getting married many adults tend to move outward to bigger apartments in the suburbs in order to meet the demand of housing opportunities with more space for the growing households (p.5)[41].

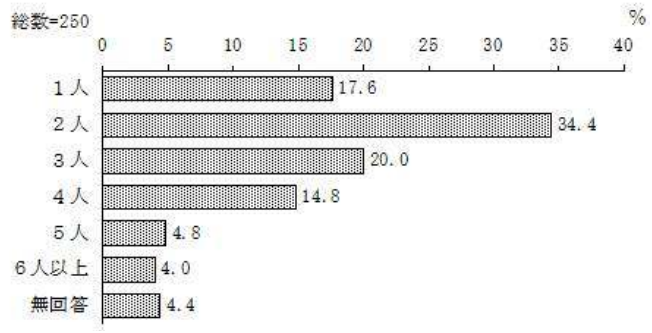


Figure 2.39: Person per household [19]

A reading of the employees' gender distribution statistics in Hikifune (fig. 2.41) proves that the portion of the working women in Higashimukojima, 2 Chome is 40% compared to almost 30% in Oshiage, 2 Chome. Mukojima, 4 Chome is the sole chome with a higher percentage of female employees, a little bit more than the half, yet this result is negligible because of the small area of the chome included in the neighborhood. The resulting approximate 35% contrasts to the 50% in Kyojima, 3 Chome but is close the overall outcome of 38% in Sumida-ku. The employment-to-population ratio of all units, including the ward, is about 70% but due to the aging population is expected to decrease in the next decades. Figure 2.42 illustrates the occupation distribution in the same city units. It reveals that the employees' main occupation in Hikifune lays in the wholesale and retail, variety of services, restaurants and lodging, public and complex business in comparison to Kyojima, where trade is a significant economic factor but 22% of the other laborers commute in the medical care and welfare industry. Apart from that, transportation makes up nearly one third of Oshiage 2 chome's local economy due to the proximity of the big infrastructure hub at Oshiage station. The occupation in Sumida ward, Oshiage and Kyojima, 2 chome is concentrated in one or two main activities. On the contrary, the occupation distribution in Hikifune's biggest area Higashimukojima, 2 chome is divided relatively even between four categories. Regarding the distribution of these employees in single establishments, the statistics show that the most fine-grained business takes place in Kyojima, 3 chome where 83% of the working force is occupied in establishments giving job to 1-4 people, followed by Mukojima, 4 chome with 71% and the rest of the addressed areas with similar portions of about 65%. The statistics show as well that presence of bigger establishments is less common than in Sumida ward in general and the ones employing more than 30 people are less than 4% in Hikifune.

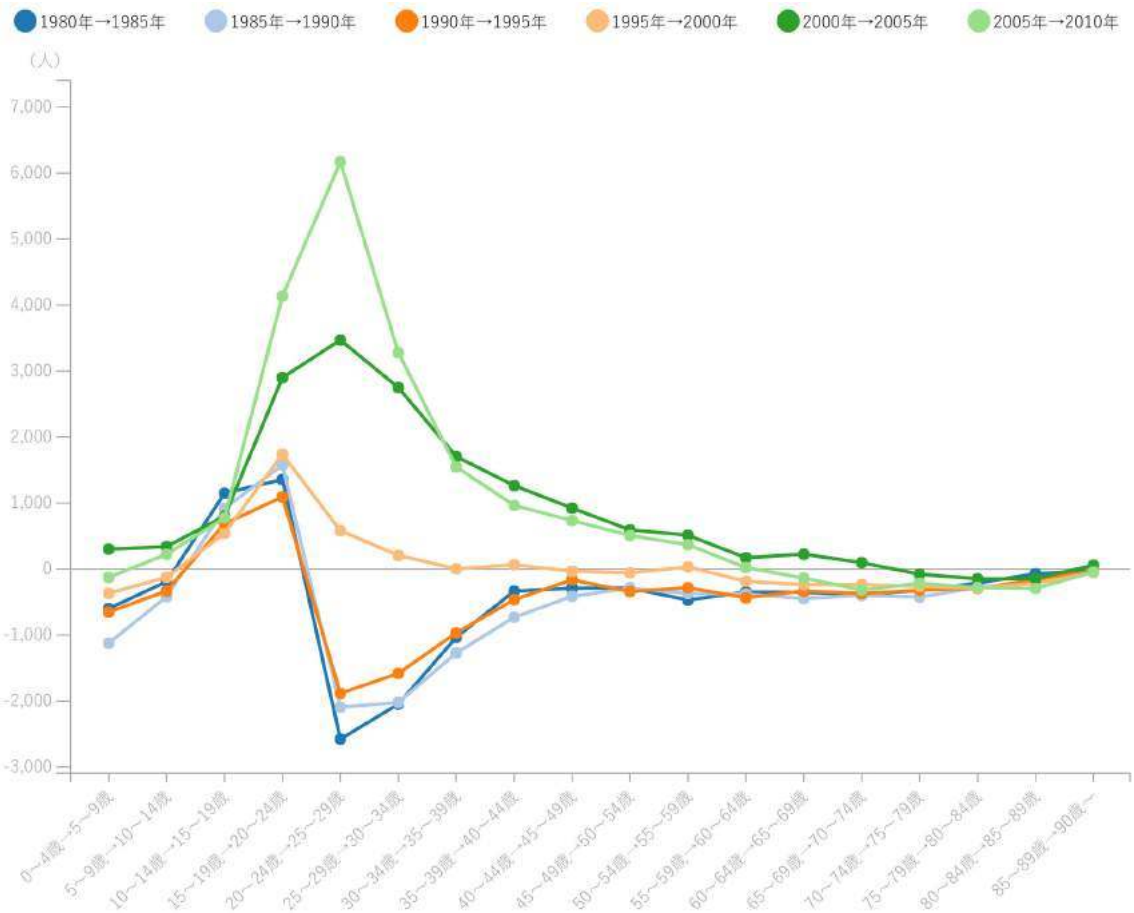


Figure 2.40: Age group migration in Sumida ward [43]

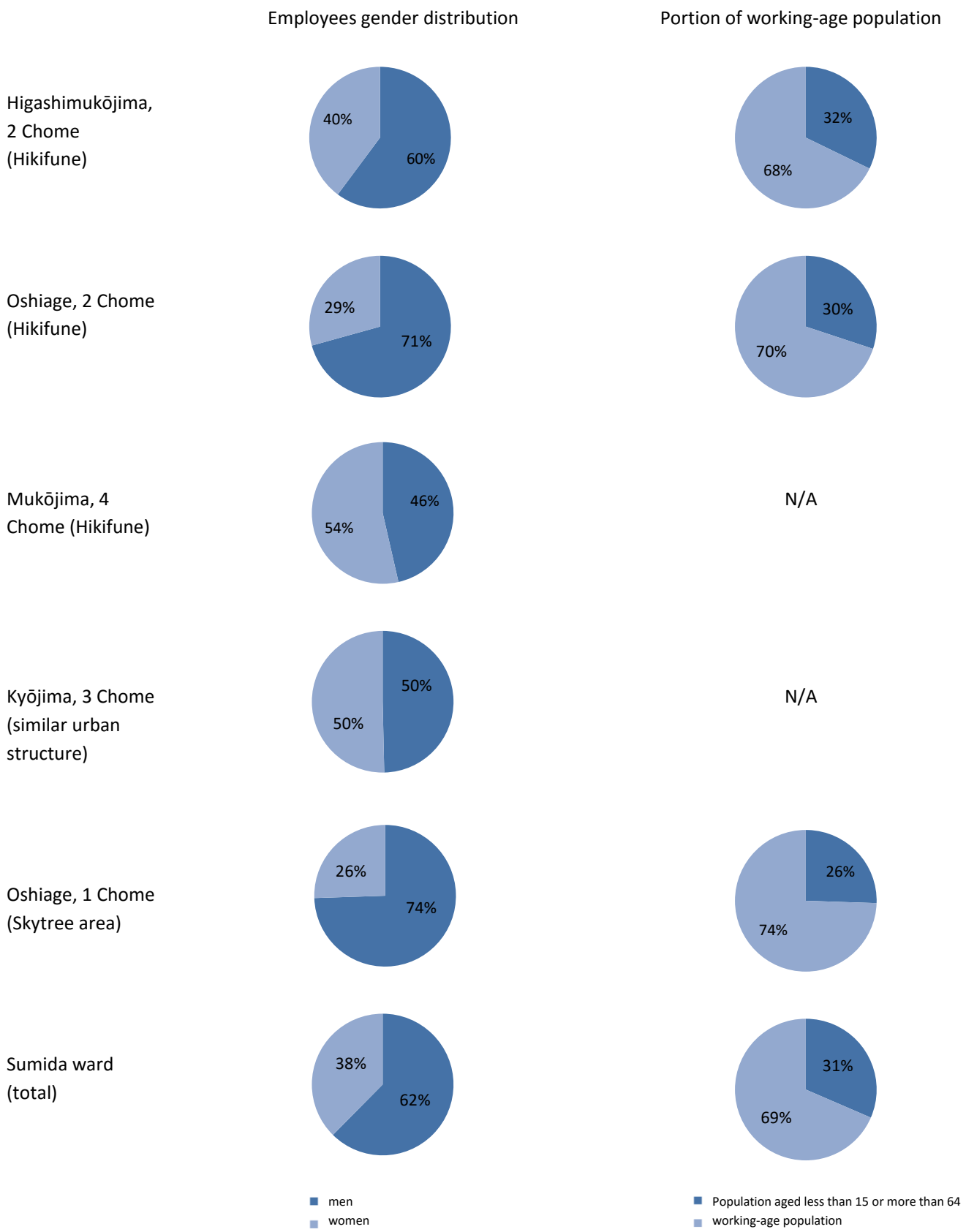


Figure 2.41: Employees distribution in Sumida ward. Credit: VANKOVA, Kalina [42]

Unit / Industry	Higashi-mukōjima, 2 Chome	Oshiage, 2 Chome	Mukōjima, 4 Chome	Kyōjima, 3 Chome	Oshiage, 1 Chome	Sumida ward
Construction	4%	12%	2%	4%	2%	6%
Manufacturing	16%	19%	22%	16%	8%	21%
Transportation	3%	29%	3%	9%	49%	5%
Wholesale and retail trade	24%	16%	25%	27%	14%	26%
Finance and incurance	2%	1%	0%	2%	2%	5%
Real estate business	2%	6%	0%	2%	2%	3%
Restaurants | Lodging	13%	4%	6%	6%	7%	8%
Medical care | welfare	7%	7%	26%	22%	5%	6%
Education | learning support	3%	1%	7%	2%	0%	2%
Services | non-categorized	14%	5%	6%	10%	9%	13%
Public | Complex service business	12%	0%	3%	0%	0%	2%
Agriculture, forestry, fisheries, mining	0%	0%	0%	0%	0%	0%
Info and commun. | el., gas, heat, water supply	0%	0%	0%	0%	2%	3%
Distribution of employees in establishments	**Higashi-mukōjima, 2 Chome**	**Oshiage, 2 Chome**	**Mukōjima, 4 Chome**	**Kyōjima, 3 Chome**	**Oshiage, 1 Chome**	**Sumida ward**
1 - 4 employees	69%	67%	71%	83%	68%	63%
5 - 9 employees	17%	17%	15%	13%	17%	19%
10 - 19 employees	7%	10%	6%	1%	9%	10%
20 - 29 employees	4%	2%	3%	2%	3%	3%
more than 30 employees	3%	4%	5%	1%	3%	5%

Figure 2.42: Occupation distribution in Sumida ward. Credit: VANKOVA, Kalina [42]

Sumida is one of the most dense wards in Tokyo city and Hikifune neighborhood is not an exclusion. Most of the areas, except parks and the vicinity around the railway have density above 100 inh./ha.? A closer look at the density distribution shows that it reaches its highest numbers in the peripheral areas with surroundings along the main Mito street in the west leading with more than 300 inh./ha. whereas the core of the neighborhood is between 100 and 200 inh./ha [19]. The reason for the difference is not only because the high-rise condominiums along the periphery accommodate more households but also due to the fact that the core consists of very densely built-up detached houses with 2-person households. There seems to be socio-spatial relation between age, density and type of residence resulting in demographic segregation within the neighborhood borders - the periphery of new mansions preferred by young families surrounds the inside of old wooden 2-storey houses with low household ratio and high average age. Additionally, conflict of

interests and lack of solidarity between newcomers and original inhabitants is common in neighborhoods with homogenous society, rules and community connections established decades ago (p.33)[46]. Most of the elderly residents have been living in Hikifune their entire life. They identify themselves with the historical background of the neighborhood and struggle to maintain their *legacy as firsts*.

Demographic diversity and regular population renewal, however, are important for a healthy, prosperous and productive community. Monotony and homogeneity have negative impact on the human psychology and thus quality of life. Moreover, lack of age variety leads to less activities making peoples less creative and energetic.

Besides the social aspects of the issue, presence of different demographic groups is crucial also in case of emergency. Dense areas with population of mostly elderly people are much more vulnerable to natural disasters due to the limited mobility and orientation of the residents when evacuation needed. 53% of those killed in the Kobe earthquake in 1995, for instance, were elderly people living in old wooden buildings [46]. Young adults, on the contrary, tend to react faster and more adequate in such situations. Their organizational skills and ability to solve problems under strain could be critical if a fire-spread threatens residents' lives and decisions must be taken within seconds. Furthermore, self-preservation instinct is stronger by people with families, children and property of great value.

The younger generation seems more proactive when it comes to disaster prevention. Elderly Japanese people are, in general, extremely conservative when it comes to change of habits and lifestyle. *"We are not afraid of earthquakes. We like things the way they are. This is our religion."* - answers a local when asked about his opinion regarding the neighborhood safety. Most of the elderly people are not concerned or scared about possible disaster hitting the area and threatening their property and lives. Disaster occurrence is deeply ingrained in Japanese culture and has been part of peoples' lives since ever. Elder generation, however, is basically not aware of the hazards pending over their neighborhood. Young people, on the other hand, are much more worried about their safety and show genuine interest in disaster countermeasures. Despite their lack of expertise, they are willing to learn more about hazard mitigation methods and get involved in disaster prevention activities. This is the reason why, would have much more successful implementation for the next generation.

2.2.5 Concomitant issues

Besides disaster vulnerability and aging population, there are four other relevant for Hikifune issues which are also mutually interdependent and are raising concern about the resilient future of the neighborhood.

The first such problem is the passive *plinth*. Commonly, the high-rise structures along the periphery accommodate a parking lot or, in a few cases, a shop on the ground floor. These towering buildings, indeed, have a disaster prevention qualities and isolate the core from the loud wide streets, nonetheless they spread over large areas creating monotonous environment, cause gentrification and have a negative effect on the social interactions at street level (fig. 2.43(d)). The introvert *plinth* can be found also in many small dwellings

both along the wide streets (fig. 2.43(a)) and in the interior (fig. **??**). The ground floor functions plan (fig. 2.45) shows that most of the ground floor areas are being used as a workshop, service, retail or a restaurant. Observations prove, however, that their facades are largely closed, plain and under poor maintenance. Even the most vibrant areas around the station and the street leading to Fujinoki park have rather unwelcoming and unattractive character. Often, the only sign revealing their functions is a faded plate saying 居酒屋 izakaya (traditional Japanese pub) or カラオケ karaoke. As a result, people are just passing by without entering. The reason for the poor condition of the ground floor is to a certain extent again the average high age of the residents. From one side, the owners have no physical or economic ability to run, promote and invest in their business. On the other side, the potential customers are also elderly people who lead a modest life and prefer to stay at their home than being in restaurants or shopping.

(a) Two houses with an unattractive plinth-s separating two buildings with active GFs along Mito street

(b) Passive space under the railway

(c) Garage of a residential building

(d) Passive condominium GF

(e) Passive street-at-eye-level

(f) Unattractive plinth combination of factory parking lot and vacant house

Figure 2.43: Examples of passive *plinth*-s. Credit: VANKOVA Kalina.

What is more, the non-lucrative passive ground floor influences the local economy. The only profitable facilities, besides a few industries and services, are the parking lots. However, usually they are private property of a non-local. Moreover, currently parking lots and garages cover around 36 000m^2 of the district's area and approximately 200 houses have a garage on the GF. By the rest of the dwellings they serve predominantly residential and storage functions or are vacant contributing further to the inactivity of the non-profitable urban space. The principal condition for a successful restaurant or service is the attractiveness of its surroundings and the way to get there. The design of the place itself is of secondary importance. This is the reason why places with a good concept, already active plinth and creative design are not achieving the intended success.

(a) Chopstick shop next to the car-parts factory

(b) Sushi restaurant in front of the under-railway space

Figure 2.44: Examples of active *plinth*-s in unattractive surroundings. Credit: VANKOVA Kalina.

Consequently, the sole internal benefits are leaking out or can't reach the maximum of their profit. Without income circulating within the neighborhood's borders, economically Hikifune is absolutely dependent on external support - the pensions of the majority of the population and the salaries of the younger who work in more developed districts. The presence of many areas in a similar situation all over Japan deepens the economic difficulties of the country as a whole. Additionally, dependency in terms of disaster prevention makes the urban space extremely vulnerable to natural hazards. After the 2011 Tohoku earthquake, apart from the huge economic damage, the whole transportation network of Tokyo was suspended for days, there was no internet connection, many households were left without electricity and running water and, eventually, the supplies stopped for reasons of impossible delivery.

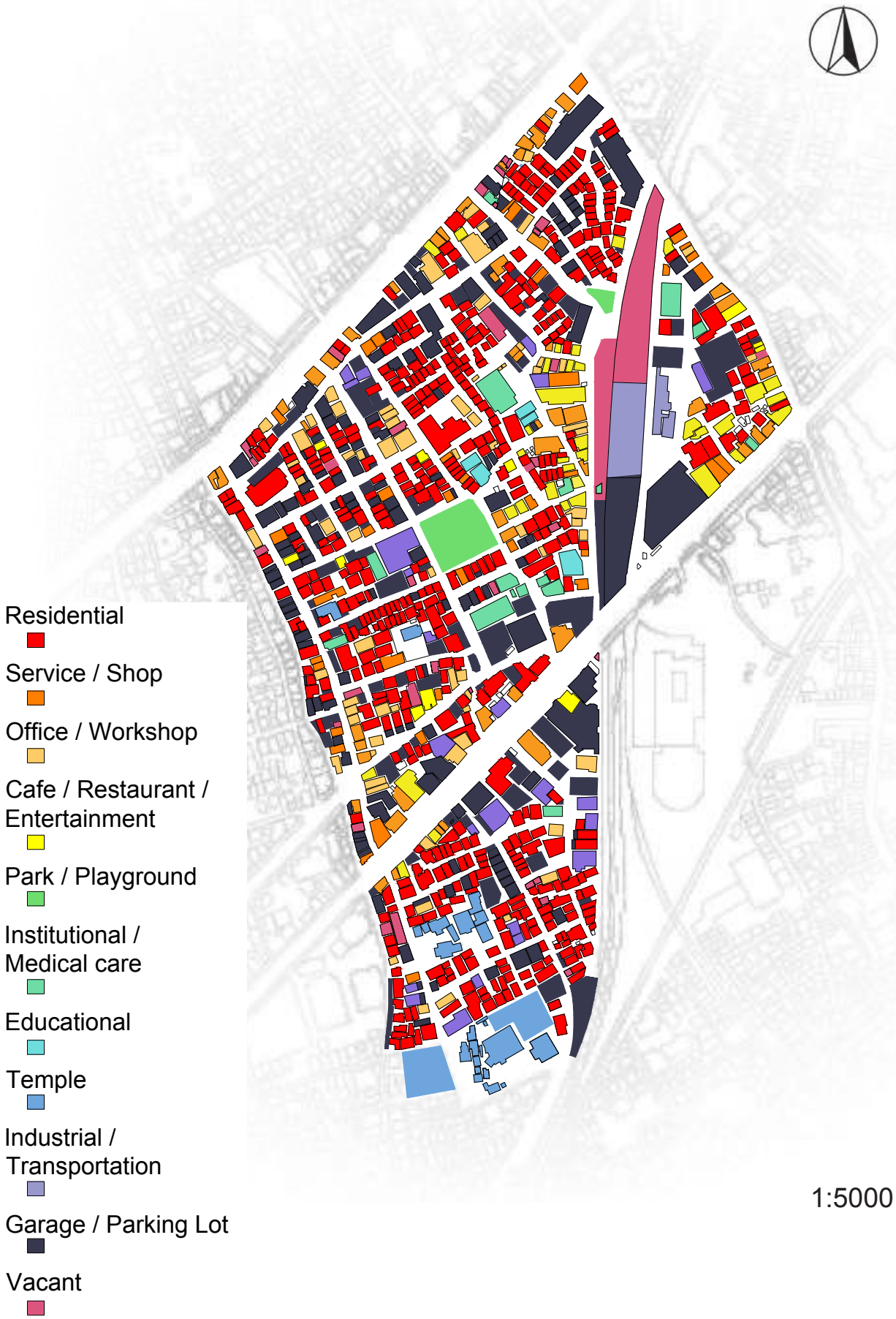
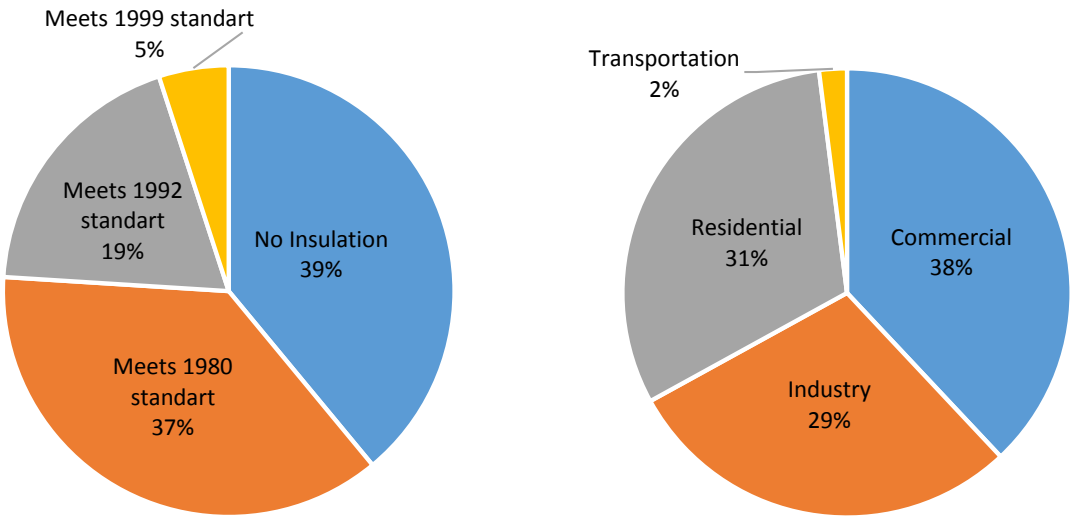


Figure 2.45: Ground floor functions plan. Credit: VANKOVA Kalina

There is also the environmental side of the problem - Japan, as one of the biggest energy consumers in the world, owes 31% of its electricity consumption to architecture (fig. 2.46). The old wooden detached houses, populated mostly by elderly couples, have very low energy saving performance and affect notably the cost of life. The lack of insulation is the main reason why an elderly resident in Hikifune spends approximately four times more energy on heating and cooling than a youngster living in a 4-member household in a new condominium. According to government data, senior consumption was responsible for more than 40% in 2011 of the total consumption and thus rising by 10% since 2000. Nevertheless, local elderly residents are not interested in retrofitting or maintaining their homes. The lack of sufficient greenery and good tree canopy is rising the rates of ecological footprint in the area and the flood threat as well.

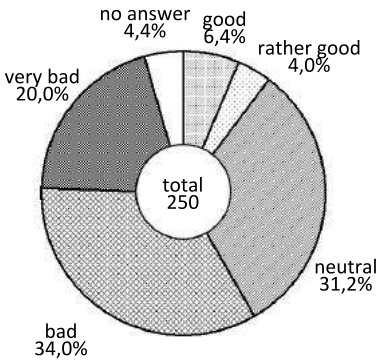


(a) Estimated % of all homes meeting BLDG standards for insulation, 2014

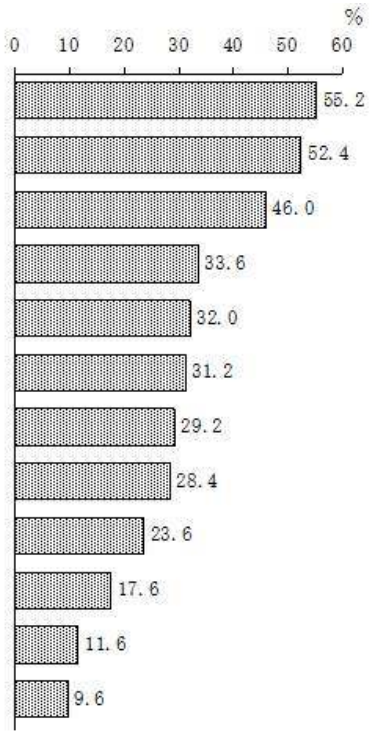
(b) Electrical consumption by sector Japan, 2009

Figure 2.46: BUNTROCK (2016): Untapped opportunities in Japanese architecture [47]

The conducted by Prof. Nakamura analysis in Hikifune shows that 54% of the residents are not satisfied with the greenery richness within the neighborhood (fig. **??**). Indeed, the narrow alleys boost of vegetation and a feeling of livable environment is easy to perceive for the reason that these zones are semi-private spaces and the locals design the street-at-eye-level as they want (fig. **??**). The high degree of dissatisfaction comes from the public areas, where the responsibility for taking care of the quality of the living environment falls on the municipality, or the Tobu Railway Corporation in the case of the area in front of the train station. Most of those zones characterize with unattractiveness and lack of sufficient flora. In addition, vegetation not only could serve as an effective anti-flooding system but is an efficient noise and CO2 absorber – issues identified as the fifth most important priority in the survey.



(a) Greenery satisfaction in Hikifune neighborhood [19]



(b) Priorities for future urban environment [19]

Among the other main factors for the future urban environment, the majority of the population in Hikifune pointed out were safety in terms of crime and natural disasters, livable environment and shopping opportunities, integrated community, public transportation accessibility and qualitative sunlight and ventilation (fig. **??**). Overlapped with the age of the surveyed, the analysis shows that people in their 30s and 40s express deeper concern about issues of safety in terms of both natural disaster and crime whereas people above 60 years seem to worry mostly about transportation matters.

An issue that many locals don't recognize as a real problem but which is actually playing a crucial role for the living environment is the presence of *akia*-s or vacant houses. Vacancy rates in Hikifune neighborhood are not very high compared to other regions with predominantly elderly residents but their distribution within the area has a negative impact on the social and economic stability. When aging residents pass away or move to nursing homes, their houses end up unoccupied because the new generation prefers to live in the new popular districts instead of staying in their inherited homes. Furthermore, most of these wooden structures, erected before 1970 and designed as *one-generation-buildings*, left unattended present clear danger due to a possible collapse in case of an earthquake, fire spread or flooding due to their deteriorated construction and lack of maintenance. Abandoned homes are also an easy prey for burglars. Because of their poor quality, insufficient infrastructure and low hygienic conditions, these houses are hard to rent or sell. Meanwhile, with the increasing number of vacant houses, the neighborhood is becoming even less popular. From legal point of view, the local government is in charge of building control in areas with small detached houses lower than 3 storeys [32]. Despite the fact that BSL includes measures against buildings violation and local governments all over Japan are empowering new ordinances regarding demolishing of the most dangerous buildings after the 2011 Tōhoku Earthquake, direct interventions are extremely problematic due to the fragmentation of the land in many small individual plots and the

complicated ownership relations. Hence, the only possible way for disaster risk reduction interventions is a community-based approach and work with the individual land and house owners. Machizukuri, literally meaning *town-making* but also translated as *community development*, is a popular community movement in Japan that started in the post-war years (p.60)[13]. The *machizukuri council* consisting of local people, is an association performing the overall coordination between the residents and the local government and draws up the machizukuri (community improvement) plan. *"Under machizukuri plan, the LG controls developments in the area through a development review procedure, supports cooperative or individual rebuilding or housing, and improves public spaces including widening of narrow streets and creating pocket parks"*(p.60)[13]. This approach, unlike *toshikeikaku* [57], characterizes by gradual but slow and incremental rebuilding actions due to the numerous actors involved and doesn't provide the effectiveness needed to deal with the confronting issues. The multi-layered system for renting is a typical phenomenon for small-scale Japanese neighborhoods. According to the conducted survey, 15,2% of the interviewed locals live in a private house on a borrowed land and 3,2% reside in a rented detached house [19]. These entangled relations between land-owner, house-owner and sometimes subtenant, all protecting their property rights, and the traditional unwillingness of the majority of the elderly population for a change despite the threatening hazards complicate further the situation. In addition, the average demolition cost of a two-storey detached house of about 1.000.000 yen and property taxes imposed on open land are stopping the owners from demolishing their houses if they don't have an intention to live there, sell or rent them, as they will have to pay about six times more.

A typical feature of Japanese houses is their short lifespan (around 40 years) or the so called *scrap-and-build* approach. Traditionally, an empty lot in Japan is worth more than one with a building on it and the house begins to lose its value after the 30 year. Almost everything in Tokyo is marked by the short lifespan of the buildings. Being largely destroyed on two occasions over the last 100 years, the Great Kanto Earthquake and the Bombings in 1945, the city has almost no architectural verification of its historical identity. As P. Waley notes in 'Urban spaces in Tokyo', *"Preservation of existing built environment [...] is not articulated as an aim of policy"*[56]. According to Waley, the legislative framework refers mostly to conservation of religious structures and traditional crafts, but not the authentic look of old neighborhoods with *machiya* and *roji*. That is why the life of Japanese dwellings is short and reselling of pre-owned houses is unusual. Even when inherited, the house of the old generation is being knocked down and a new one is raised for the heir on the same site. This type of one-generation lifecycle predisposes a weaker timber frame construction vulnerable to disasters and high levels of energy consumption. The rebuilding of a house every 40 years means not only construction cost of the new house but also demolishing cost and disposal of many appliances that can't be used in the new one like air-conditioners or old TV sets. Therefore, many young singles and families prefer to move to the more popular high-rise condominiums. Besides that, the little value ascribed to historical and cultural space justified by the traditional short lifecycle of Japanese houses results in absence of physical sense of identity: *"Much of Tokyo's space was rendered to capital accumulation on the one hand, but on the other hand this gain also signifies loss, because this process requires the inhabitants to identify with the drastically different city at the cost of losing more and more of their concrete space of everyday life"*[56].

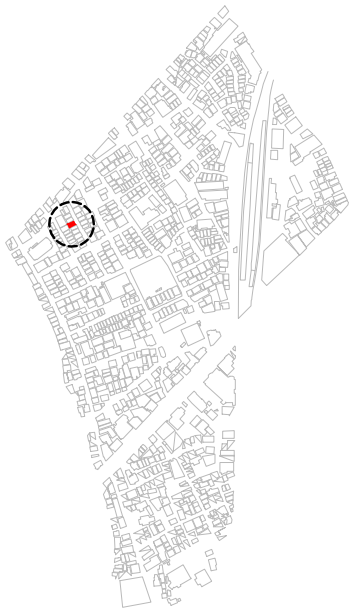


Figure 2.47: Location of Fujinoki Community space. Credit: VANKOVA Kalina

Nevertheless, there are some signs of retrofitting local initiatives in Hikifune. The most significant retrofitting project is the transformation of a former *akiya* into Fujinoki community space. The previously abandoned structure is located at two minutes walking distance north-west from Fujinoki park and was provided almost free of charge by the owner who didn't want to maintain it. The renovation of the two-storey wooden detached house was funded by a non-profit organization and partially by a local government subsidy. In collaboration with the local *machizukuri* and many experts of different areas it was completed in 2013. The two main purposes of the new space are *"enlightment and dissemination of earthquake resistant and fire-proof renovation and reconstruction"* and *"promotion of exchange of people"*[58]. At present, a variety of community-based activities take place daily in the building including residents of all ages: workshops for preparing of a disaster prevention map, lectures by locals, café, healthcare education, children's care classes, cooking, soap making, kimono dressing-up workshops and many others. The entrance has a very welcoming entrance with a constantly changing façade elements making the *plinth* even more attractive. The schedule for all upcoming events is available online on the website and the Facebook page.

(a) Before (b) After

Figure 2.48: Fujinoki community space [58]

Figure 2.49: Activities in Fujinoki community space [58]

The last but not least issue confronting the vicinity is the possibility of large-scale developer interventions *'toshikeikaku'*(p.227)[57]. Such *"projects both by the state and by private capital currently form one of the biggest threats to many existing neighborhoods in Japanese cities."*(p. 271)[**?**] Detached houses are an attractive investment for construction and redevelopment companies because they bring fast benefit. There are numerous cases of areas in Tokyo and Kyoto where large condominiums have replaced whole wooden-house districts. The reason why Hikifune had preserved its townscape and vernacular appearance is not resulting from the efforts for its conservation but simply due to a sequence of historical circumstances. However, the danger becomes real when two or more owners agree on consolidation of their plots. Even if protected by the building height regulation, what is happening in such cases is that the previous little detached houses with a townscape look and an active ground floor area are replaced by a new larger building, often with a parking lot at the first floor, cutting all communication with the street (fig. 2.43(c)). Such transformations usually have an immediate negative impact on the livability of the environment.

2.3 Concluding remarks

After a detailed analysis of the historical background and the local identity features of the neighborhood, this chapter distinguished the four issues in Hikifune on which the work is going to concentrate and the concomitant issues of equal importance but outside the

thesis' focus. The next chapter will seek possibilities for synergistic solutions for these issues.

Chapter 3

POTENTIAL OPPORTUNITIES FOR HIKIFUNE URBAN SPACE

3.1 Global relevance

The synergistic improvement prospects to influence the world urban agenda and develop policies for overcoming issues that are confronting the cities at global level. Hence, the purpose of this work is to form a framework of steps on how to use the potentials of a vicinity in order to create safe and resilient environments. Hikifune neighborhood incorporates many valuable for the global city characteristics and has the chance to unfold its vast potential towards an *urban renaissance*. For these reasons, even though the study is concentrated on the context of a particular area in Sumida ward, it prospects to stimulate further thinking and debate on the issues of hazard risk mitigation and diverse community building and provide a guideline with a possible global implementation.

3.2 Cultural and historical value of Hikifune

Global socio-economic shifts are an integral factor for the urban development. However, what makes a place special are its local identity and potentials which must be considered when putting new strategies into practice. Undoubtedly, a great asset of Hikifune neighborhood is the distinct cultural and historical value of the area. Having survived both great destructions and reconstructions of the city, as well as the large scale redevelopment during the bubble economy, Hikifune in the context of its dense urban structure offers a unique landscape within the modern heart of Tokyo. Instead of a setback, its presence could be used as a powerful resource. Yet, firstly local, predominantly elderly residents don't see the need of a change, secondly, direct interference of the government is difficult (look p. ...) and thirdly, preservation of building environment is not a priority for the LG. However, in coalition with NGOs and using other funding possibilities, *machizukuri* could enhance the improvement process of the area and support the local efforts. Furthermore, promoting the image of a safe area of great historical and cultural value will attract young people and investors - actors who would embark on a resilient improvement course with greater eagerness. Finally, property value in Hikifune neighborhood is rising

due to the advancing economic, cultural and tourist importance of the ward as a whole. In this respect, the increasing value of the properties could contribute to the affirming the sense of identity through renovating the built environment.

3.3 Walkability and townscape

The next untapped recourse in Hikifune neighborhood is its walkable and peaceful environment. Schulz, acknowledging Kafu, describes the importance of the *roji* for the vitality of the city everyday life in the Edo period and the *"danger of being replaced by more modern houses"* (p.189)[9]. The author states that they are *"enclosed spaces, which [are] separated from Tokyo's modernity in both geographical and cultural terms"* and *"contribute to the formation of an inverse urban tissue of the global city"*(p.196)[9]. Indeed, in today's world of rapidly growing agglomerations increasingly strapped for space on one side, and race for financial supremacy on the other, the search of the urban dweller for a personal place to retreat and experience the *come home effect* is natural. In this respect, walkability is identified as a feature of the living environments, that has become a luxus and an urgent issue for the big cities. Moreover, vibrant public spaces are crucial for social integration of the communities. *The city at eye level* tackles the rising significance of the *plinth* for the social, economic and ecological performance of the public realm. In the first chapter of the book, *Economic values of a walkable city*, the public space researcher Stahle points out that this socio-spatial variable is becoming more and more valuable in the context of the contemporary European cities thus affecting the demand for housing and offices (p.57)[50]. Due to the high density, the large scales and the long commuting times, the validity of the correlation between car-independence and the housing markets is even more legitimate for Tokyo. With this in mind, Hikifune stays one step ahead in the battle for resilient environments.

3.4 Regional accessibility, proximity to water bodies and commercial zones

Among the most pertinent qualities of Hikifune is the absolutely central location of the neighborhood. Stahle suggests that regional accessibility, by means of public transport, by bicycle and on foot affects housing and office prices but, surprisingly, car accessibility has *"only a marginal impact on house prices"*(p.57)[50]. Of equal importance, proximity to qualitative parks next to water bodies as well as to commercial and cultural hubs is vital for the choice of home, especially for the young generation. Besides the already progressing as centers of commercial and business facilities areas around Skytree and Asakusa, Sumida-ku master plan from 2008 proposes a development *"considering the environment through Sumida river and vegetation"*. From this angle, Hikifune has a chance to make use of these changes and rise its popularity as a desirable place to live.

3.5 Ineffectively used open-space areas

The conducted mapping of the vicinity indicates that development of individual plots under a weak planning system has resulted in a considerable mismatch between effectiveness and demand not only in respect to buildings but also to open space. Examination of Hikifune shows that the largest ineffectively used areas are situated around the railroad (fig. 3.1). The first such zone that draws attention is the open space surrounding the train station covering an area of approximately 3,1km^2 (fig. 3.2(a) and 3.2(b)). Being an important part of the railway network, the zone around the station surprises with its unattractiveness and mono-functionality. The plaza serves only as a connecting area for the locals between their homes and the station and reminds nothing of the former vitality of Hikifune river. At the very end of this area, occupying the corner of Hikifunegawa street with the street along the railway, lays a large empty parking lot (fig. 3.2(c)). What is common for these spaces is their exposure to the extensive noise pollution from the train passing every 5 minutes during the daily hours. The proximity of these ineffectively used slots to the station, to each other and to the evacuation zone in the north widens the range of opportunities for possible interventions. *Ameya-Yokochō*– an open air market following the tracks leading to Ueno station - could be introduced as an antipode of it and an example of well-functioning area along a railway. The place is known for its vitality, thriving business and presentation of people's daily life, a real *sakariba* of contemporary Tokyo. *Tsukijima* market, located on a reclaimed land in Chūō ward is another case of a *successful* place. It is a home of a large number or restaurants serving the local specialty *monjayaki*. Taking these places as references could help to transform the infrastructure node of Hikifune into a meeting point boosting activities and life and connecting both parts of the neighborhood. As already mentioned, the area enclosing the station is a private ownership of Tobu Railway Corporation. Hence, the sole way for interference is through collaboration with the company and striving for synergistic solutions satisfying both sides. The rest of the ineffectively used areas are predominantly open-air parking lots and a few vacant lots spread throughout the neighborhood. Both the neighborhood density and bicycle usage are expected to increase after the synergistic improvement. Consequently, present vacancies could be used to accommodate qualitative public spaces and bicycle parking lots instead of being built-up. By filling many of these vacancies, pocket parks could not only meet the locals' needs for greenery and open space activities but also provide a natural system to prevent flooding at a low cost. The sustainable post-tsunami reconstruction master plan of Elemental S.A. for the city of Constitución is an example for such synergistic solution. On the one hand the forest between the city and the sea intends to serve as a buffer against future tsunamis and floods, on the other it could *"pay the historical depth of public space"*[51].

(a) Inefficiently used area in front of the unattractive looking train station

(b) Large empty area inefficiently used as a parking lot

(c) Parking lot

(d) Vacant lot

(e) Parking lot behind the factory for car parts

(f) Factory for car parts

Figure 3.2: Vacant or ineffectively used areas. Credit: VANKOVA Kalina.

3.6 Vacant or ineffectively used buildings

In the context of the extremely high density of Tokyo and specifically Sumida ward vacancies can be considered as an equivalent of wastefulness and poor planning system. Therefore, another possibility for intervention towards resilient improvement refers to the issue of vacant housing or *akiya mondai*.

The unused buildings in the neighborhood are relatively evenly distributed across the patchwork of individual plots with many of them at strategic locations. If refurbished and repurposed they could increase the area's effectiveness, safety and livelihood and diversify

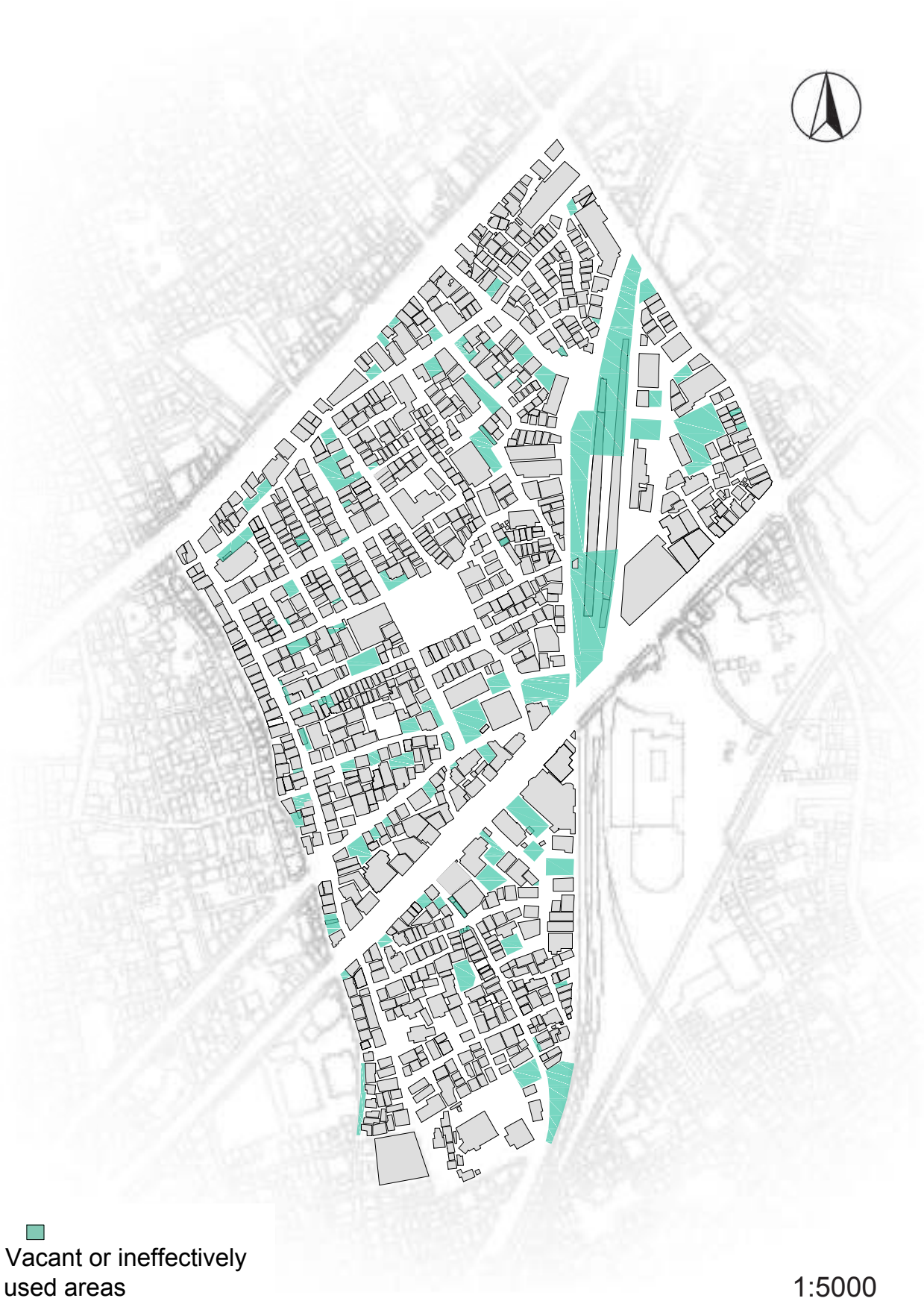


Figure 3.1: Vacant or ineffectively used areas plan. Credit: VANKOVA Kalina

the activity patterns. The process will raise locals' awareness of disaster risk and endorse the recognition of buildings' and infrastructure's safety and maintenance. The process will accelerate development mechanisms and people, especially young families, would start upgrading their homes through noticing the improvements to their community.

3.7 Ground floor activation

Ineffectiveness of land use at ground floor level is another issue which can potentially be reformed to be more socially and economically beneficial. As previously discussed, co-existence is a natural part of the Japanese urban space and a prerequisite for a livable environment. In this regard, if the currently predominant passive ground floors of all buildings are being activated (rented or used privately), the streets of Hikifune would become lucrative areas providing a variety of new employment, entertainment and commercial opportunities for local and external users, boost the economic growth, and contribute to a more livable environment. Such *plinth* metamorphosis in turn will attract young entrepreneurs on one hand and new customers on the other. An initiative which took place in Liendert in Amersfoort, Netherlands, a neighborhood which was confronted by a similar issue of poorly maintained and degrading *plinth* could be used as a reference for GF activation in Hikifune (p.237)[52]. The project, taken up by a local housing corporation in collaboration with the municipality of Liendert, converted the *plinth* into a more open and vivid place while simultaneously providing local entrepreneurial spaces through a simple renting system of the ground floors.

3.8 The advantages of resilient detached houses to condominiums

The stagnation of the land market in Hikifune and the emerging trends of renovations and reusing among young people can be pointed out as a further niche for potential improvement. In respect to this, the preserved small-scale pattern of old wooden houses could once again be considered rather as an asset than an obstacle for the synergistic improvement. Detailed analysis shows that for the young generation living in a condominium is neither cheaper nor more convenient than in a detached house. Government statistics, illustrated on figure 3.3, prove that prices of condominium apartments in Tokyo city were averagely 10% higher than detached houses prices during the last two years. Equally important, the total floor area of an owner-occupied wooden three-storey house is commonly 100m^2 in comparison to the total floor area of a regular condominium apartment of around 50-80m^2 and the average for Japan 94,4km^2 (p.16) [53]. Above all, the almost traffic-free *soto* maze of narrow alleys not only provides great space for children play and neighborly talk but also, following the idea that the environment can be considered as a semi-private space and part of the living room, the living space can be extended beyond the borders of *uchi* (p.223)[57].

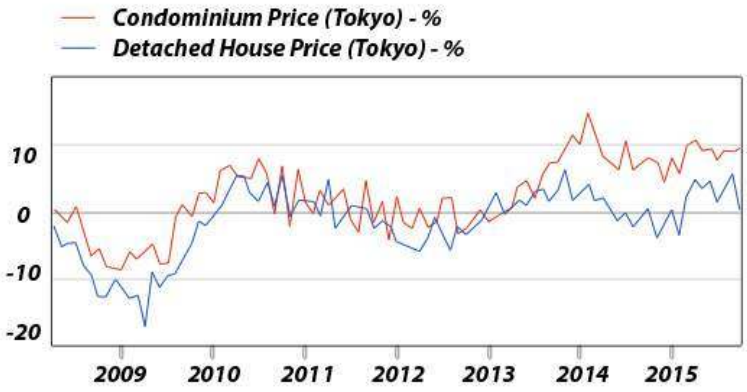


Figure 3.3: Price comparison between condominium and detached house [54]

It appears that the reasons for young people living mainly in condominiums and detached houses predominantly occupied by elderly are the proneness to natural hazards of the timber structures, the complicated ownership relations and community integration. That is why natural hazard prevention and simplifying relations between land and house owner would be the necessary steps not only for the physical preparedness of the neighborhood in case of a disaster but also play a significant role for the demographic structure of the area. Moreover, houses with longer life would reduce construction site disadvantages such as noise, pollution, demolition and rebuilding costs and eventually become a *smart* investment. The study of Komatsu and Endo on 'lifetime and life cycle cost estimation of Japanese detached house' suggests that *"you can save 107% of new construction cost during 60-year usage"* (p.8)[55]. In addition, creating buildings with longer lifespan and raising their property value will accumulate capital on the long run. On the other hand, three-storey detached houses can provide flexible homes matching families' needs. When activities on disaster prevention are accomplished the landowners could subrent the spaces as affordable accommodations to young families, students, tourists or provide working spaces or company housing and thus dynamising the real estate market.

3.9 Introduction of *sharing economy*

Being up-to-date with the state of affairs and having a long term but flexible vision for the future of the cities are crusial components for creating a guideline with a global urban application. The notion of *sharing economy* is still in its infancy but encompassing many favorable features, it is believed to become the new global socio-economic system based on sharing and collaboration. On one hand, with the advance of technology, assets of sharing are becoming cheaper, easier and more efficient than ever providing great variety of products. Furthermore, as previously mentioned trends of reusing and exchanging start appearing among the young generation in Japan making the introduction of sharing economy the logical next step for the city life. *"Despite having one of the best public transport systems in the world"*[60] car sharing options in Vienna, for instance, are growing fast due to their advantages over the metro in certain occasions 3.4(a). On the other hand, peer-to-peer exchanges stimulate personal contact and create opportunities for vibrant communities [61]. In this respect, one of the highlights of the *Share tank* event which took place in Vienna in 2015 was *"Let's slow down and connect!"*[62]. The online platform

FragNebenan launched in 2014 for Vienna neighborhoods and presented at the event is using the potential resulting from the fact that people largely don't know each other 3.4(b). *FragNebenan* provides opportunities not only for mutual help and exchange of knowledge and objects but also creates a diverse social network. Additionally, in order to enhance the economic and social impact of the sharing economy, the concept of the co-working space could be introduced to the neighborhood 3.4(c) giving a second life to a decaying building and redefining the concept of the usual office environment.

The advantages of the globally popular for young entrepreneurs co-working go beyond the simple act of space sharing and innovative design. It's about establishing a community. *"Co-working is also the social gathering of a group of people who are still working independently, but who share values, and who are interested in the synergy that can happen from working with people who value working in the same place alongside each other"*[63]. Therefore, co-working is a rich social experience, opportunity for creating an innovation hub and remedy for isolation.

Regarding these conceptions, introduction of different aspects of sharing economy would contribute to the economic growth and stability of Hikifune neighborhood. Once again, the best messenger for spreading this idea is the young generation interested to reduce its living costs, open to innovations and less constrained by social manners.

(a) Car2go [64]

(b) FragNebenan [65]

(c) ImpactHub Vienna [66]

3.10 Diversification of the demographic profile

In the light of the above-mentioned assets of a diverse demographic profile for a resilient and livable community, attraction of people of different ages and backgrounds and raising the neighborhood's average age could be the keystone for flipping around the vicious cycle into a virtuous one. The conducted analysis shows that what is keeping young people away is firstly, the threat of natural disasters, secondly, the difficulties to obtain an affordable property and its costly maintenance and thirdly, the problematic social integration in the existing community. Life in homey, physically and financially secure environments is a primordial factor when it comes to creating a family and having children. In respect to this, people can't be forced to change their residence or to have babies. What can be done is initiate certain prerequisites within the existing setting in order to stimulate young people to settle down in detached houses and establish families.

3.11 Include women and elderly people to the labor force

The conducted analysis showed that there are around 10% more male employees than female ones in Hikifune and that the portion of working-age population is approximately 30%. In this regard, including women and elderly people capable and willing to work to the labor force would enhance the economics of the neighborhood. Attractive employment conditions such as part-time jobs, home office occupation and online business in combination with the newly activated GF would be the needed set of prerequisites for making this shift possible.

3.12 Concluding remarks

The dense and complex fabric of Hikifune neighborhood is confronted with various environmental and social challenges. Nonetheless, the conducted analysis of the area proves that despite its density the urban tissue has numerous opportunities and potential space. Based on the fact that all discussed issues are interconnected and mutually reinforcing, a strategy working in a similar way but with a positive impact could be developed using the identified potentials as a foundation for creating prerequisites implementing the synergistic improvement method.

Chapter 4

PROPOSAL

The urban space in Hikifune experiences stagnation for about a century and the perception of unchangeable status quo is deeply rooted in the locals' psychology. However, *"remarkable dynamism and adaptability"*(p.12)[20] are a natural element of Tokyo's vernacular. In addition, pressing issues of climate change and demographics are confronting the neighborhood with the urgency of planning a long term resilient future. In this regard, an implementation of synergy, as an approach proved to have worked in the past for solving problems in Japanese cities [6], could be a step towards a multifunctional solution of these matters. The objective in this chapter is to introduce a headway in the issue of synergistic improvement in Hikifune neighborhood based on the untapped opportunities discussed in chapter 3. As figure 4.1 illustrates, the proposal will address the previously discussed interconnected problems and suggest an according plan for intervention at district and site scale over a period of 50 years.

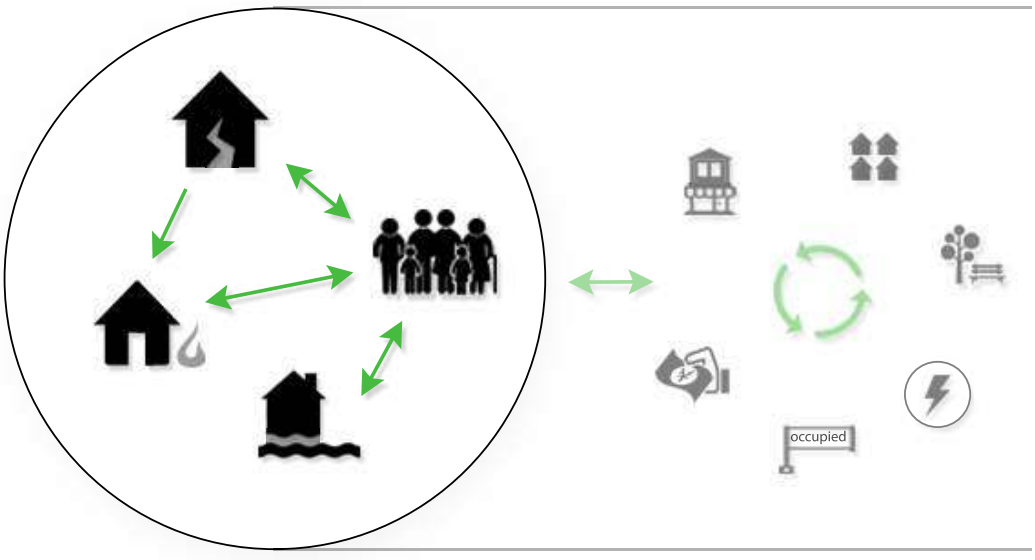


Figure 4.1: Synergy diagram. Credit: VANKOVA Kalina

Two significant points before starting the realization of the program are defining its execution: coordination and funding (fig. 4.2). The most optimal way to propose an intervention in small-scale Japanese neighbors is using the already established structure.

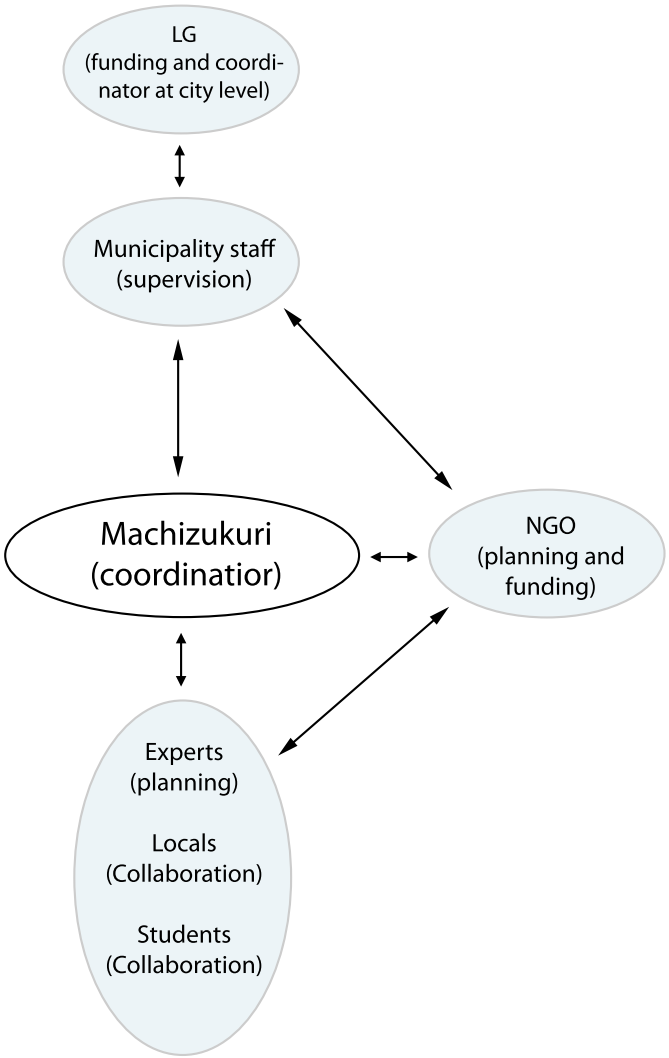


Figure 4.2: Execution diagram of the synergistic proposal. Credit: VANKOVA Kalina

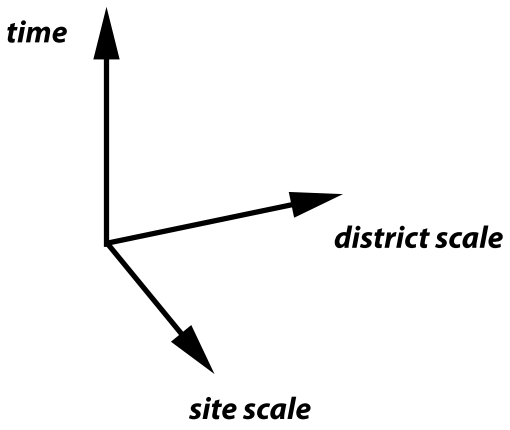


Figure 4.3: Execution diagram of the synergistic proposal. Credit: VANKOVA Kalina

Machizukuri council serves as a mediator between local people thus easily could transmit ideas and coordinate both sides during the execution process. The support of external actors such as experts in various areas and NGOs will contribute to the high quality of planning, execution and promotion of the program.

Different funding sources are necessary due to the complexity and variety of the program and the desire to avoid large-scale development. Firstly, private investments of house owners would be ensured by bank credits under favourable conditions and paid off by the GF activation. Furthermore, subsidies from NGOs could partially cover renovation costs, LG subsidies (200-years-old-house certificate) would support rebuilding of new homes and pocket parks. The area in front of the train station could be funded by Tobu Railway Corporation as part of the already ongoing project for renovation of Tobu Line. Finally, participation of locals and external volunteers would reduce the expenses on the project overall.

As previously determined, those Hikifune issues have a deep connection and are mutually reinforcing. For this reason, this work will not look for an individual solution of each problem but propose a multifunctional master plan. Following chapter suggests a set of goals firstly at district and secondly at site scale. Eventually, a distribution of the intended interventions in a 50-years improvement plan aims a gradual change and a long-term stable impact on the urban environment (fig. 4.3).

4.1 District scale

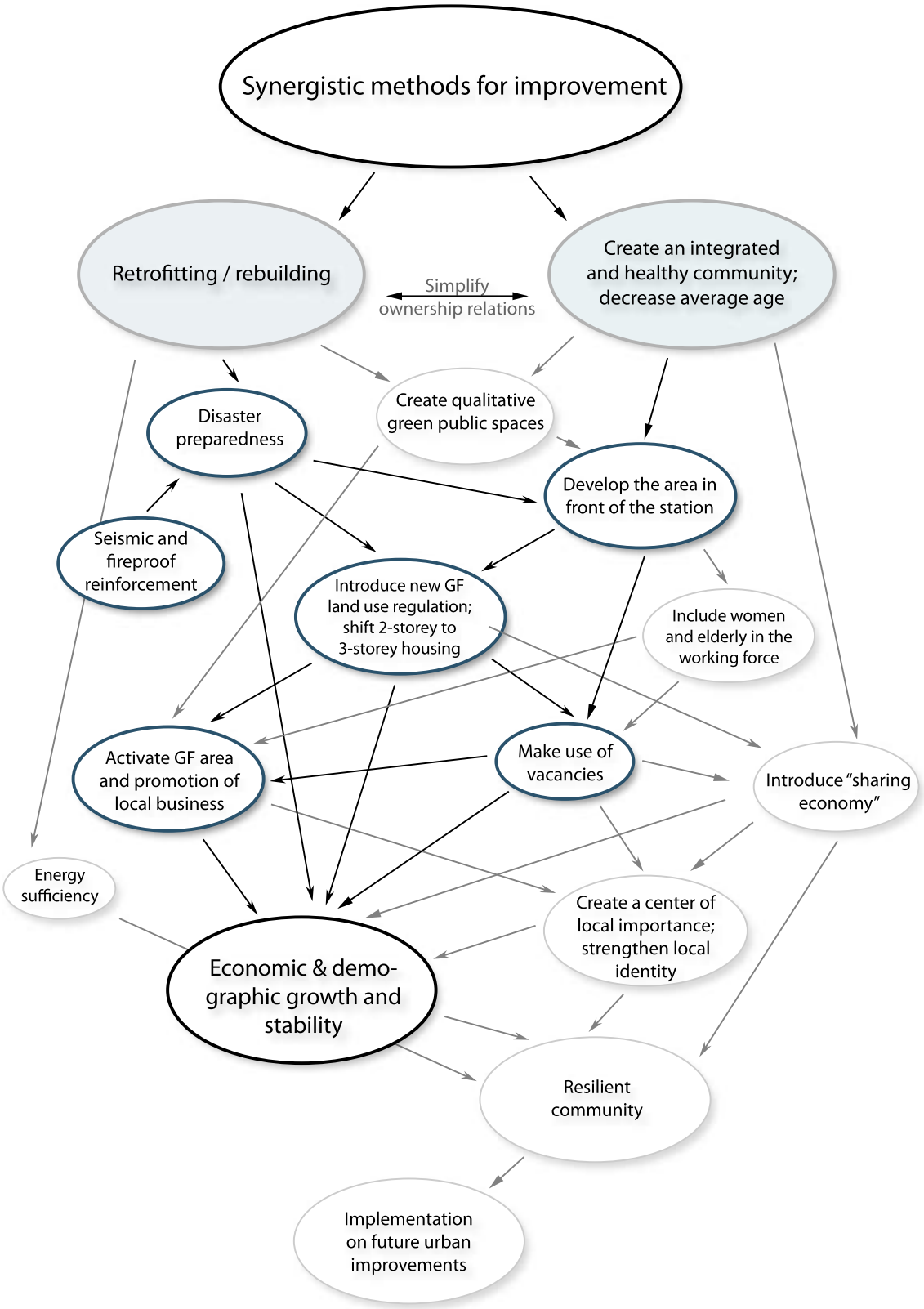
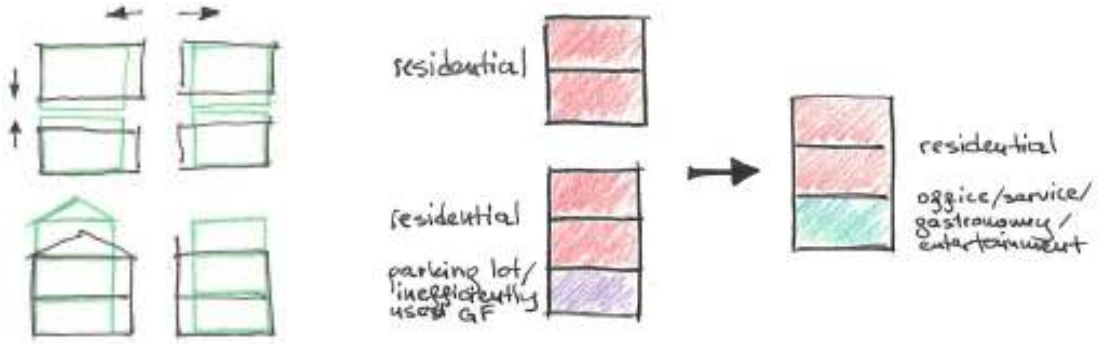


Figure 4.4: Synergistic improvement diagram illustrating the basic steps towards completing the master plan. Marked in blue are the interventions which are to be observed in detail in the next section. Credit: VANKOVA Kalina.

After establishing the coordination organs and defining the funding methods, the first condition to proceed to action is simplifying the relations of properties with complicated ownership status. Unified land and house owner will give opportunities for easier interventions of the two main neighborhood improvement policies: *retrofitting or rebuilding of housing and public space whereas preserving the existing town-scale pattern* and *creating an integrated and healthy community by decreasing average age* referring respectively to the physical and social aspects of life quality.

The prime purpose of the retrofitting/rebuilding process is the disaster risk prevention of buildings and open space. Regarding the built environment, a seismic and fireproof reinforcement starting with the vacant and most vulnerable structures, building-up of the periphery with fire-proof high-rise buildings, an introduction of a new ground floor land use regulation and the subsequent shift from two-storey to three-storey housing are going to contribute to the safety of the neighborhood in case of a natural disaster. A switch to one floor higher housing will mean a shift from IV to III category buildings which requires structural calculations. Such intervention will have as a consequence an enhanced earthquake resiliency of the buildings' structures and mitigation of the seismic impact on urban space. Three-storey-housing would be in no contradiction with the land use and height regulations (). In order to provide sufficient light for the newly created rentable spaces at GF, the new houses could be rebuilt with a setback to the street and and with less space in between. The widened streets and the impossibility to use this space as a storage would reduce the risk of fire-spread (). Along with that, the gradual change over of the unappealing *plinth* from residential, car-parking or storage function to universal rentable spaces with a short-term contract and simple attractive design aims a massive impact on disaster vulnerability mitigation in terms of floods on one hand and economic growth and social inclusion on the other. The new regulation will precede an activation of the passive and ineffective GF area (). Continuing the tradition of co-existence of separate working elements and giving it a new modern variation in the context of the future resilient city in Japan will not only enhance the vernacular but also provide new business and employment opportunities.



(a) Residential buildings transforamtion

(b) Ground floor activation

Figure 4.5: Shift to 3-storey housing with an active GF. Credit: VANKOVA Kalina.

The successfully working ground floor system in Liendert, Amersfoort, Netherlands could be translated to the language of the Japanese urban space. With a suitable promotion the idea could turn into a win-win situation - young entrepreneurs, starters or even students could be given the opportunity to express and realize their ideas without fear of debts in case of a failure on the one side and, on the other, the *plinth* would become

more open, vivid, colorful and friendly. Provisioning a great variety of new functions for the locals, the GF would boost the local economy, create new social connections and, eventually, advocate the neighborhood as a popular place for young people to live. The improvement plan anticipates to break down the big residential buildings to smaller units and include them to the GF land use transformation process. The idea is to start with offering a few pilot GF boxes at low rent prizes and flexible 2-years contract. The spaces should be completely empty and as simple as possible in order to adjust easily to the tenants' needs and give them freedom to design it the way they want. As an anti-flooding measurement, they should be ready for a fast evacuation. Another options for using these spaces are modern working styles by the house owners - men who could reduce their commuting time and work from home, women desiring a flexible working hours at a part-time job or enterprising elderly people still capable of working.

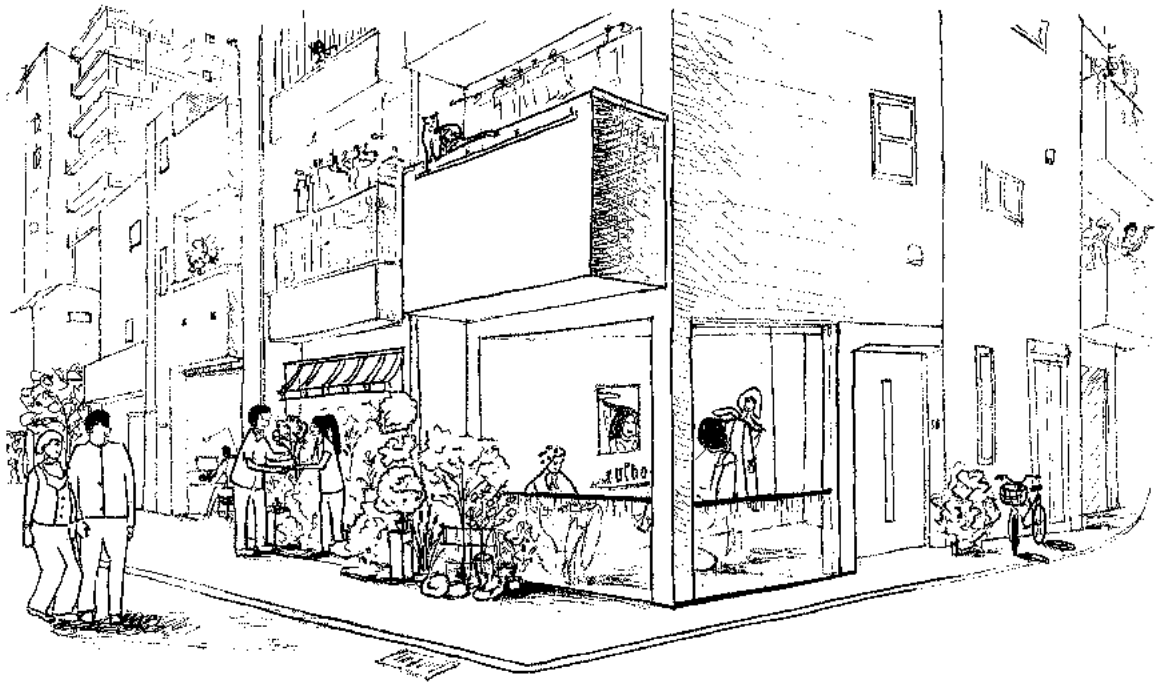


Figure 4.6: Activation of a detached house ground floor. Credit: VANKOVA Kalina.

On one hand, given the chance to choose their working time, women could easily combine work with parenthood. Involving the female part of the population at working age in the labor force would lead to a growth of the domestic income and financial security. On the other hand, reducing the commuting time by providing local job opportunities will increase the time spent with the family and strengthen the bonds between its members. Such healthy environment of high-frequency interactions is a prerequisite for raising the birthrates. On this matter, child related ties are essential for creating the harmony within the community, eliminate conflict of interests and relative lack of solidarity between newcomers and original residents (p.283)[36]. Hence, small-scale units with diverse functions and including women and elderly to the working force will affect positively the population structure, contribute to a healthy and integrated community and relieve the demographic and economic pressure.

Figure 4.7: Activation of a condominium ground floor. Credit: VANKOVA Kalina.

Besides the *plinth*, which is part of the built-up city area, a crucial role for making the urban fabric safe, livable and attractive is utilizing the space between the buildings or the *soto*. In this relation, developing the area in front of the train station will provide a qualitative multifunctional public space. It was described in the analytical part as an ineffective, non-lucrative and with the sole function to connect people from their homes to the station. through merging this space with the current playground in the north and inefficiently used parking lot in the south it would become the main evacuation zone for Hikifune. Connecting the three spaces will provide an area of 6300m^2, which is more than two times more than the current evacuation area. With a financial support from Tobu Railway Corporation, creative design ideas of all internal and external actors and under the coordination of the *machizukuri* council it could transform into a hotspot of productivity and connectivity, a *sakariba* as a modern version of the Edo *bashi*. Becoming a place of local importance is *"an instrument both for shaping and mouldling collective memories and construction of territorial identity"*(p.187)[9] through celebration of numerous Japanese festivals during the year or organizing local community events. Examples of such events could be a workshop with the purpose of inventing the name of the place, designing the train station entrance or an open-air-cinema evening. This constantly changing appearance reviving the urban space would be accompanied by the opening of the market underneath the railways using the currently *dead* zone and re-functioning the *plinth* of the surrounding high-rise buildings. The development aims an inclusion of the eastern part of the neighborhood as well.

An important drawback pointed out by prof. Nakamura in survey conducted by him are the lack of qualitative greenery and extensive noise pollution along the main transportation arteries. Regarding this, the development of the plaza will take into consideration the green look of this space during the design process thus reducing the noise levels from the

train station. Another way to boost the vegetation in the neighborhood is creating pocket parks following the Kyojima incremental improvement model. Re-functioning vacant or inefficiently used land into mini green oases scattered throughout the urban fabric will act as refugee from the loud streets, spaces for relaxation, small events, meeting point for the intermediate neighbors, lunch break spots for the new GF tenants, places for informal business meetings or urban gardens. From ecological point of view, the pocket parks will serve as the lungs of the densely built-up city and provide microhabitats for small animals, particularly birds. The roots system of the threes will contribute to the anti-flooding disaster risk management. The original design of the flora, benches, flooring and special names are going to give these places individual charm and identity.

Given new functions, the former vacant or inefficiently used areas and buildings will create possibilities for introduction of the *sharing economy*. With reference to the previously discussed assets, needs and potentials for transportation and the new GF land use regulation in Hikifune, an appropriate first step for implementation of the *sharing economy* would be launching the *car sharing* concept. Using the neighborhood's most valued potential, its *walkability*, will be a natural move within the dense urban fabric. The area is absolutely walkable, the bicycle is already a popular and largely used transportation method and Hikifune train station is in a radius of less than 10 minutes walking distance from each home when it comes to longer trips. Hence, cars are unnecessarily occupying up to the half of many dwellings' areas, taking a toll on the local's living costs and distorting the urban landscape. Using a shared car is easy, cheap and non-binding. Adopting the system provides the present used-cars-dealer new horizons for business development taking over the maintenance of the cars. Apart from renting small spaces, the condominium ground floors along the periphery could serve as parking lots for the little electricity powered vehicles. A monthly abonnement system combined with the income of the rest of the rented ground floor will substitute the current profit of the big parking lots for private cars at present. In the same time, an easy access to a car will be provided as an alternative transportation method outside the neighborhood borders while the interior will be car free. Access will be granted only for emergency vehicles, transportation of disabled people and delivery services at specific day and time of the week (Monday morning for example). Additional bicycle parking lots with original compact design will appear in order to meet the needs of the new cyclists. The reduction of car-use within the neighborhood will make the streets safe and contribute to an environment where children can play safe on the street.

The advancement of the digital technology is opening up further possibilities for local residents to engage effectively with the community. Another application of the sharing economy is the adoption of the *Fragnebenan* platform and shape it to the needs of the neighbors. *Fragnebenan* will be of great use for organizing all the community activities which will take place in the newly rebuilt vacant buildings, activated *plinth*-s and public areas. Moreover, it will provide opportunities for social interactions, exchange of knowledge and objects. The platform could also promote the disaster risk awareness and low-energy consumption, give information on evacuation and facilitate an efficient coordination during the urban renewal project.

Making use of the ripple effect of the re-development of Sumida ward through the LG coupled with the listed actions for synergistic urban improvement will result in a rise of a centre with local importance which will provide amenities, employment and connections residents from the surrounding districts as well (fig. 4.8). The purpose is, however, to

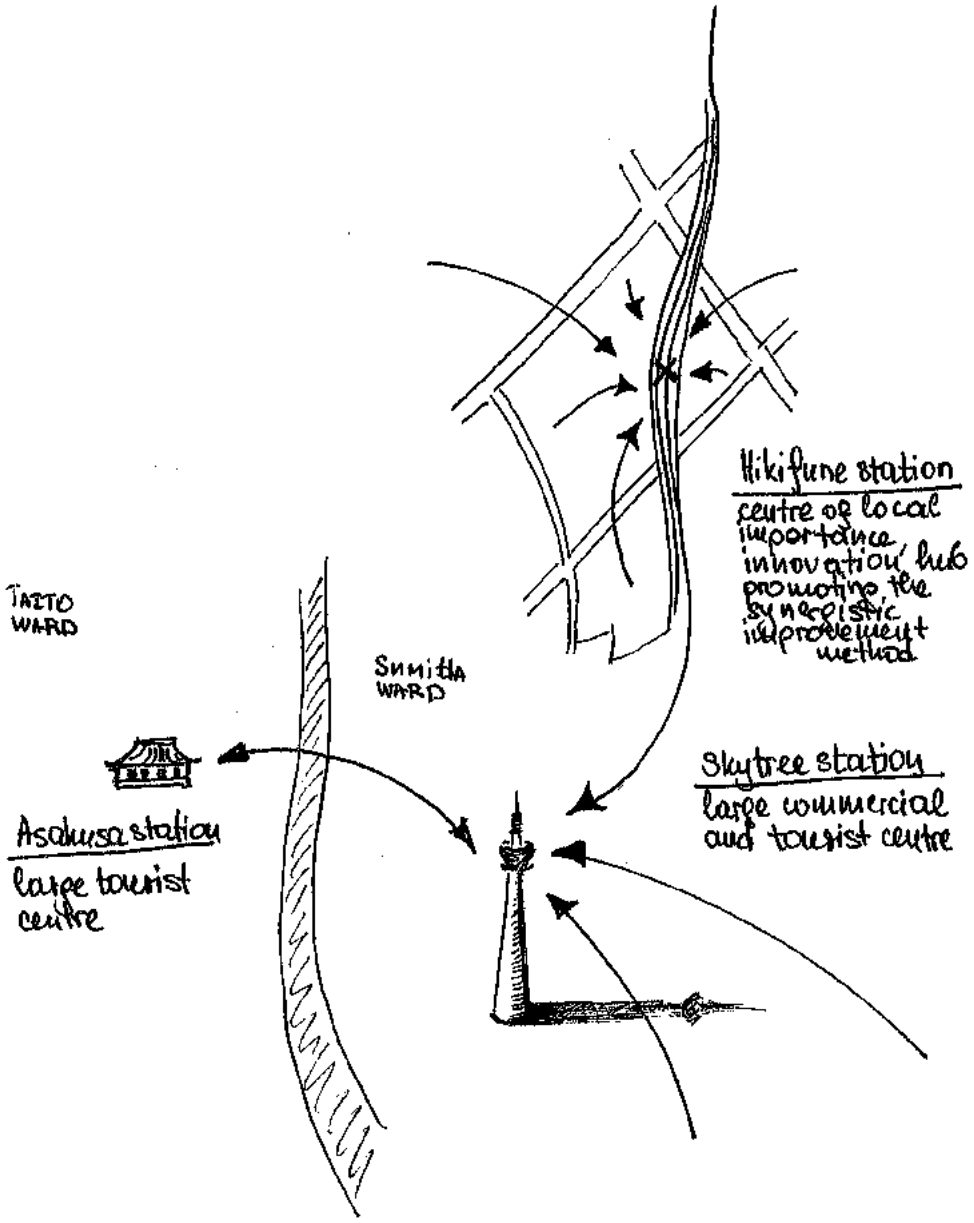


Figure 4.8: Anthropogenic flow between Hikifune, Oshiage and Asakusa stations. Credit: VANKOVA Kalina

Consequently, the cooperative efforts of internal and external actors and the effective coordination by the *machizukuri* council will lead to an economic growth of Hikifune and in a few years of growth, when the investments start to pay off, the neighborhood will be economically stable. Through the disaster risk prevention measurements, the AAL will be reduced, safe housing will become more valuable and competitive on the real estate market. In addition, activation of the GF area will create an attractive business environment and justify the initial investment. Due to the synergistic implementation of many diverse interventions the demographic profile will contribute to and benefit from this growth. On one side, resilient houses, new entrepreneurial opportunities will attract young people. On the other, qualitative inclusive urban space will provide prerequisites for mental and physical health thus raising the birthrates.

Albeit economic and demographic stability are the short run anticipated goal for this work, along with disaster risk reduction and improvements on business-related and social matters, ecological issues are a global topic and must be taken into account for every urban project nowadays. Via reducing the car-use, stimulating green transportation modes and creating parks, the synergistic improvement method will reduce the CO2 emissions and energy consumption. Yet, buildings must respond to the confronting issue of climate change as well and contribute to restoring and sustaining the environmental balance. When creating buildings with a long lifespan, besides structural requirements, the new materials, constructions and facilities must fulfill conditions referring to the environmental resilience. An efficient housing design will result in low maintenance, heating and cooling costs and provide free resources like water, electricity or even food on site level.

Figure 4.9: Expanding of the synergistic improvement method to the neighbor district. Credit: VANKOVA Kalina

After completing all proposed steps for synergistic improvement the community will reach a substantial level of autonomy in terms of disaster preparedness, demographic and economic dynamics and energy consumption. Achieving independence on outside factors will make the system resilient. After obtaining this freedom, the community could decide the direction for its future evolution by itself. Meanwhile, if the synergistic improvement method proves to work successfully in Hikifune neighborhood, the surrounding districts would embark on a similar development course and proceed the urban renewal. An immediate example for such a process could be an expansion of the area along the railway in direction of Northern Higashimukojima, 2 Chome, where the area currently is a parking lot with a passive *plinth* and poor quality of the public space (fig. 4.9).

4.2 Site scale

Following section will observe in deeper detail a few examples of how the renewal process will proceed at site scale. It is divided in two parts referring respectively to buildings and open-space areas.

4.2.1 Buildings

The project will start with a few pilot houses which will follow the method used for the seismic and fire-proof renovation of Fujinoki Community Space and the *Guidebook for renovation of wooden buildings* [67] provided by Prof. Nakamura's lab. Depending on the structural scheme, the materials used for the initial construction and the owner's financial capacity, the house could be either renovated according to the seismic and fire-proof regulations of the BSL or demolished and rebuilt again. Following pages will provide information on what both renewal processes should include and what will be the respective lifespan of the construction after that.

House retrofitting

The house refurbishing incorporates fire, earthquake and flood resistance repair along with preparation for re-functioning of the ground floor according to the new regulation. The seismic-related strengthening includes installation of box-framing for big openings such as windows and entrance door, possible placing of construction braces for glass facades, replacement of worn out horizontal braces, installation of dumpers for a more effective mitigation of the vibration, installation of reinforcing panel which also provides natural light and ventilation, fixing the (*kawara*) tiles on the roof, attaching the furniture to the prime construction and using it as an additional structural support, installation of framed sliding doors. Regarding the fire-proof renovation, the anticipated actions are replacing the windows' glass with a fire-proof-mesh insulation glazing, exterior sheathing with fire-resistant material, placing fire-proof insulation, furnishing with curtains of fire-resistant fabric. The anti-fire sprinkler system serves simultaneously an anti-flooding function by collecting the rainwater in a reservoir. Further steps towards energy and resource autonomy could be using this water for the household consumption, installation of solar panels for reducing the cooling, heating and electricity costs and supplying the attic with emergency equipment for flood evacuation. The ground floor will be stripped of its previous use leaving only the stairs to the upper floor thus providing a free and simple space to the coming tenant or the house owner's work. When possible, its façade will have big openings with a visible timber construction braces or box-frame reinforcement. Its ability to transform to a more open-space mode will be beneficial not only for the social climate but also for the comfortable environment in the house. Natural ventilation through the open ground floor will help for easier cooling of the building from below. Furthermore, there will be added a noise insulation layer in the floor between the first and the second storeys to ensure the convenience on both sides. Finally, a simple design intervention could contribute to restoring of the *vernacular* look of the neighborhood – re-appearing of the traditional *kōshi* (格子) will indicate the newly established function of the *plinth*. After the renovation the house's life will be extended with at least 30 years.

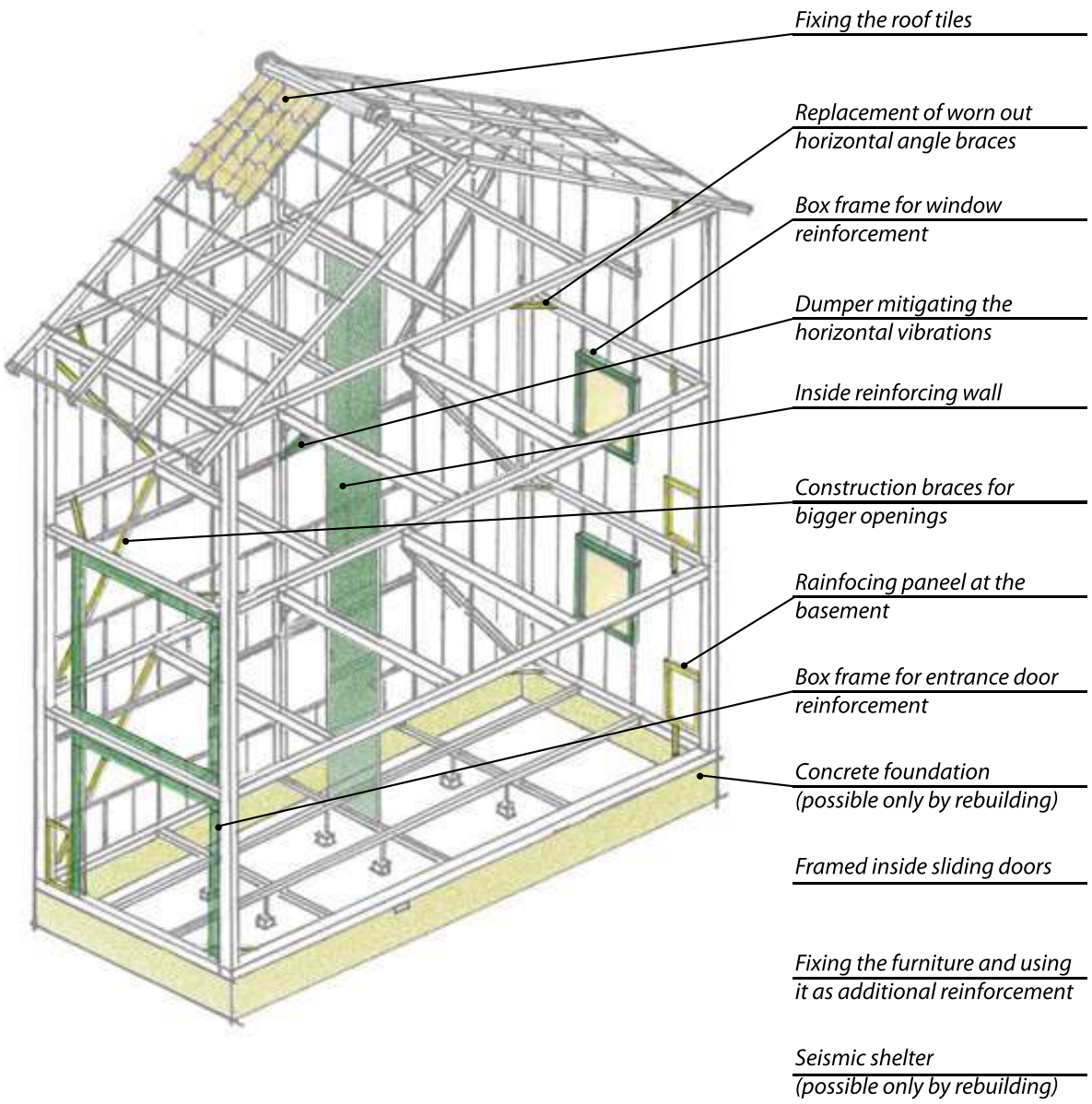


Figure 4.10: Seismic reinforcement of a detached house. Credit: VANKOVA Kalina.

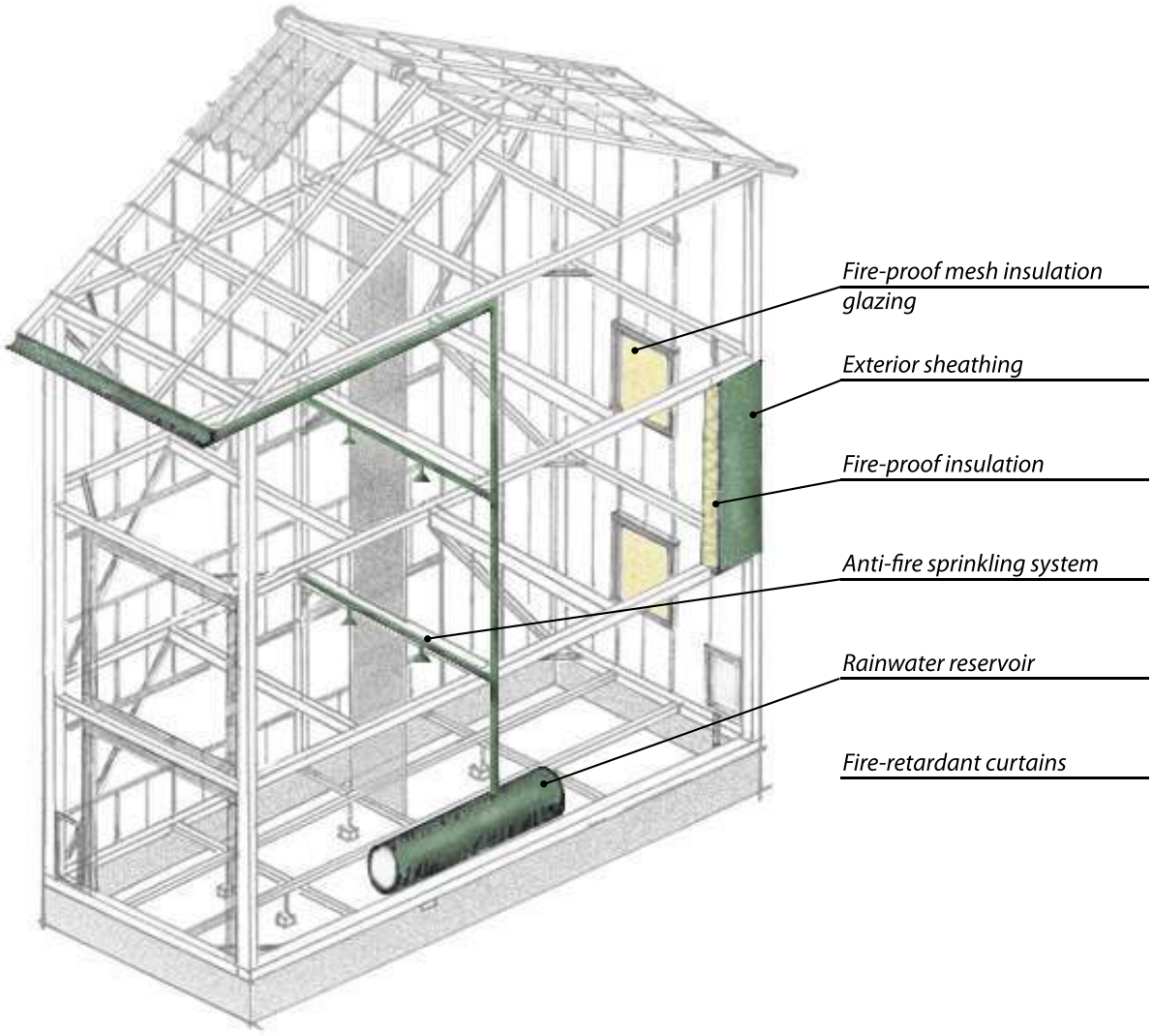


Figure 4.11: Fire-proof reinforcement of a detached house. Credit: VANKOVA Kalina.

(a) Fixing the roof tiles

(b) Replacement of worn out horizontal angle braces

(c) Dumper mitigating the vibrations

(d) Box-frame reinforcement

(e) Reinforcing panel at the basement

(f) Bracing for bigger openings

(g) Framed inside sliding doors

(h) Fixing the furniture and using it as an additional reinforcement

(i) Seismic shelter

(j) Exterior sheathing

(k) Fire-proof insulation

(l) Fire-resistant insulation glazing

(m) Anti-fire sprinkling system

(n) Rainwater reservoir

(o) Flame retardant curtains

Figure 4.12: Renovation of a detached house. Credit: VANKOVA Kalina.

House rebuilding

Renovation requires less investment and could be a preferred option for many residents. Yet, by many of the 2-storey dwellings with less than 120m^2 living area, the ground floor currently serves a residential function. For this reason, they can't be renovated applying the new land use regulation and must be rebuilt. Rebuilding will be the renewal method applied on a larger proportion of the buildings in Hikifune – most of the 2-storey houses and dwellings with an extremely deteriorated construction where a renovation is not worth it. The *scrap-and-build* approach provides opportunities for easier fulfillment of the disaster prevention requirements and the new GF land use regulation. A deeper foundation will reduce the impact of seismic motions to the building in case of a big earthquake. The advanced timber construction covered with a fire-retardant coating will ensure additional resilience to natural hazards. One of the main advantages of the rebuilding is the integration of the ground floor shelter which will function as a dumper protecting the most vulnerable part of the building and reducing the shaking of the two upper floors. Valid and more effortless will be also the re-functioning of the *plinth*, actions in terms of energy efficiency and resource independence. The integrated in the initial plan rainwater reservoir and sprinkler system will serve with a higher efficiency its triple synergistic function – to mitigate the effect of heavy rainfalls, use the collected water for extinguishing of fire and to reach a relative energy and resource autonomy of the building. With a proper maintenance the rebuilt version of the modern *machiya* can last for generations. In the same time, however, the method hides a danger of losing the *vernacular* of the traditional house in Hikifune. That is why, after the plan and design of the house are ready, they must be approved by the local *machizukuri* council in order to make sure they follow the main policies of the synergistic improvement plan.

At first, the prize for refurbishing or rebuilding of a single dwelling will be high, nevertheless it will decrease substantially after creating a few prototypes which will define the possible materials, constructions and setbacks. Once developed, a pre-pared construction of a timber house will become cheap, easy, fast and clean to install on the laid foundation. Afterwards, the spatial distribution, facade and garden can be designed according to the user's needs. Active participation by the owners themselves will reduce the construction costs on one side and create bonds to their property on the other. Consequently, the houses could become a legacy for the next generation.

Refurbishing of the car-parts-factory

Apart from the housing, the synergistic improvement in the neighborhood concerns also buildings with other functions but residential. Among the ones with highest priority is the factory for automobile parts next to Fujinoki park due to its proximity to the main evacuation area, extreme vulnerability to natural hazards and passive unattractive *plinth*. The prime steps for its renovation are similar to those of the housing refurbishment. However, it covers a much bigger area than a single dwelling and is located in a very strategic place therefore requires a more detailed examination of its seismic and fire-spread performance and an appropriate safe planning proposal. Regarding its re-functioning, after the introduction of the car sharing system there will be no large demand on car parts in the future. Hence, the building could preserve its original appearance but be transformed into a rentable modern co-working space providing a shared working environment rich on ideas and contacts and attract freelancers, work-at-home professionals or frequent travelers. In the context of the Japanese urban space the renovation will refer to the traditional co-existence by juxtaposing the architecture of the old factory and a new contemporary style, the shared space and the independent activities.

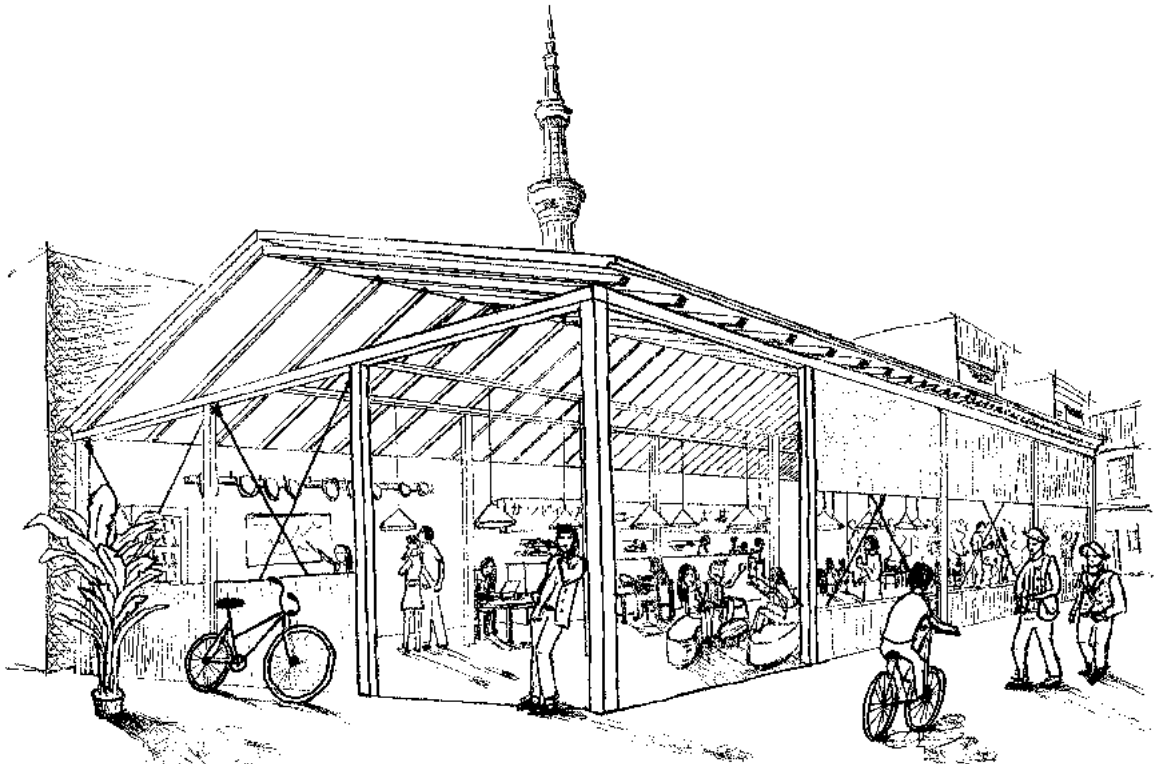


Figure 4.13: Renovation and repurposing of the car-parts factory. Credit: VANKOVA Kalina.

4.2.2 Plaza in front of Hikifune station

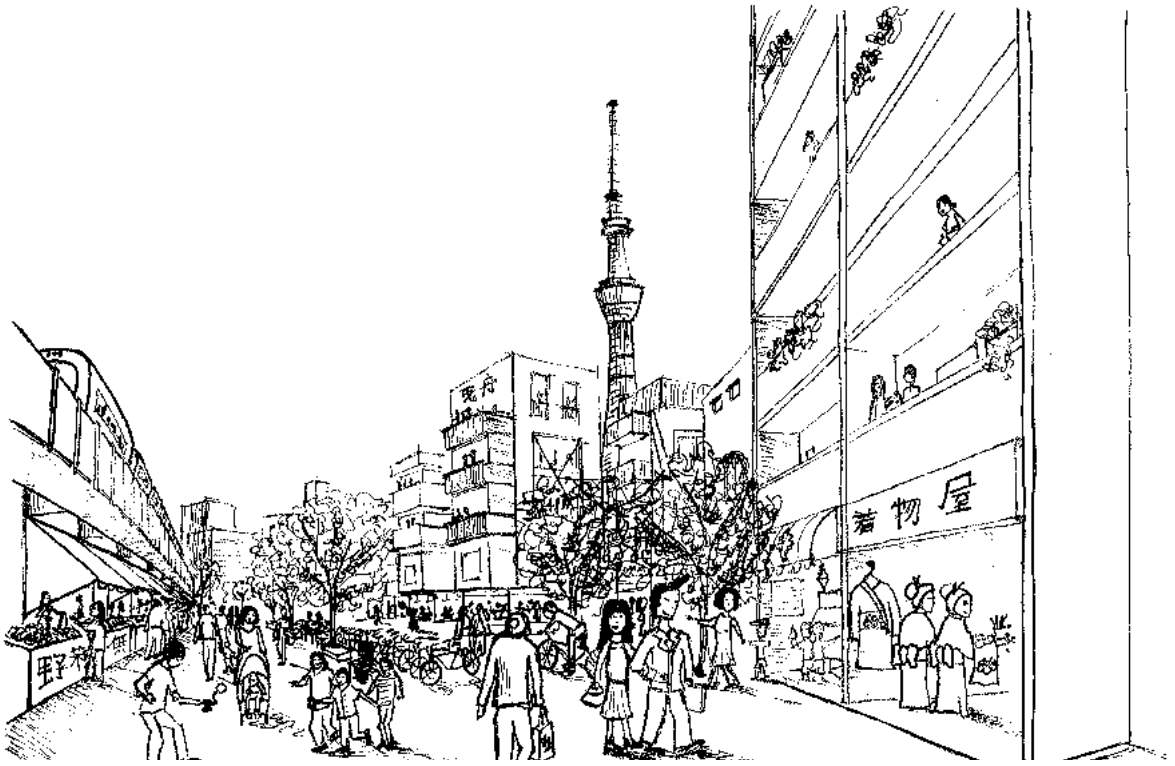


Figure 4.14: Renovation and repurposing of the area in front of the train station. Credit: VANKOVA Kalina.

Disaster preparedness is the highest priority for the area in front of Hikifune station. Due to its central location within the neighborhood, it is suitable for providing a safe evacuation zone for all local residents. From there is granted an easy access to the regional transportation system, if it is available, or immediate contact to the evacuation Mito street. After the Tobu Railway Renovation Project is completed, the tracks and the station itself will fulfill the necessary requirements for disaster prevention. On the opposite side the high-rise condominium ensures a fire-proof wall as well. The surrounding buildings will be seismic and fire-proof reinforced and the shift to a 3-storey housing will prevent a potential fire-spread in the evacuation zone.

Finally, all new GF spaces must be easy to evacuate and non-combustible. Taking Ameya-Yokochō and Tsukijima markets as references, could contribute to the growth of this place as a commercial center and an image of local identity. Opening a market under the railways and activation of the surrounding buildings' *plinth* will provide employment opportunities and, in the same time, attract as customers not only the residents but also all newcomers working in the area. As time goes on, stopping at the market while going out from the station to buy fresh products or just say *hello* to the seller from whom you bought your groceries yesterday will become a natural daily action. For a more diverse social impact, the design of the zone must be flexible, offering a wide range of recreational, leisure and cultural activities. Depending on the hour, the day or the season, the space could transform according to the needs of the event which will take place. Moreover, the plaza must embody the new environmental thinking as a part of the synergistic improvement and, through implementing the well-known Japanese gardening

skills, become a park with a qualitative greenery and appealing urban landscape. In addition, in order to enhance its flooding resilience, the planted trees within the area will soak up excess rain water and support the drainage system. Besides their ecological and visual advantages, the tree crowns will also absorb the noise of the passing train and the bustling social life thus securing the rest of the residents living nearby. Lastly, the new multifunctional community area will invisibly divide public from semi-public and serve as a buffer between the loud and bustling street and quiet and intimate space in front of the houses.

4.2.3 Pocket parks

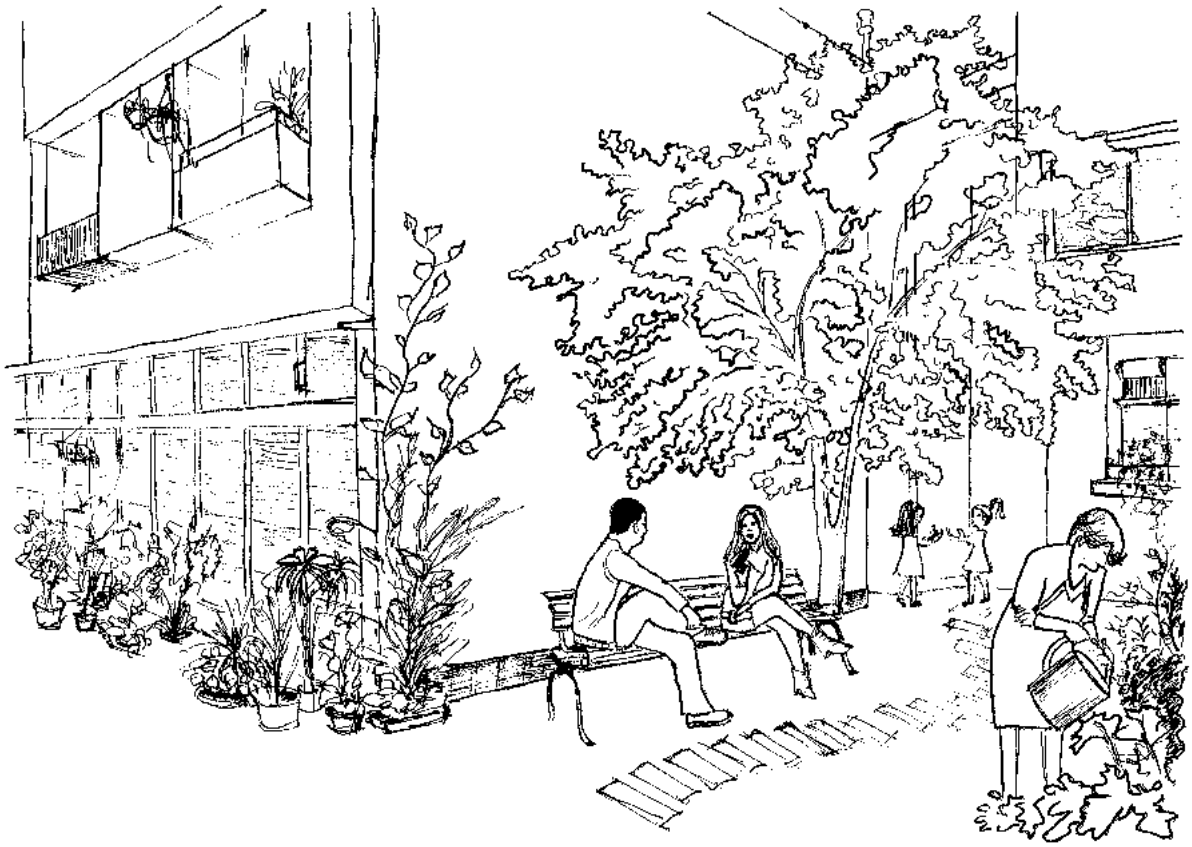


Figure 4.15: Creating of a pocket park. Credit: VANKOVA Kalina.

The semi-public space between the densely built-up dwellings plays an important role for the livability of the urban environment and every free area is a valuable potential. Instead of raising new buildings on the currently vacant or inefficiently used lots in the densely built-up interior of the neighborhood, the synergistic improvement plan anticipates converting them into pocket parks. An example of such transformation gives fig. 4.15. The illustrated vacant lot has a central location in a 4m wide alley and is surrounded by buildings with a service or gastronomic function. The presence of this vacancy has a distorting impact on the urban image and effects negatively the prosperity of the street *plinth*. In addition, the landowner has no intentions for using the land and the annual land tax is nothing but an economic burden for him. In this context, the *machizukuri* council could coordinate an agreement between him and the LG for changing the land use

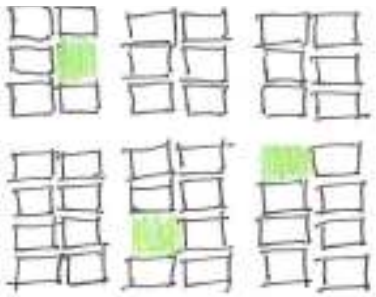


Figure 4.16: Pocket parks replacing vacant and parking lots. Credit: VANKOVA Kalina

to a park for the next 50 years. In exchange the owner would be freed from obligation to pay the land tax for that period. After the agreement has been reached, the *machizukuri* council can initiate a renovation process powered by the efforts of volunteers. In this way, with a minimal investment and good organizational skills, the empty non-lucrative space could be transformed into an appealing intimate paradise for the use of locals, tenants and customers. If more such areas follow this example and scattered pocket parks start popping-up during the renovation process the flooding risk within the neighborhood would be reduced. In addition, not only the local business and social environment will be benefited, but the pocket parks will also let the dense urban tissue breathe and affect positively the overall ecology. (fig. 4.16).

4.3 50 - years plan

This section attempts to provide a plan for implementation of the discussed synergistic improvement steps over the next 50 years. Gradual transformation and work on a small scale with the residents' participation themselves will reinforce the bonds of the locals with their property and neighbors and create sense of belonging to the area. As a result, the new houses will become homes and valuable legacy for the next generation.

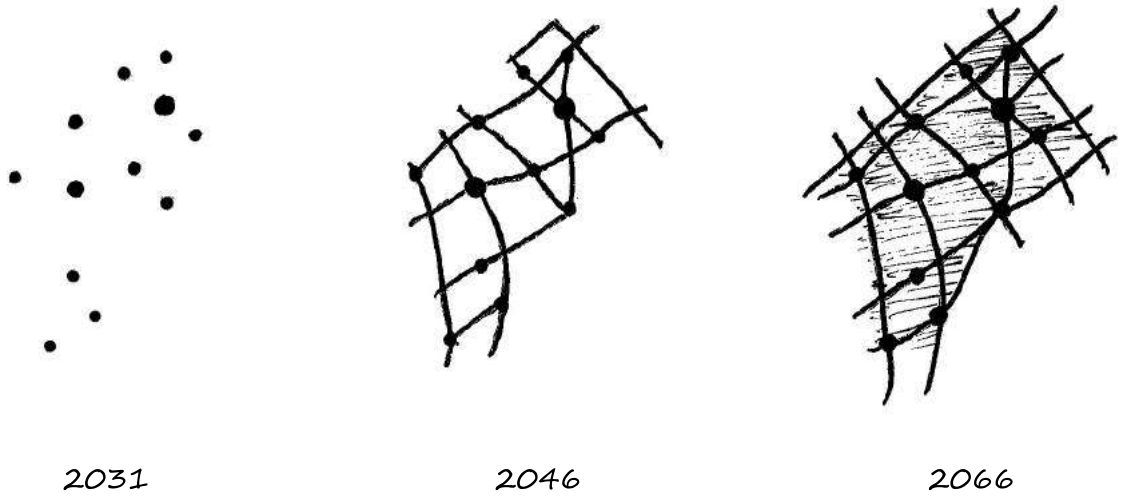


Figure 4.17: Implementation of the synergistic improvement method over the next 50 years. Credit: VANKOVA Kalina.

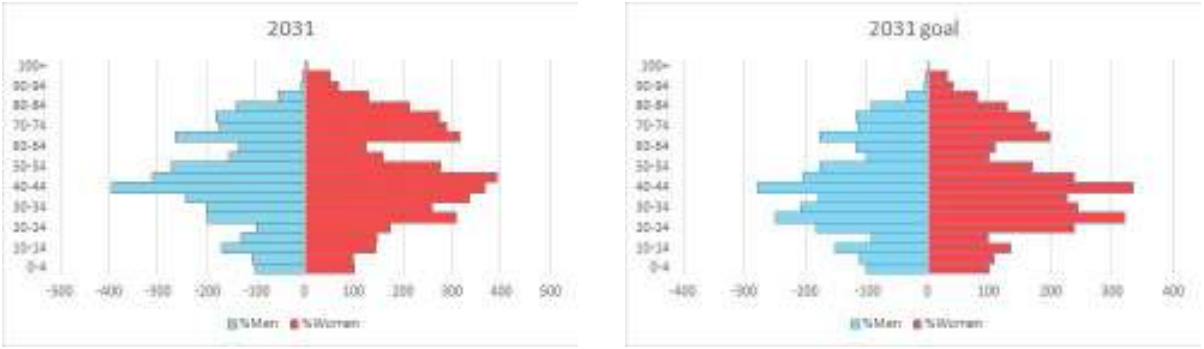
The renewal process should happen gradually but at a stable pace in order to keep the inertia of the initial financial, marketing and design inputs. In this regard, the *machizukuri* council, in the role of a coordinator, must make sure of the following a basic plan for the completing a minimum of both land and buildings' interventions per year. Certainly, everyone who is willing to make a renovation before by the plan appointed time will be granted an opportunity to do it. Such actions will enthuse his neighbors and accelerate the overall process acupuncturally.

4.3.1 2031 Goal

Figure 4.18: 2031 Goal. Credit: VANKOVA Kalina

During the first 15 years the most important part of the process is introduction and promoting of the idea. The goal of the marketing campaign is to highlight the benefits instead of forcing the changes. The renewal project will gain publicity through events, *machizukuri* meetings, the local version of *Fragnebenan* platform but primarily via verbal contact. That is why, creating of prerequisites for social interactions is of extreme importance. Regarding the first physical interventions (fig. 4.18), priority will be given to the most dangerous zones - vacant and extremely vulnerable to natural hazards buildings, the two-storey houses along the periphery and widening of the streets where needed (areas a - L with L representing all self-initiated renovations). In addition, activation of the GF area of the condominiums and the involved dwellings (areas a, c, d and f), renovation in front of the station with first events taking place in the multifunctional area, establishing of the market under the railway, creation of Hikifune Machizukuri headquarters (area c) and transforming the car-parts factory into a co-working space connected with a pocket park (area g) are aiming to form hubs for developing and spreading the concept of the synergistic improvement, a comfortable and attractive business environment, rapid economic growth and repayment of the initial investments. The new employment opportunities will attract young people and provide financial security for families in order to increase the birth rates. Apart from that, a progressive shift to non-private-car mobility system, sufficient bicycle parking lots and the first pocket parks replacing the empty lots will transform the urban environment into a safer and more comfortable area welcoming social interactions (areas a - L).

Since the 50-years-plan is anticipating synergistic changes for the next generation it is important to take into account the demographic projection of the current residents. By 2031 approximately % of the today's inhabitants would have passed away leaving around ... housing units to their heir. As previously discussed, the relevant buildings are among the oldest and most vulnerable in the neighborhood and that is why they would stay in focus within the next 15 years. In this regard, not only must the new functions and renovation methods of the buildings and spaces be considered but also a thought should be given to the demographic profile of the people who are going to move in in order to start stabilizing the demographic pyramid of Hikifune. Based on the proposed interventions in areas a - L illustrated on fig. 4.18, fig. A.2 suggests a respective detailed distribution prognosis of the new land use and demographics. If the intentioned synergistic steps are completed, in comparison to the prediction (fig. 4.19(a)), the portion of population aged 0-35 years by 2031 should have increased (fig. 4.22(a)).



(a) Prediction 2031

(b) Goal 2031

Figure 4.19: Population pyramid of Hikifune neighborhood. Credit: VANKOVA Kalina

4.3.2 2046 Goal

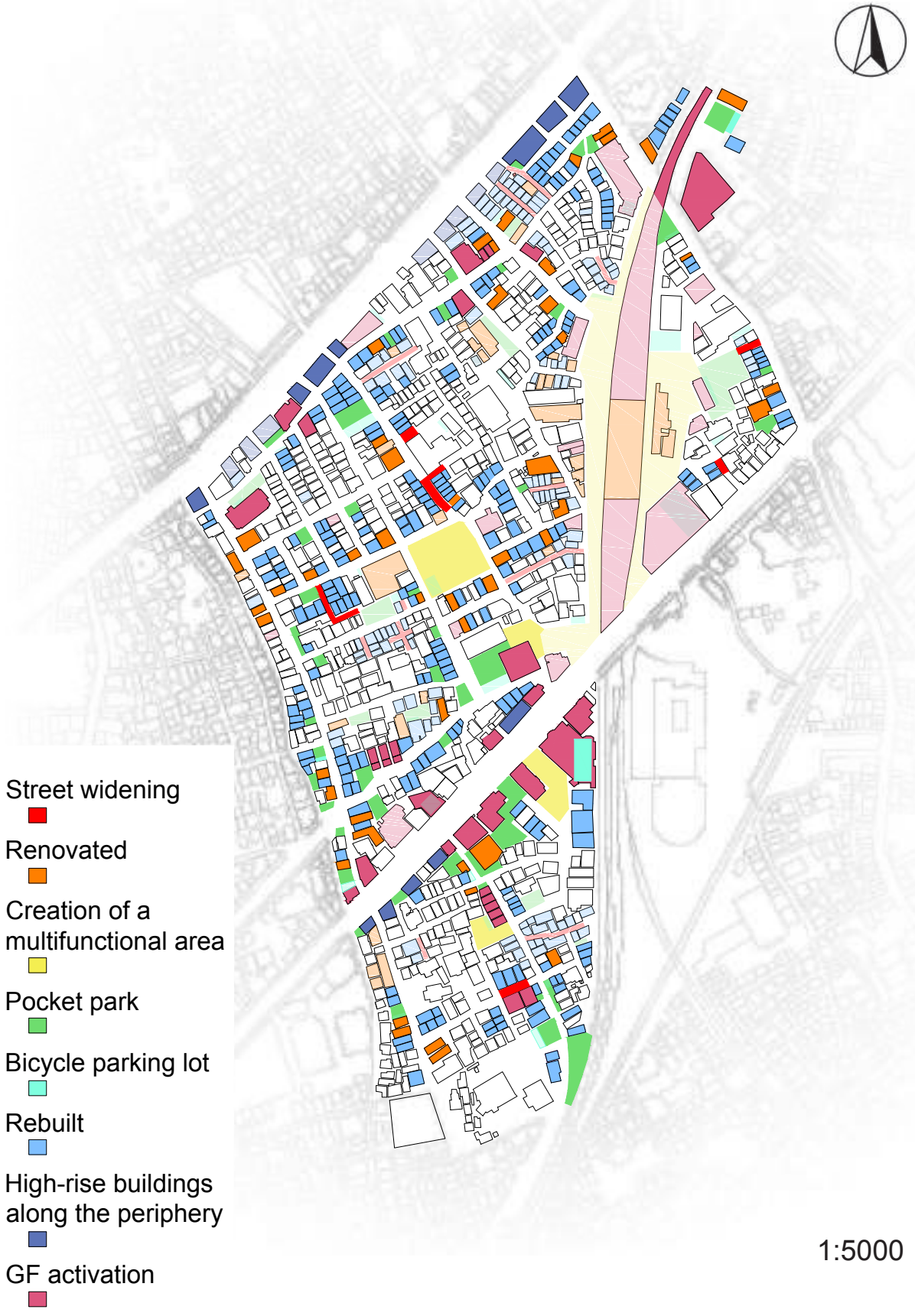


Figure 4.20: 2046 Goal. Credit: VANKOVA Kalina

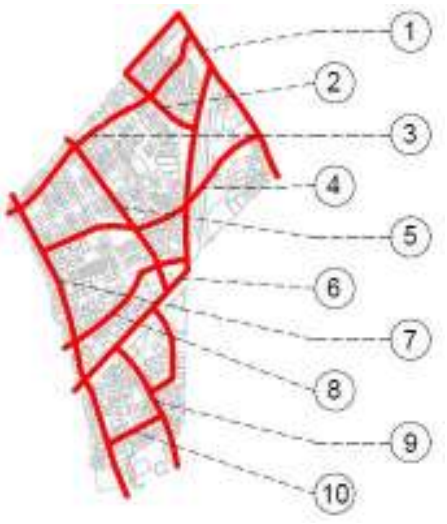
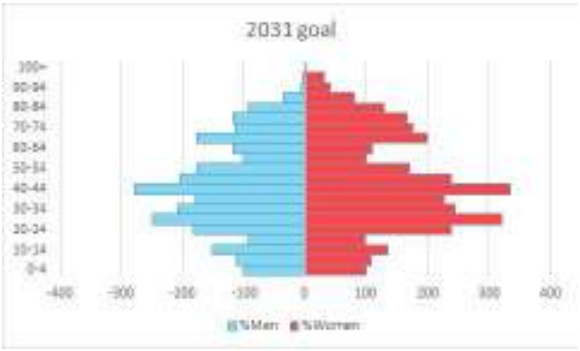


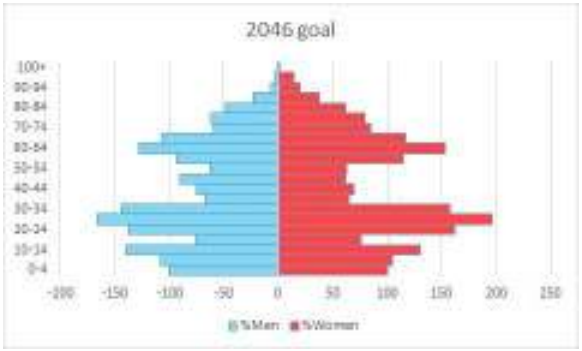
Figure 4.21: Main Axes. Credit: VANKOVA Kalina

By the 30th year since the beginning of the project all houses built before 1970 must be rebuilt or refurbished. Moreover, the first users of the new GF land use regulation and the limited rental system regulation would have changed 15 times thus creating a dynamic small-grain business environment. In three decades the multifunctional area in front of the train station must be an economically and socially thriving hub. The image of Hikifune as a pioneer in the resilient urban improvement would have reached the neighbor districts and taken roots in the urban dynamics there. The main tasks for this period are an active intervention along the axes with highest pedestrian and commercial activity (fig. 4.21), connection of already successful *plinth*-s and enhancing the engagement of the surrounding areas (fig. 4.20). Examples for main axes of action are the street between the train station and Fujinoki park, passing the renovated co-working space and the chopstick shop ending at the neighborhood border (axis *4*), the former commercial street along the last house row crossing Hikifunegawa street and reaching the two shrines in the South (axis *7*), the street starting at the present little evacuation zone next to the station and leading to Mito street, respectively to the bus station (axis *2*) or the axis starting from Hikifunegawa street, passing the renovated co-working spaces surrounded by pocket parks and a new multifunctional area eventually reaching Entsuji shrine (axis *9*). Additionally, with the renovation of the cultural center, the opening of the new Hikifune museum and the surrounding pocket parks and multifunctional areas, the intersection between the axes *6* and *8* will prolong the development of area *c* and turn into the spot sustaining the local identity of the neighborhood. All buildings in the mentioned areas must be retrofitted or rebuilt following the synergistic improvement policies. Another major step would be relocation of most industries in the southern part of the neighborhood along axis *10* but in the same time providing a large number of amenities and qualitative space as well as safe evacuation path to the main evacuation zone for the residents living south from Hikifunegawa street. Furthermore, all former parking lots and vacant spaces must be transformed into pocket parks with additional community functions and bicycle parking lots.

Resting on the suggested implementations of the synergistic improvement for *Goal 2046*, fig. A.3 gives a comprehensive presumption for the land use and demographics distribution along the axes *1 - 10*. If accomplished, the implementations will contribute to further strengthening of the base of the demographic pyramid however visible decrease of the population aged 35 - 55 due to the still low birth and emigration rates during the past 15 years (fig. 4.22).



(a) Goal 2031



(b) Goal 2046

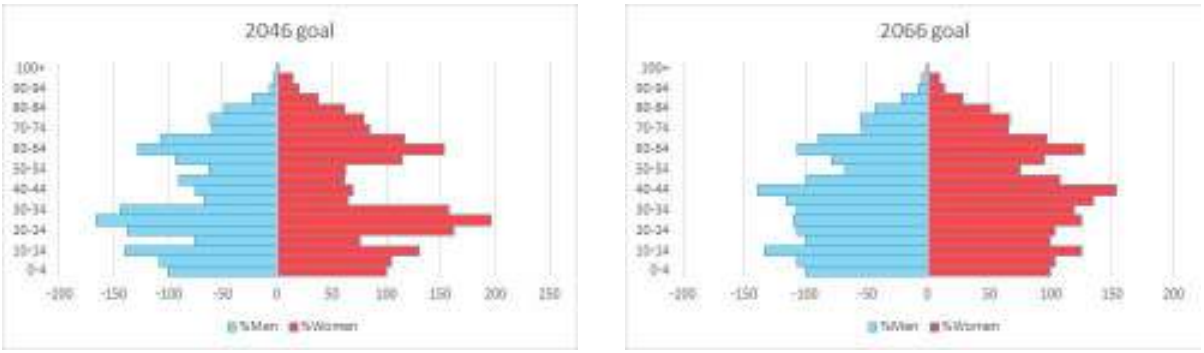
Figure 4.22: Population pyramid of Hikifune neighborhood. Credit: VANKOVA Kalina

4.3.3 2066 Goal

Figure 4.23: 2066 Goal. Credit: VANKOVA Kalina

With the completing of the 50-year period Hikifune must be a resilient unit independent in terms of natural hazards, demographics and, to a certain extent, economics. In addition, the notion of the synergistic improvement method would have extended and developed further in the surroundings establishing new social and commercial relations. Depending on the outcome of the first five decades, new school, hospital or other institutions might open doors giving new life to renovated large-scale buildings. In areas where the residential function is to be preserved, large-scale buildings would be torn down and replaced by timber dwellings in a small-scale pattern. Last but not least, Ensuji and Takagi shrines would be renovated according to the regulations for preserving the cultural heritage (fig. 4.23).

In terms of demographics, the pyramid in 2066 should have a stable base and middle part (fig. 4.24). Owing to the similar working commitment, the life expectancy of both genders would equalize and the pyramid will symmetrically decrease at the top.



(a) Goal 2046 (b) Goal 2066

Figure 4.24: Population pyramid of Hikifune neighborhood. Credit: VANKOVA Kalina

Even though connections in the contemporary global world are essential for the functioning of the entire system, a relative autonomy at local level will provide the neighborhood a chance to build a stable and healthy community within a resilient environment and to choose freely the directions for its development.

4.4 Concluding remarks

All proposed interventions are attempting to embrace the opportunity for designing systems resilient to the confronting Hikifune neighborhood issues. After building the main framework of the synergistic improvement, significant attention must be paid on the synchronized work. In this regard, one must ensure the according implementation of the established at district scale concept on site scale and parallel keep in mind the progress and its flexibility in time.

Chapter 5

CONCLUSION AND FUTURE DIRECTIONS

5.1 General conclusions

5.1.1 Analysis

The central problem addressed in this work was to outline a framework for synergistic improvement in urban areas confronted by a complex set of mutually reinforcing issues. The first step related to that goal was gaining a comprehensive understanding of the local cultural and historical background, discover the roots of the problems, and obtain deep knowledge about their interconnection. In the case of Hikifune, the analysis revealed that the neighborhood has a unique for Tokyo small-scale *patchwork*-like pattern of densely built-up timber dwellings and meandering narrow alleys, *roji*-s. All of those were preserved in both greatest destructions of the city in 1923 and 1945 and also survived the large scale redevelopment during the economy bubble in the 1980s. This unique vernacular, however, turned out to be also its weakness being the reason for the vulnerability of the area today both in terms of natural disasters and its demographic profile. The study confirmed that these issues are not isolated but have a major impact on local economics, on social and natural environment, and on opportunities for the district to advance as a resilient community.

5.1.2 Processing

Once the fundamental steps to discern the relevant issues were achieved, it became possible for the research to go forward with identifying the potentials of the neighborhood and introduce already successfully working economic models to the Japanese urban space. The central location and the small-scale pattern of Hikifune make the area absolutely walkable, providing a chance to bring into use concepts such as *sharing economy*, preserve the built environment and a new land use regulation. These changes in turn would open possibilities for new functions of all vacant or ineffectively used spaces and buildings, thus

developing a self-funding system in the long run and creating safe, livable, and healthy environments. Such prerequisites would not only attract young entrepreneurs looking for possibilities to start their own business but also couples, providing them with financial security, strengthening the family and social bonds and consequently increasing the birth rates. The synergistic improvement approach aims an impact not only within the borders of Hikifune neighborhood. Nevertheless, in order to achieve global relevance one must take into account the local untapped opportunities of the related area.

5.1.3 Implementation

The last step of the process consists of the according implementation of the discovered local potentials, of the new economic models translated in the context of the neighborhood and suggested execution and funding plan. A proposal at district scale in following directions would give a rough framework for action, which is to be elaborated at site scale:

- Earthquake resilience of buildings and open space through seismic retrofitting and creation of qualitative evacuation zones
- Fire-spread resilience of buildings and open space through fire-proof reinforcement and creation of qualitative evacuation zones
- Flood-resilience through the introduction of a new land use regulation providing an opportunity for easy evacuation of the ground floor and anti-flooding system through extensive vegetation
- Demographic diversification through creation of prerequisites for a safe and livable environment
- Concomitant improvements:

    Raising the overall awareness about the neighborhood confronting issues

    Providing flexible employment possibilities through ground floor activation

    Reducing the ecological footprint of the neighborhood

    Designing qualitative public space

    Refunctioning vacant buildings

    Strengthening the bonds between residents and vicinity by enhancing the sense of local identity

    Promotion of small-scale development

Work on both levels should happen simultaneously and in parallel with clear vision for the future. The *machizukuri* council in Hikifune would be the coordinator between all executive organs and facilitate the financial operating during the improvement process. Furthermore, it will be responsible for communicating the idea among the locals,

educating them on the present dangers and possible assets of the approach and eventually involving them in the process. The district scale proposal for Hikifune anticipates interventions in two main directions: *retrofitting or resilient rebuilding* and *creating an integrated and healthy community, decreasing the average age*. Actions in both directions will strive for achieving the ultimate goal of this thesis, *economic growth and stability of the neighborhood*. A comprehensive system for carrying out these actions would be developed at site scale - methods for seismic and fire-proof reinforcement or for rebuilding of the structures, renovation of the plaza in front of the train station, refunctioning of numerous parking lots into pocket parks, giving second life to vacant buildings, identifying missing amenities in the vicinity along with others. In contemplation of performing the synergisting improvement method at a steady pace, the coordinating institution must distribute the actions in time, set priorities and start planing for the next generation. Despite that, certain directions and terms would be given, growing organically and having the ability to change over time. The 50-years plan for Hikifune intends a subdivision of the program in three parts with a possibility for reevaluation and upgrading of the initial plan after the 15th, 30th and 50th years since the beginning of the project. The priorities for the neighborhood in the first fifteen years would be firstly, giving publicity to the idea, secondly, interventions in the most vulnerable zones, thirdly, creating the prerequisites for a fast economic growth in the interest of funding the project since its launch and fourthly, replacing the car-oriented mobility system with an environment-friendly one. Depending on the results of the first period, the plan for 2046 might vary but in its essence it incorporates connecting the already renovated zones through active interventions along the axes with highest pedestrian and commercial activities and enhancement of the modeling of a livable and enterprising community. By the year 2066 Hikifune would not only have reached autonomy regarding disaster resilience, demographics and, to a certain extend, economy so that it could shape freely its further development path but also would have extended the concept to the surrounding districts.

5.2 Main contribution of this work

5.2.1 Scope

Traditional urban planing approaches tend to concentrate on a single problem and seek according incremental solutions involving experts in the relevant area. The cities at present, however, are extremely complex systems facing various challenges simultaneously. Considering this, the above-mentioned conventional methods are not optimal. The proposed in this thesis synergistic improvement approach is pursuing multifunctional results by leaping across disciplinary boundaries and using global knowledge and ingenious ideas.

5.2.2 Flexibility

Another asset of the suggested method is its flexibility. Instead of setting rigid boundaries, fixed planing goals and clear terms, the system provides opportunities for the synergistic interventions to grow organically through the urban space, like all cities did initially, following the needs and wishes of its inhabitants. The proposed directions may take

turns over time depending on the results leaving potential for self-improvement. Having the freedom to chose the way their community advances, residents would more likely participate in the process and develop strong sense of belonging to the place.

5.2.3 New concepts

Finally, the introduction of already existing economic models such as *sharing economy*, GF activation, new land use regulations etc. to a new urban context is innovative for the relevant area and could serve as a suitable addition to the local potentials. With a careful translation to the according setting such concepts could contribute to the advancement of the neighborhood and its resilient development in a more ingenious way.

5.3 Consideration for future studies

5.3.1 Execution and elaboration

Due to its limitations, this thesis provides only an overall framework for implementation of the synergistic improvement method. Natural directions for future research include clarifying the execution process. The coordinator organ, which is the institution bringing the whole system together, must take into consideration which set of skills would the enterprise need in order to make the plan work. Undoubtedly, there will be a necessity of advisers in the spheres of marketing, networking, communication strategies, legal and environmental issues, economy, architecture etc. Such diverse spectrum of positions would create many employment opportunities for the locals. Still, if needed, the coordinator must look for external experts. Afterwards, the assembled team must elaborate on every step of the process eliminating possible setbacks or including new ideas.

5.3.2 Preservation of the vernacular

Cultures and communities in cities are being successively destroyed because of initiated new urban models without respect for the local urban pattern. Taking this into account, much research remains to be done on the way of applying the synergistic improvement method while preserving the local vernacular, on introducing new resilient systems and affordable housing without causing gentrification. Possible answers are hiding in the agreement of the locals with the changes and their participation in the process or in traditional Japanese urban architecture and practices.

5.3.3 Future implementations

Hikifune project is the first step for the synergistic improvement method towards the battle for resilient urban future and it aims to stir up larger decisions on a global level.

This work is leaving opened the questions how and where to implement this approach in the future and in what manner is it going to affect the global urban agenda.

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Appendix A

APPENDIX

<table>
<tr><th>City unit</th><th>№ of establishments | employees</th><th>Men | women</th><th>Total pop. | pop. in working age (aged between 15-64)</th><th>Construction industry</th><th>Manufacturing industry</th><th>Information and communication industry</th><th>Transportation industry</th></tr>
<tr><td>Higashimukōjima, 2 Chome (Hikifune)</td><td>439 | 2838</td><td>1708 | 1130</td><td>4435 | 3007</td><td>17 | 105</td><td>89 | 448</td><td>1 | 2</td><td>5 | 82</td></tr>
<tr><td>Oshiage, 2 Chome(Hikifune)</td><td>175 | 1586</td><td>1121 | 465</td><td>3769 | 2635</td><td>13 | 155</td><td>71 | 301</td><td>0 | 0</td><td>6|456</td></tr>
<tr><td>Kyōjima, 3 Chome (similar urban structure)</td><td>307 | 1410</td><td>700 | 710</td><td>n/a</td><td>19 | 60</td><td>87 | 230</td><td>0 | 0</td><td>41 | 131</td></tr>
<tr><td>Oshiage, 1 Chome (Skytree area)</td><td>295 | 2805</td><td>2089 | 716</td><td>n/a</td><td>37 | 65</td><td>41 | 226</td><td>5 | 47</td><td>14 | 1370</td></tr>
<tr><td>Sumida ward (total)</td><td>17940 | 169881</td><td>102125 | 61538</td><td>227202 | 155664</td><td>1075 | 8954</td><td>4856 | 55762</td><td>125 | 4814</td><td>392 | 7925</td></tr>
<tr><th>City unit</th><th>Wholesale and retail trade</th><th>Finance and insurance industry</th><th>Real estate business</th><th>Restaurants | Lodging industry</th><th>Medical care | welfare</th><th>Education | learning support</th><th>Complex service business</th></tr>
<tr><td>Higashimukōjima, 2 Chome (Hikifune)</td><td>100 | 680</td><td>4 | 62</td><td>24 | 64</td><td>86 | 372</td><td>24 | 198</td><td>14 | 97</td><td>1 | 267</td></tr>
<tr><td>Oshiage, 2 Chome(Hikifune)</td><td>31 | 260</td><td>1 | 8</td><td>5 | 00</td><td>37 | 67</td><td>7|112</td><td>4|12</td><td>0 | 0</td></tr>
<tr><td>Kyōjima, 3 Chome (similar urban structure)</td><td>131 | 403</td><td>8 | 35</td><td>9 | 26</td><td>38 | 92</td><td>18 | 120</td><td>4 | 27</td><td>2 | 9</td></tr>
<tr><td>Oshiage, 1 Chome (Skytree area)</td><td>81 | 390</td><td>4 | 52</td><td>26 | 48</td><td>53 | 204</td><td>10 | 141</td><td>3 | 6</td><td>1 | 2</td></tr>
<tr><td>Sumida ward (total)</td><td>5066 | 42002</td><td>162 | 3087</td><td>569 | 4591</td><td>2140 | 13238</td><td>752 | 10525</td><td>235 | 3960</td><td>55 | 848</td></tr>
<tr><th>City unit</th><th>Services | non-categorized</th><th>Public business</th><th>Agriculture, forestry, fisheries</th><th>Mining</th><th>Electricity, gas, heat, water supply</th><th>Subcontracted establishments</th><th></th></tr>
<tr><td>Higashimukōjima, 2 Chome (Hikifune)</td><td>75 | 384</td><td>2 | 77</td><td>0 | 0</td><td>0 | 0</td><td>0 | 0</td><td>2</td><td></td></tr>
<tr><td>Oshiage, 2 Chome(Hikifune)</td><td>23 | 81</td><td>1 | 4</td><td>0 | 0</td><td>0 | 0</td><td>0 | 0</td><td>0</td><td></td></tr>
<tr><td>Kyōjima, 3 Chome (similar urban structure)</td><td>44 | 145</td><td>0 | 0</td><td>0 | 0</td><td>0 | 0</td><td>0 | 0</td><td>0</td><td></td></tr>
<tr><td>Oshiage, 1 Chome (Skytree area)</td><td>30 | 241</td><td>0 | 0</td><td>1 | 3</td><td>0 | 0</td><td>0 | 0</td><td>1</td><td></td></tr>
<tr><td>Sumida ward (total)</td><td>2272 | 21943</td><td>28 | 3095</td><td>3 | 16</td><td>1 | 17</td><td>5 | 105</td><td>68</td><td></td></tr>
<tr><th>City unit</th><th>Establishments with 1 - 4 employees</th><th>Establishments with 5 - 9 employees</th><th>Establishments with 10 - 19 employees</th><th>Establishments with 20 - 29 employees</th><th>Establishments with more than 30 employees</th><th></th><th></th></tr>
<tr><td>Higashimukōjima, 2 Chome (Hikifune)</td><td>300 | 667</td><td>75 | 508</td><td>31 | 430</td><td>17 | 404</td><td>14 | 827</td><td></td><td></td></tr>
<tr><td>Oshiage, 2 Chome(Hikifune)</td><td>120 | 363</td><td>30 | 186</td><td>18 | 230</td><td>3 | 63</td><td>8 | 835</td><td></td><td></td></tr>
<tr><td>Kyōjima, 3 Chome (similar urban structure)</td><td>297 | 625</td><td>47 | 285</td><td>4 | 50</td><td>8 | 635</td><td>4 | 337</td><td></td><td></td></tr>
<tr><td>Oshiage, 1 Chome (Skytree area)</td><td>200 | 403</td><td>49 | 314</td><td>25 | 342</td><td>10 | 222</td><td>8 | 835</td><td></td><td></td></tr>
<tr><td>Sumida ward (total)</td><td>11213 | 25200</td><td>3480 | 22434</td><td>1746 | 23416</td><td>581 | 13668</td><td>852 | 78923</td><td></td><td></td></tr>
</table>

Figure A.1: Business situation statistics and occupation. Credit: VANKOVA Kalina. [42]

a

» rebuilt buildings	25 build. (1 house to compensate)
» renovated buildings	2 build. (1 vacant)
» high-rise cond. with an active GF along the periphery	5 cond. replacing 10 houses and 1 vacant lot
» street widening to 4m	85 m
» pocket parks	1
» new rentable GF spaces	28
» bicycle parking lots	3 (1 in cond.)
» car-sharing parking lots in a con.	1
» refunctioned vacant building	1
» other renovations	move Mutsumiinari Shrine due to the street widening

82 housing units, 292 new residents

» couple with 1 ch.	29 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	36 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	10 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	4 h.u. x 2 (20-34)y
	1 h.u. x 2 (50-65)y
» single	2 h.u. x 1 (20-34)y

b

» rebuilt buildings	2 build.
» renovated buildings	3 build. (1 vacant)
» pocket parks	1
» new rentable GF spaces	3
» bicycle parking lots	2
» refunctioned vacant buildings	1

4 housing units, 14 new residents

» couple with 1 ch.	2 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	2 h.u. x [2 (20-49)y + 2 (0-19)y]

c

» rebuilt buildings	34 build. (1 vacant)
» renovated buildings	11 build. (2 vacant; Hikif. Machizukuri headquarters; train station)
» street widening to 4m	136 m
» area revitalisation	980m^2 around the train station (evacuation zone, commercial center)
» pocket parks	1
» GF activated	12
» new rentable GF spaces	39
» bicycle parking lots	11 (1 house to compensate)
» car-sharing parking lot in a cond.	2
» refunctioned vacant buildings	2

36 housing units, 125 new residents

» couple with 1 ch.	11 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	16 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	4 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	3 h.u. x 2 (20-34)y
» single	2 h.u. x 1 (20-34)y

d

» rebuilt buildings	7 build.
» renovated buildings	1 build.
» street widening to 4m	56 m
» GF activated	1
» bicycle parking lots	1
» new rentable GF spaces	6

8 housing units, 29 new residents

» couple with 1 ch.	2 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	4 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	1 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	1 h.u. x 2 (20-34)y

e

» renovated buildings	1 (vacant)
» pocket parks	1
» bicycle parking lots	1
» refunctioned vacant buildings	1

f

» rebuilt buildings	1 build. (vacant)
» high-rise cond. with an active GF along the periphery	3 cond. replacing 7 houses
» pocket parks	1
» new rentable GF spaces	3
» bicycle parking lots	2
» car-sharing parking lot in a cond.	1
» refunctioned vacant buildings	1

30 housing units, 103 new residents

» couple with 1 ch.	10 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	13 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	3 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	2 h.u. x 2 (20-34)y
	1 h.u. x 2 (50-65)y
» single	1 h.u. x 1 (20-34)y

g

» rebuilt buildings	17 build. (1 vacant)
» renovated buildings	1 build. (co-working space)
» street widening to 4m	68 m (3 houses to compensate)
» pocket parks	1
» bicycle parking lots	4 (1 house to compensate)
» new rentable GF spaces	9 (besides co-working space)

18 housing units, 63 new residents

» couple with 1 ch.	6 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	8 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	2 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	1 h.u. x 2 (20-34)y
» single	1 h.u. x 1 (20-34)y

h

» rebuilt buildings	7 build.
» renovated buildings	2 build. (vacant)
» pocket parks	1
» bicycle parking lots	1
» new rentable GF spaces	7
» refunctioned vacant build.	1

9 housing units, 25 new residents

» couple with 1 ch.	2 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	5 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	1 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	1 h.u. x 2 (20-34)y

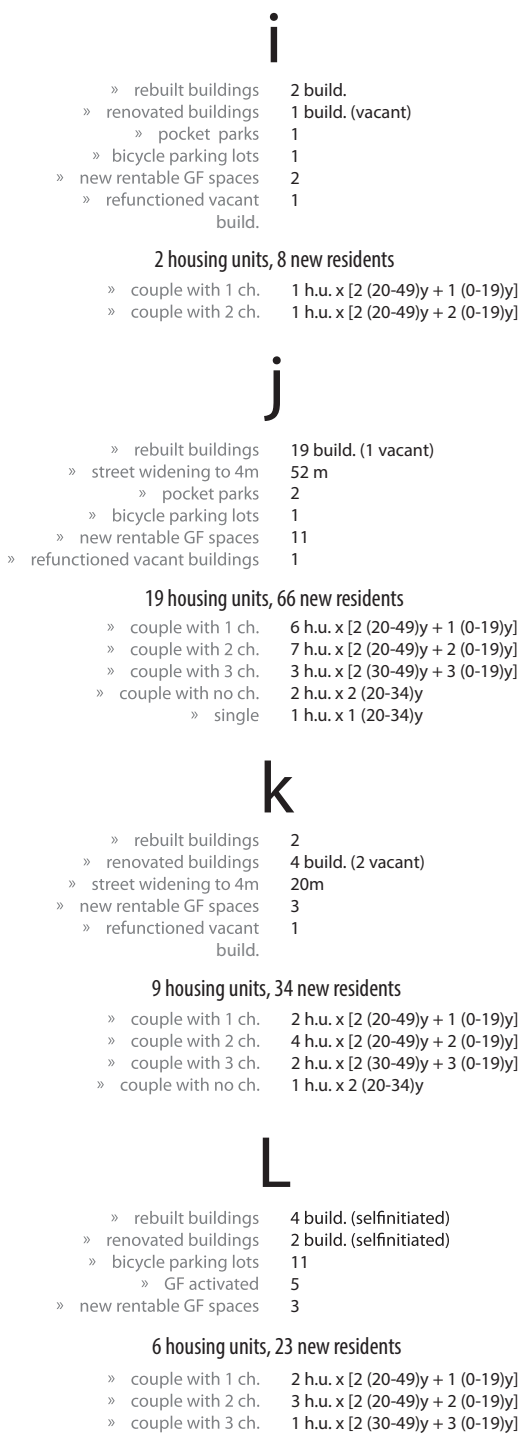

Figure A.2: Goal 2031: land use and demographic distribution in Hikifune. Credit: VANKOVA Kalina.

1

» rebuilt buildings	10 build. (1 new h.)
» renovated buildings	3 build.
» street widening	19 m
» pocket parks	3
» new rentable GF spaces	3 (continue subrenting to the current tenants)

13 housing units, 48 new residents

» couple with 1 ch.	4 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	6 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	2 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	1 h.u. x 2 (20-34)y

2

» rebuilt buildings	9 build. (3 new houses)
» renovated buildings	6 build.
» pocket parks	1
» new rentable GF spaces	11
» bicycle parking lots	1

15 housing units, 49 new residents

» couple with 1 ch.	4 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	5 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	2 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	2 h.u. x 2 (20-34)y
	1 h.u. x 2 (50-65)y
» single	1 h.u. x 1 (20-34)y

3

» rebuilt buildings	36 build. (4 new h.)
» renovated buildings	6 build.
» replacement of large-scale build.	12 houses replacing 4 large-scale build.
» high-rise build. with an active GF along the periphery	7 h-r. build. replacing 15 2-3 storey build.
» pocket parks	7
» new rentable GF spaces	50
» bicycle parking lots	1
» GF activated	8

138 housing units, 292 new residents

» couple with 1 ch.	47 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	52 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	25 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	9 h.u. x 2 (20-34)y
	2 h.u. x 2 (50-65)y
» single	3 h.u. x 1 (20-34)y

4

» rebuilt buildings	56 build. (6 new h. replacing parking lots)
» renovated buildings	13 build.
» street widening	56 m
» area revitalisation	train station - Fujinoki Park (commercial, entertainment, playground)
» pocket parks	5
» new rentable GF spaces	50

69 housing units, 179 new residents

» couple with 1 ch.	25 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	32 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	7 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	3 h.u. x 2 (20-34)y
	1 h.u. x 2 (50-65)y
» single	1 h.u. x 1 (20-34)y

5

» rebuilt buildings	25 build. (2 new h. replacing parking lot)
» renovated buildings	3 build.
» street widening	35 m
» pocket parks	1
» new rentable GF spaces	20
» bicycle parking lots	1

28 housing units, 101 new residents

» couple with 1 ch.	9 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	14 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	3 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	1 h.u. x 2 (20-34)y
» single	1 h.u. x 1 (20-34)y

6

» rebuilt buildings	4 build. (2 new h.)
» high-rise build. with an active GF along the periphery	5 h-r. build replacing 8 houses
» area revitalisation	continuing the ongoing development along the railways
» relocation of industrial buildings	3
» pocket parks	4
» new rentable GF spaces	15
» bicycle parking lots	1 (in a cond.)
» GF activated	11

79 housing units, 277 new residents

» couple with 1 ch.	30 h.u. x [2 (20-49)y + 1 (0-19)y]
» couple with 2 ch.	35 h.u. x [2 (20-49)y + 2 (0-19)y]
» couple with 3 ch.	7 h.u. x [2 (30-49)y + 3 (0-19)y]
» couple with no ch.	4 h.u. x 2 (20-34)y
	1 h.u. x 2 (50-65)y
» single	2 h.u. x 1 (20-34)y

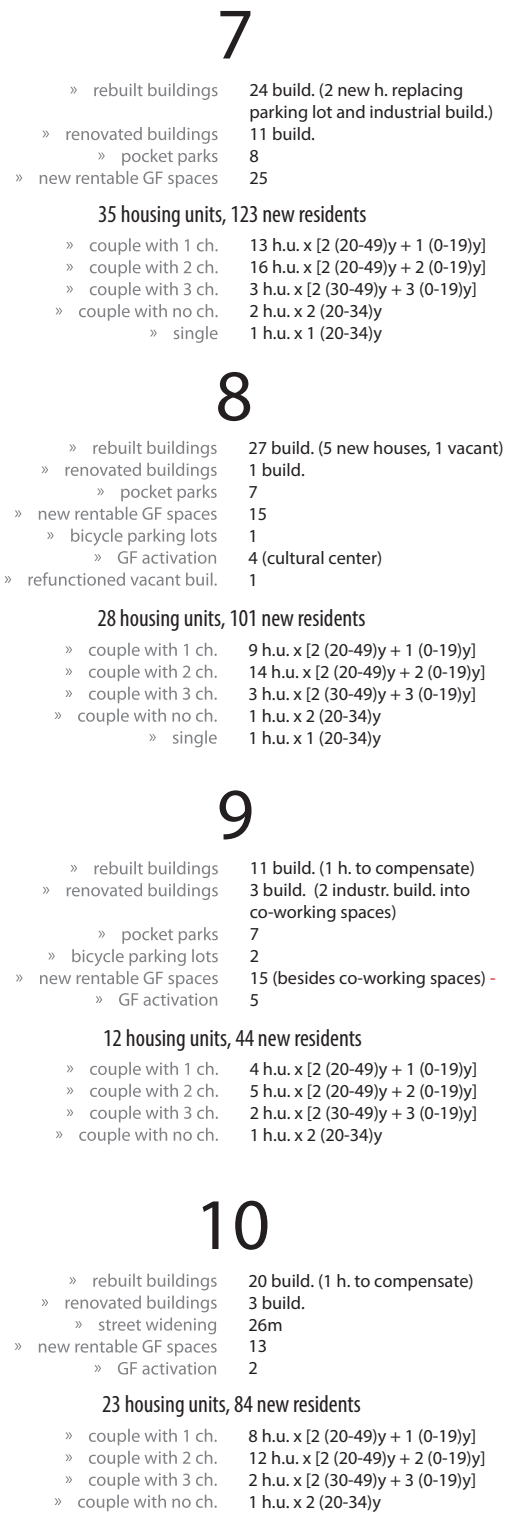

Figure A.3: Goal 2046: land use and demographic distribution in Hikifune. Credit: VANKOVA Kalina.

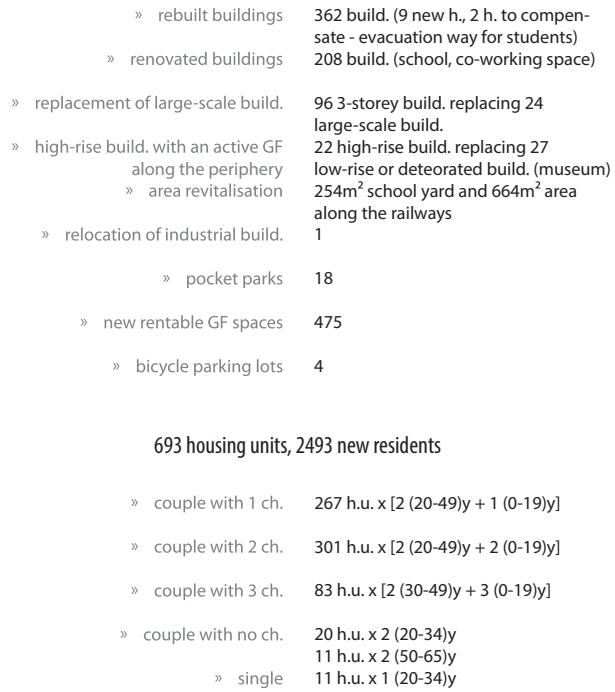

Figure A.4: Goal 2066: land use and demographic distribution in Hikifune. Credit: VANKOVA Kalina.