2004

Effective Planning for Seismic Risk: Case of Kobe, Japan

Mami Itamochi

Effective Planning for Seismic Risk: Case of Kobe, Japan

Thesis submitted to
The Graduate College of
Marshall University

In partial fulfillment of the
Requirements for the degree of
Master of Arts
Geography

By
Mami Itamochi

DR Sarah Brinegar: Committee Chairperson
MR Larry G. Jarrett
DR James Malcolm Leonard

Marshall University
April 30, 2004

ABSTRACT

Effective Planning for Seismic Risk: Case of Kobe, Japan
By Mami Itamochi

This thesis discusses the city of Kobe's recovery from the Great Hanshin Earthquake from the perspective of city planning. The earthquake and fire devastated many established parts of the city, impacting housing, businesses, and community institutions, resulting in a need for coordinated planning of of rebuilding.

The purpose of this research is to investigate effective planning techniques for seismic risk, using Kobe, Japan as a case study. My research examines a neighborhood where a new plan was developed after the earthquake. It also describes how Kobe is dealing with the massive loss of housing and town resources.

After this devastating earthquake, people in Kobe tried to have new urban districts which have wider roads, more open spaces, and fire proof buildings.

ACKNOLEDGEMENT

The following people were all extremely generous with their time and thoughts when I was working on this research. In particular, DR. Sarah Brinegar from Marshall University went far out of her way to help me.

Dr. Sarah Brinegar, Marshall University
Dr. James Leonard, Marshall University
Professor Larry Jarrett
Professor Masaya Kobayashi, Kobe University
Mr. Takashi Yamashita, Urban Planning Bureau, Hyogo Prefecture
Mr. Yosuke Ikenaga, City Planning Bureau, Kobe City

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter I

Introduction

On Tuesday, January 17, at 5:46 a.m. local time, the Hanshin Awaji Earthquake of magnitude 7.2 (Mj) struck the region of Kobe and Osaka in south-central Japan. This region is Japan's second-most populated and industrialized area, after Tokyo, with a total population of about 10 million. The magnitude 7.2 earthquake occurred a shallow depth on a fault running from Awaji Island through the City of Kobe, which in itself has a population of about 1.5 million. Strong ground shaking lasted for about 20 seconds and caused severe damage over a large area (Kobe Newspaper 01/23/1995, Japan 21st).

Nearly 5,500 deaths have been confirmed, with the number of injured people reaching about 35,000. Nearly 180,000 buildings were badly damaged or destroyed, and officials estimate that more than 300,000 people were homeless on the night of the earthquake. The life loss caused by the earthquake was the worst in Japan since the 1923 Great Kanto Earthquake, when about 140,000 people were killed, mostly by the post-earthquake conflagration. The economic loss from the 1995 earthquake may be the largest ever caused by a natural disaster in modern times. The direct damage caused by the shaking is estimated at over 13 trillion yen (about U.S.$147 billion) (Copper 1995). This does not include indirect economic effects from loss of life, business interruption, and loss of production (Copper 1995, Kobe Newspaper 03/04/1999, Japan 21st).

Damage was recorded over a 100-kilometer radius from the epicenter, including the cities of Kobe, Osaka, and Kyoto, but Kobe and its immediate region were the areas most severely affected. Damage was particularly severe in central Kobe, in an area roughly 5 kilometers by 20 kilometers parallel to the Port of Kobe. This coastal area is

composed primarily of soft alluvial soils and artificial fills. Severe damage extended well northeast and east of Kobe into the outskirts of Osaka and its port (Copper 1995, Hakeda).

Japan began to implement anti-earthquake measures in the wake of the Great Kanto Earthquake of 1923 (Fluchter 2002), but by about 1935 the important lessons from that disaster had began to be forgotten because of the war in Asia. Postwar reconstruction went forward without much thought being given to disaster prevention. The question today is whether government policy emphasized earthquake mitigation planning in the recovery from the Hanshin Awaji earthquake. The purpose of this research is to investigate effective planning techniques for seismic risk, using Kobe, Japan as a case study.

Chapter II

Review of Literature

Study Area: Kobe, Hyogo Prefecture, Japan

In 1868, a port was opened to international trade and the modern city of Kobe was created. It grew in size and importance as an international port and industrial center during the early twentieth century. By 1939 the population had reached one million. During World War II, Kobe sustained enormous damage, with large parts of the city devastated. The population fell to less than four hundred thousand. After the war, Kobe rebuilt quickly and grew steadily to its November 1994 population of slightly over 1.5 million (Icon Group International 1997, Tanaka 1997).

Osaka, Kyoto and Kobe form the Kansai Metropolis, Japan's second largest metropolitan area. Located on Osaka Bay, the urbanized portion of Kobe stretches about 30 kilometers along the waterfront with a width of about 2 to 4 kilometers, about 80% of the population live in this part of the city. In the Rokko Mountains surrounding the traditional urban development, and still within the city boundaries, Kobe has developed a number of new towns with high-density housing, industry, and universities. They are linked to the city center by train and subway. Most of the population growth of the last thirty years has been accommodated in these new towns, rather than in the traditional urban area, or in U.S. style sprawl. The contrasts between the city center and the new communities, between the bay area and the mountains, visible from the heart of the city give Kobe a distinct character(Icon Group International 1997, Tanaka 1997).

The port of Kobe, the largest in Japan, is a major factor in the city's culture and the region's economy. Like other large first world cities, Kobe has been experiencing decline in heavy industry and greater dependence on office, service sector, and retail

employment. Before the earthquake, almost a third of the city's approximately 770,000 jobs were in wholesale and retail trade, over 25% in services, and 10% in transportation and communications(Icon Group International 1997, Tanaka 1997).

Kobe's port-based history gives it an international flavor for a Japanese city. About 3% of the population are foreign-born or of foreign extraction, a high proportion for Japan. Tourism is one of Kobe's signature industries, Japanese tourists are attracted by the Victorian-style mansions built by European and American merchants in the Kitano District, modern retail districts on the waterfront with international restaurants and boutiques. In 1994, the year before the earthquake, Kobe had about 24.4 million visitors, a number 11% lower than 1993, which had been a very good year for tourism (Icon Group International 1997, Hakeda, Nakase 2000).

Kobe's central city neighborhoods are well-defined communities, usually grouped around a shopping street with strong traditional institutions. Some, particularly on the less prosperous and prestigious west side of Kobe, are experiencing a change in the age of the population as industries decline and the younger, more mobile population seek opportunities elsewhere. Still, many residents feel a strong identification with and loyalty to their neighborhood. East side neighborhoods are generally higher income, with many residents commuting into Osaka (Icon Group International 1997, Hakeda, Nakase 2000).

Before the earthquake, there were about 540,000 residential units in Kobe, most built since the war. Both old and new housing is dense by U.S. standards, citywide density is about 2,500-persons/square kilometer. Nagata Ward, on the city's west side, is the densest of Kobe's nine wards, with 11,000-persons/square kilometer in 1993. Some of these older residential neighborhoods still have before war land patterns, very small lots with wooden houses served by every narrow lanes which are sometimes

easements over a neighbor's property rather than part of the public road network. New high-density residential construction in the city center, as well as the new developments outside of the traditional center, is usually reinforced concrete or steel frame. However, in the early 1990s there were still over 250,000 wooden residences (Icon Group International 1997, www.city.kobe.jp).

Seismic Risk

An earthquake occurs when rocks break and slip along a fault in the earth. Energy is released during an earthquake in several forms, including as movement along the fault, as heat, and as seismic waves that radiate out from the "source" and causes the ground to shake, sometimes hundreds of kilometer's away (Copper 1995).

Earthquakes occur all over the world; however, most occur on active faults that define the major tectonic plates of the earth. Ninety percent of the world's earthquakes occur along these plate boundaries (that represent about 10% of the surface of the earth) (Icon National International 1997, Wisner 1998). Due to the heating and cooling of the rock below these plates, the resulting convection causes the adjacent overlying plates to move, and, under great stresses, deform. The rates of plate movements range from about 2 to 12 centimeters per year. Sometimes, tremendous energy can build up within a single, or between neighboring plates. If the accumulated stress exceeds the strength of the rocks making up these brittle zones, the rocks can break suddenly, releasing the stored energy as an earthquake (www.yomiuri.co.jp 05/05/1996, Icon National International 1997).

Most earthquake damage is caused by ground shaking. The magnitude or size of an earthquake, distance to the earthquake focus or source, type of faulting, depth, and

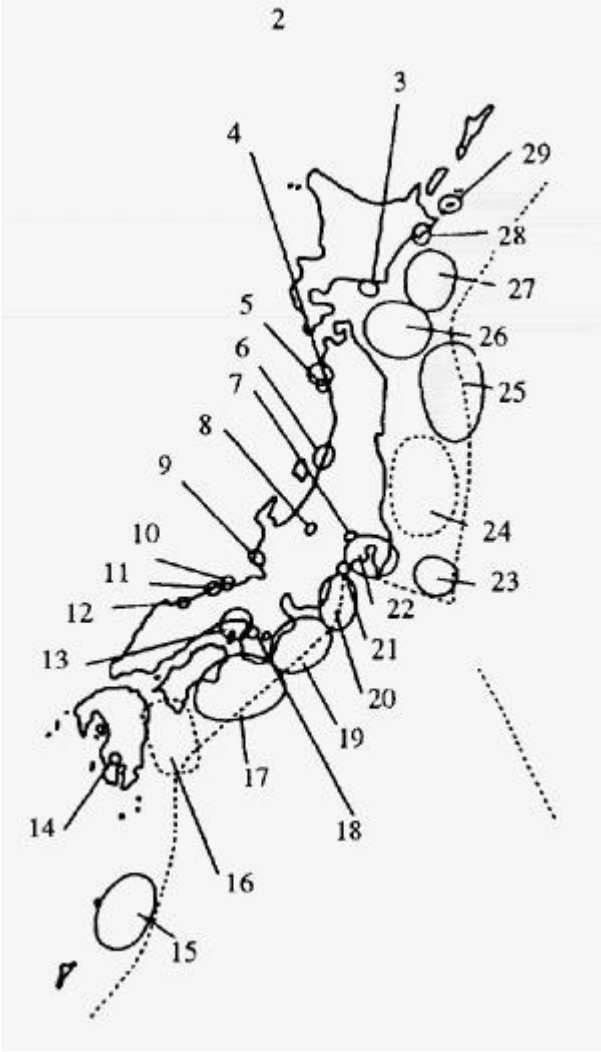
type of material are important factors in determining the amount of ground shaking that might be produced at a particular site. Where there is an extensive history of earthquake activity, these parameters can often be estimated. The magnitude of an earthquake, for instance, influences ground shaking in several ways. Large earthquakes usually produce ground motions with large amplitudes and long durations. Large earthquakes also produce strong shaking over much larger areas than do smaller earthquakes. In addition, the amplitude of ground motion decreases with increasing distance from the focus of an earthquake. The frequency content of the shaking also changes with distance. Close to the epicenter, both high (rapid) and low (slow)-frequency motions are present. Farther away, low-frequency motions are dominant, a natural consequence of wave attenuation in rock. The frequency of ground motion is an important factor in determining the severity of damage to structures and which structures are affected (Masuda 1997)

Japan, in general, is earthquake country, and the Kansai Region (Kobe, Osaka, Kyoto) has a long history of major earthquakes, although the largest event in the 20th century (before the Hanshin Awaji Earthquake) within the immediate vicinity of Kobe was magnitude 6.1 in 1916 (Figure 1). Southwestern Japan (Kansai Region) is located on the southeastern margin of the Eurasian Plate, where the Philippine Sea Plate is being thrust (subducted) beneath the Eurasian Plate in a northwest direction along the Nankai Trough (Figure 2). A portion of this relative plate motion is taken up by right-lateral strike-slip faulting along a major east-northeast-trending fault known as the Median Tectonic Line, located immediately south of Awaji Island and Osaka Bay. (Masuda 1997).

Kobe is located farther than many other cities in Japan from the dangerous intersection of three tectonic plates: the Eurasian, Philippine, and North American. This triple junction is a intersection of three compressive subduction zones. Kobe is also

somewhat off the Median Tectonic Line, a zone of strike-slip faults that follows the plate boundaries (Yomiuri news paper Jan 20, 1995).

Figure 1[*]: Map - Destructive Earthquakes Occurring in Japan in the 20th century[†]



3. Urakawa Earthquake (03/21/1982 M7.1)
4. Nihonkai-Chubu Earthquake (05/26/1983 M7.7)
5. Oga-Hanto Earthquake (05/01/1939)
6. Niigata Earthquake (06/16/1964 M7.5)

---

[*] Source: Kobe News Paper Sep 15 2001

[†] Earthquake 1 and 2 are located outside of this image

7. Nishi-Saitama Earthquake (09/14/1984 M6.9)

8. Nagano-ken Seibu Earthquake (09/14/1984 M6.8)

9. Fukui Earthquake (06/28/1948 M7.1)

10. Kita-Tango Earthquake (03/07/1927 M6.8)

11. Kita-Tajima Earthquake (05/23/1925 M6.8)

12. Tottori Earthquake (10/06/2000 M7.3)

13. Hanshin Awaji Earthquake (01/17/1995 M7.2)

14. Ebino Earthquake (02/21/1968)

15. Kikai-Shima Earthquake (09/15/1973 M6.8)

16. Hyuga-nada Earthquake (04/01/1968 M7.8)

17. Nankai-Mie Earthquake (12/07/1944 M7.9)

18. Yoshino Earthquake (07/18/1952 M6.8)

19. Tonankai Earthquake (06/04/1945 M8.0)

20. Mikawa Earthquake (01/13/1945 M7.1)

21. Kita-Izu Earthquake (11/26/1930 M7.0)

22. Kanto Earthquake (09/01/1923/M7.9)

23. Boso-Oki Earthquake (11/26/1953 M7.4)

24. Fukushima-Oki Earthquake (earthquakes (M7.0-7.5) occur frequently here) (1987)

25. Sanriku-Oki Earthquake (12/28/1994 M7.5)

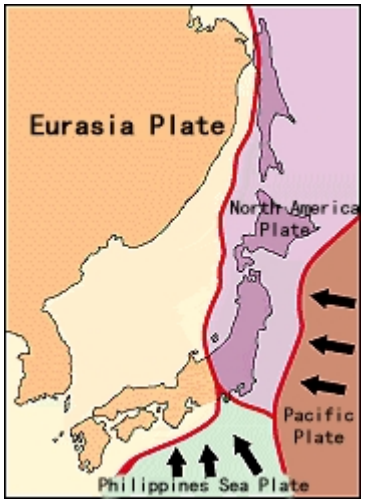
26. Tokachi-Oki (1968) Earthquake (05/16/1968)

27. Tokachi-Oki (1952) Earthquake (03/04/1952)

28. Kushiro-oki Earthquake (01/08/1993 M7.8)

29. Hokkaido Toho-Oki Earthquake (10/04/1994 M8.1)

Figure 2: Map-Around Japan[‡]



The main shock of the Hanshin Awaji Earthquake occurred along a northwest-trending branch of the Median Tectonic Line called the Arima-Takatsuki Tectonic Line. This region has seen somewhat lesser seismicity than in the Tokyo area and some other parts of Japan, but has had magnitude 7 or greater events in historical times (e.g., in 1596). In 1916, a magnitude 6.1 earthquake occurred at almost the same epicentral location as the 1995 event. (Kunami 1999, www.yomiuri.co.jp 3/11/1995, Zhang 1999)

In the Kobe area, crust material is composed of cretaceous granites overlain by a relatively thick sedimentary deposits called the Osaka group, which consists of alluvium interbedded with marine clays (Pavlenko 2002). Relatively thin terrace deposits and recent alluvium overlie the Osaka group. Fill material has been placed along much of the waterfront and comprises the human-made islands, such as Port and Rokko islands (Menomi 2001, www.yomiuri.co.jp 2/15/1996). The earthquake caused extensive ground

[‡] Source: www.yomiuri.co.jp(05/14/1996)

failures, which affected buildings, underground infrastructure, the port, highways, all types of other facilities on soft or filled ground (Kunami 1999, Icon group International 1997).

Urban Planning Japan

Since the Meiji Restoration in 1868, Japan has transformed from a feudal agrarian society into one that is focused on the city. The rapid building of cities occurred in a context that values cities and the investment that they represent. Since World War II, impressive economic growth has accompanied large-scale urbanization without the large scale abandonment of the inner city that has occurred in some American urban areas (Evans 2002, Fluchther 2003, Palm 1998).

The Japanese Government's role in the development and building of cities has often emphasized the creation of up to date infrastructure that reinforces the role of the city center. Transportation defines the shape of the urban area, with higher density areas usually closely linked to railroads and subways. Some planners, activists, and citizens criticize this approach today, decrying the lack of attention to design and social factors in Japanese city planning (Evans 2002, Flechther 2003, Todokoro 1996).

Throughout history there have been many occasions when Japanese cities had to rebuild quickly after disasters, such as fires, earthquakes, floods, and wars. Preparing for, and recovering from, disasters have been an explicit topic in city planning. Indeed some of the common programs and tools in Japanese planning have evolved in response to the country's experience with rebuilding cities after disasters. This repeated experience of rebuilding has also reinforced a cultural belief that land, not buildings, represents the primary value of real estate. Japanese planning and development practices reflect this strong tie to land rather than buildings (Flechther 2003, Todokoro

1996).

The central government continues to play a major role in determining urban policies and programs. Since the national Comprehensive Development Law of 1950, the central government has created National Comprehensive Plans to guide development at the national level and to set national land use policies. Local governments prepare master plans, working within national guidelines of the Ministry of Home Affairs. These plans cover a broader range of issues than the typical U.S. plans, including social services and economic development as well as physical planning, and are updated on a ten-year-cycle. Kobe City was in the final stages of preparing a new master plan when the earthquake struck (Flechther 2003, Todokoro 1996).

The Urban Planning Act of 1968, administered by the Ministry of Construction, is the framework for land use planning and zoning in urban areas. The prefecture government defines the urban planning zones within which the Act applies. Cities with a population of over one million, including Kobe, have special status and are able to operate more independently of the prefecture. The urban planning zones are divided into Urban Promotion Areas and Urbanization Control Areas. Development within Urbanization Control Areas is discouraged within the time period of the plan.

In the Urbanization Promotion Area public facilities, infrastructure, roads, and parks are planned for development. Generalized zones are designated, using twelve zoning classifications that regulate use, height, floor area ratio, and other features. Specific areas where the local government intends to carry out defined planning projects to change or intensify development are identified, as are areas where neighborhood planning will take place.

Other national legislation that determines how city planning is carried out is the

Building Standards Act. In addition to regulation construction, it sets standards that in the U.S. might be part of planning or zoning codes, such as setbacks based on the street width. These building and lot regulations are primarily directed at mitigating fire hazards (Evans 1999, Flechther 2003, Palm 1998, Todokoro 1996).

Kobe's 1986 Master Plan, the last completed before the 1995 earthquake, designated 36% of the city as urbanization promotion area and 64% as urbanization control area. It contained a series of very general land use policy goals, and more specific consideration of the transportation network and recommended improvements. It reflected the philosophy that much of the city's population and economic growth should occur at identified areas away from the traditional city center and should be linked by public transportation. Within the existing urbanized area, the Plan shows an ongoing history of land readjustment and urban redevelopment projects to "improve not only public facilities and roads, but also living and business environments" (www.city.kobe.jp). One of the goals identified in the Plan was to implement "preventive measures against disaster" (Fluchter 2003, www.city.kobe.jp, web.pref.hyogo.jp) .

Kobe City's pre-earthquake planning and economic development efforts focused on the service sector and capitalized on Kobe's international ties and image. Economic development efforts included fostering the tourist and fashion industries, and encouraging information-based activities such as multimedia and health research as strategies to ease the transition from an industrial economy to one strong in the service sectors and more likely to provide economic growth in the future. Local government had been seeking the establishment of the World Health Organization headquarters in Kobe and planning for new airport on Port Island. Many of these initiatives were promoted after the earthquake as recovery tools (Fluchter 2003, www.city.kobe.jp, web.pref.hyogo.jp).

The land use conditions articulated in the 1986 Kobe Master Plan explain some of the patterns of damage during the 1995 earthquake. The new development during the rapid growth of the past three decades, was built to higher engineering standards and escaped the level of devastation experienced by some older neighborhoods. The worst hit parts of the city in 1995 earthquake had a very different development history. Some sections had escaped destruction in World War II, had avoided or resisted the city's advancement of land readjustment over the years, and had not experienced much new privately financed construction (Fluchter 2003, Hiyarama 2000, www.city.kobe.jp, web.pref.hyogo.jp).

Japanese planning faces some challenges that are not so common in the U.S. One is the small scale of traditional Japanese neighborhoods. A desire to maintain ownership have resulted in remarkably small land holdings, in complex layouts, with access sometimes off of alleys across another's land. Yards and setbacks are difficult or impossible to provide and access by car or emergency vehicle can be limited. Another challenge is the complexity of landownership. Land and the buildings that occupy it can have different owners. Tenants often hold substantial rights to their spaces. When tenants with rights occupy buildings, there can be several parties with a stake in the property, complicating the decision making process and making changes difficult (Flechther 2003, Todokoro 1996).

Japanese use of infrastructure as a way of shaping the form of cities within the urbanization control areas probably does so more than any other form of city planning, construction, or regulation. But within the cities, land use planning tools, largely controlled locally, can shape districts and influence the appearance and function of neighborhoods (Evans 1999, Flechther 2003, Todokoro 1996).

Many of these methods, from large-scale urban redevelopment to the very local joint building projects, involve ceding, joining, trading, or acquiring various kinds of property rights. Calculating and negotiating the land, property rights, and money contributions of the various participants is complex and sometimes difficult. Explaining, brokering, and working out these negotiations is a large part of the responsibility of the planners working on these projects. After the earthquake, this was one of Japan's biggest challenges (Flechther 2003, Todokoro 1996).

Land readjustment is a planning method of changing property boundaries to allow community improvements, such as wider streets and more open place. Since the nineteenth century, land readjustment has helped to expedite the conversion of agricultural land to urban use. It was used during reconstruction after the Great Kanto Earthquake of 1923, and during rebuilding following World War II. During 1960s, it was used to create new towns. More recently land readjustment has been used as a way to revitalize and reshape city neighborhoods that do not meet current standards of public service and amenity, where roads are inadequate and small lot sizes and inadequate street access make building in compliance with regulations difficult or impossible. It can provide opportunities to create higher density housing and to provide necessary infrastructure and public services.

Government agencies, individuals, or cooperatives can initiate land readjustment projects (Flechther 2003, Todokoro 1996, www.city.kobe.jp). The central government encourages land readjustment for planning and recovery by subsidizing the roads and infrastructure that result (Evans 2002, Flechther 2003, Todokoro 1996, www.city.kobe.jp).

Land readjustment involves the pooling of private land and redesigning the

spatial pattern of land use with adequate space allowed for roads, infrastructure, and open space. Because some of the pooled land is now devoted to public uses, the new lots are smaller than the old ones, by consistent percentage. But because the property has gained better access, services, and amenities, their value has increased by a similar amount.

Many of the older portions of Kobe have been through the land readjustment process. Projects totaling over 5,000 ha were identified in the 1989 version of Master Plan. The primary goal of these projects was to reduce fire risks by rebuilding crowded wooden buildings, widening roads, and providing open space. Planning consultants supplied by the city were usually very involved, serving as designers, technical advisors, and community organizers. They eased communication between the city and the residents, who were sometimes distrustful (Menoni 2001). In some cases, the readjustment process was lengthy, taking as many as fifteen years to complete. There were many discussions between the city and the residents regarding the various plans that were developed (www.city.kobe.jp, http://web.pref.hyogo.jp).

Government subsidies are available to assist in the preparation and implementation of land readjustment projects. Since World War II, 30% of the land in Japanese central cities has been subject to land readjustment. There is considerable controversy among land use professionals and academics about the strengths and weaknesses of the land readjustment process. Especially in areas with small lots, property owners sometimes view it as confiscatory, and focus on the percentage of land they will lose. Nonetheless, it remains an available and common way for cities to plan and build public infrastructure, and to influence landownership patterns (Flechther 2003, Hirayama 2000, Tokorodo 1996).

Larger scale planning occurs where more substantial land use changes, density increases, and infrastructure improvements are sought, often around urban train stations. Public agencies or private development organizations can acquire property, or property owner's interest can be converted from land to building space in the new development. The usual goal of urban redevelopment is to increase land use density and take advantage of investments in infrastructure. It can be carried out by a private or public corporation, and involves substantial involvement of the property owners. Typically, the owners of the land can convert their property rights into ownership of a portion of the new building, for example a condominium unit in a new residential building (Flechther 2003, Todokoro 1996).

District planning allows neighborhoods to create neighborhood specific regulations such as land use, setback, lot coverage, and floor area ratio. Regulations can be stricter or less restrictive than the existing zoning, for example imposing height or design limits while permitting greater lot coverage in an area where small lots are a problem, or precluding specific uses that are seen as local problems. District planning also allows discussion of building and landscape design, not usually major issues in land readjustment (Flechther 2003, Hirayama 2000, Tokotodo 1996).

Other tools are available to owners, and advocated by planners, to provide flexibility when building on substandard lots, even when there is no area wide planning effort. Kyoudouka, a condominium like process, allows owners to pool their lots into single building site. Each then owns part of the building, in proportion to his or her land contribution. To encourage this cooperation, the government subsidizes construction of common areas with multi-unit buildings. Another approach allows owners to build a single building on their adjacent lots, while maintaining ownership of their land and the part of

the building that occupies it. Either of these methods of cooperative design and construction can help the owners share costs, simplify construction, develop substandard lots, and improve access and appearance (Hirayama 2000).

Like many large cities in Japan and elsewhere, housing in Kobe was tight prior to the 1995 earthquake, with low vacancy rates and high prices. While maintaining a strong cultural bias towards private homeownership, the Japanese government, as well as other institutions, had responded to fill gaps in the housing market. National, prefecture and local governments, and quasi-government corporations, constructed, owned, and operated a large amount of housing. Rent, while below that available in the private housing market, did not seem to be considered a subsidy for the very poor, or a safety net for the destitute. Public and semi public agencies, including the city, the prefecture, and national Housing and Urban Development agency, operated about 73,000 units in Kobe before the earthquake. Private companies, which often provide housing to attract and keep employees, operated about 22,000 Kobe units. Because of their experience and importance in providing housing, government housing agencies have considerable expertise, experience, and resources to undertake large scale housing construction (Lekkas 2002, www.city.kobe.jp, web.pref.hyogo.jp).

Attitudes toward landownership and homeownership also differ between Japan and the U.S. For many in Japan, land is viewed less as a commodity than in the U.S. and more as representing one's family heritage. It is often held for long periods of time, rather than being bought and sold as the market and the owner's needs change. While an American family with a house that does not meet its current needs will often sell it and buy another, a Japanese family will demolish and rebuild in the same location. As a result, people are not always willing or able to move freely, especially those without financial

resources (Fluchter 2003, Palm 1998).

The City of Kobe has reputation for entrepreneurial city planning. Its independent approach is both praised and criticized in Kobe and elsewhere in Japan. This independence had strained the relationship between the local and central governments. The most dramatic city development projects are the creation of two large manmade islands, Port Island and Rokko Island, off Kobe's central waterfront. These islands, at 830 ha and 580 ha, contain port facilities on their perimeters, commercial, convention, and industrial facilities, and residences and supporting services intended to house fifty thousand residents. They are connected to downtown Kobe with monorails (Menoni 2001).

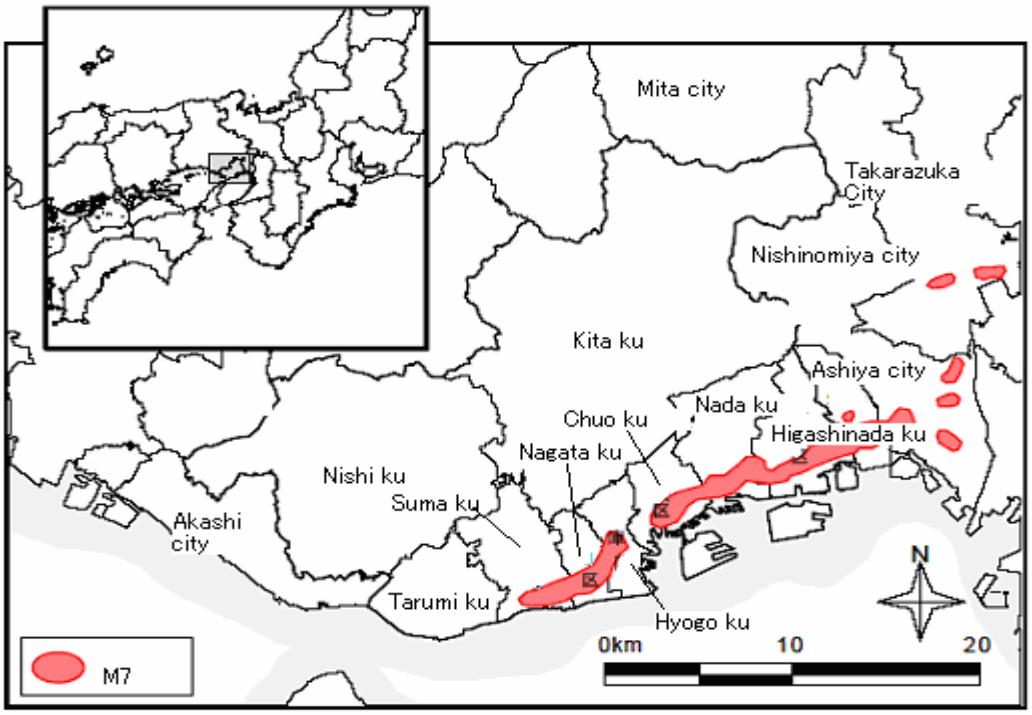
The islands were created using cleared material from the hills inland from the city, where new town development occurred. The islands (also new town sites) are linked to the city center with subways and have a planned population of 185,000 (Lekkas 2002). This entrepreneurial approach and development of new towns has resulted in substantial income to the city, especially during the years when Japanese land prices were increasing Menori 2001).

Hanshin Awaji Earthquake

At 5:46 am on January 17, 1995, the Great Hanshin-Awaji Earthquake, the first major quake to directly hit a Japanese urban area, inflicted unprecedented heavy damage in the Hanshin-Awaji region, i.e on the cities of Kobe, Awaji, Ashiya and Nishinomiya and their surrounding areas (Figure 3, Table 1). The powerful jolt, which lasted barely 20 seconds, took 4,569 lives in Kobe City alone, practically reducing the elegant harbor city developed through many centuries of hard work, to mere piles of debris and depriving many people of the very basis of their livelihood. The death toll of

the earthquake totaled about 6300 and about 35,000 people were injured. Fifty eight percent of those who died were 60 years old or older. Many people died from being crushed by collapsed houses, seventy three percent died from suffocation or being crushed. (Icon Group International 1997, www.city.kobe.jp)

Figure 3: Areas of Kobe Wards Experiencing Magnitude 7 Shaking[§]



[§] Source: www.city.kobe.co.jp

Table 1: Earthquake Victims by Kobe City Wards[**]

		Higashi Nada	Nada	Chuo	Hyogo	Nagata	Suma	Tarumi	Nishi	Kita	Total
Dead		1,471	933	244	555	919	401	25	11	12	4,571
Evacuees (Peak)	**-Shelters**	120	74	90	96	79	69	41	16	29	599
	-Overnight	60,700	35,000	35,172	26,300	35,347	21,067	6,926	1,777	2,348	222,127
	-Daytime	65,859	40,394	39,090	26,300	55,641	21,728	4,747	1,787	2,360	236,899

Great Hanshin-Awaji Earthquake took thousands of lives including later earthquake-attributed deaths due to sickness, difficult living conditions, etc. after the earthquake. Many roads, including highways, were damaged and traffic disrupted. The Hanshin Expressway Kobe Route 43 and Route 23 were restricted during this expressway reconstruction period. Since both roads are major trunk roads linking Osaka and Kobe, car traffic between Osaka and Kobe remained congested until their reconstruction (Chang 2003, Hirayama 1999).

The number of buildings destroyed by the earthquake exceeded 100,000 across the Kansai region. An additional 80,000 buildings were badly damaged. The large numbers of damaged traditional-style Japanese residences and small, traditional commercial buildings of three stories or less accounted for a great deal of the destruction. In sections in the central Kobe, where these buildings were concentrated, entire blocks of collapsed buildings were common. Several thousand buildings were also destroyed by

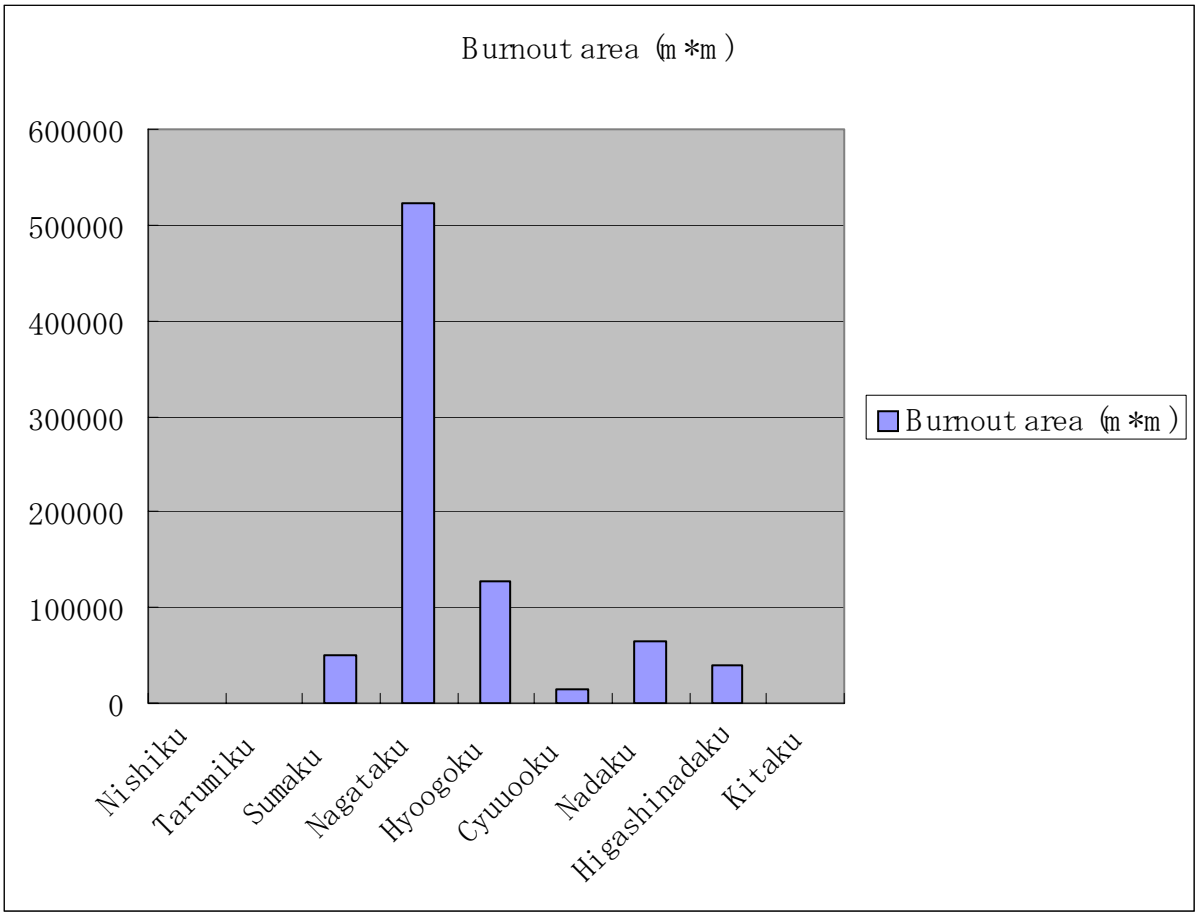
[**] Revised figures as of January 11,2000, Source: www.city.kobe.jp

the fires following the earthquake (Chang 2003, Hirayama 1999, Lekkas 2000, Palm 1998).

Many Japanese municipalities, and particularly Tokyo, have long considered earthquake-generated fires to be very high risks, and various risk management programs have been started in Japan. Kobe, for example, had specially constructed underground cisterns for fighting fires if parts or all of the distribution water lines failed. However, whatever measures had been taken in Kobe were overwhelmed following the Hanshin Awaji Earthquake (Lekkas 2000).

The Kobe Fire Department (KFD) had minimal staffing on duty at the time of the earthquake, possibly because the previous day had been a holiday. Initial actions included recalling off-duty personnel and responding to fire calls. Approximately 100 fires broke out within minutes, primarily in the densely built-up, low-rise areas of the central city, which comprise mixed residential-commercial occupancies, predominantly of wood construction. Within 1 to 2 hours, several large conflagrations had developed. There were a total of 142 fires reported in Kobe on January 17, the majority being in the wards of Higashi Nada (24), Nada (24), Hyogo (37), Nagata (19), and Suma (18). The fire response was hampered by extreme traffic congestion, and collapsed houses, buildings, and rubble in the streets (Figure 4). Because of numerous building and road collapses, many areas were inaccessible to vehicles (Lekkas 2000).

Figure 4. Burnout Area by Kobe Ward[††]



Damage to structures due to shaking affected tens of thousands of commercial and residential buildings in the Kobe area. Mid-rise commercial buildings, generally 6 to 12 stories high, make up a substantial portion of the buildings in the Kobe business district. The highest concentration of damaged mid-rise buildings was observed in the Sannomiya area of Kobe's central business district (Nagata Ward). In this area, most of the commercial buildings had some structural damage, and a large number of buildings collapsed on virtually every block. Failures of major commercial and residential buildings

[††] Souce: www.city.kobe.jp

were noted as far away as Ashiya, Nishinomiya, and Takarazuka districts. Newer structures performed quite well and withstood the earthquake with little or no damage (Lekkas 2000, Palm 1998, Yamada 1999).

In the heavily damaged central sections of downtown Kobe, approximately 60% of the buildings had significant structural damage, and about 20% completely or partially collapsed. One survey of a 120,000-square-meter area in downtown Kobe (the Sannomiya area) found that 21 out of 116 buildings, or 18%, were visibly destroyed. Another report indicated that 22% of office buildings in a portion of the Kobe city center were unusable, while an additional 66% may need more than six months for complete restoration. City inspectors declared approximately 50% of the multifamily dwellings in Kobe as unsafe to enter or unfit for habitation, leaving more than 300,000 people homeless (Figure 5) (Lekkas 2000, Palm 1998).

Age of construction, soil and foundation condition, proximity to the fault, and type of construction were major determining factors in the performance of structures. Damage was worst in the areas bordering the port or streams and rivers where soils were either poorly consolidated alluvial deposits or fill. Loose and soft soils amplify ground motions in comparison to bedrock, especially ground motions within a certain frequency range. The duration of shaking also tends to be longer on such soils. Consequently, damage tended to be relatively minor in the foothills of Rokko Mountain, where either soils are very shallow or there are rock outcroppings rock (Lekkas 2000, Palm 1998, Pavlenko 2002).

Figure 5: Loss of Housing Units[‡‡]

	Units lost		Remaining Units		Total	
	#	%	#	%	#	%
Kobe City	79283	15.1	445450	84.9	524733	100
Severely Damaged Urban Wards	74234	23.7	238851	76.3	313085	100
Higashi-nada	16174	24.9	48845	75.1	65019	100
Nada	10050	23.2	33280	76.8	43330	100
Chuo	5964	13.5	38271	86.5	44235	100
Hyogo	7984	20.9	30237	79.1	38221	100
Nagata	23301	39.2	36186	60.8	59487	100
Suma	10761	17.1	52032	82.9	62793	100
Suburban Wards	5049	2.4	206599	97.6	211648	100
Tarumi	3094	3.6	81847	96.4	84941	100
Kita	922	1.5	61002	98.5	61924	100
Nishi	1033	1.6	63750	98.4	64783	100
Housing Type						
Single family houses	27738	27.0	75006	73.0	102744	100
Wooden terraced houses	17475	55.6	13969	44.4	31444	100
Wooden multi-family houses	11223	44.6	13948	55.4	25171	100
Houses with commercial and other area	10298	30.7	23254	69.3	33552	100
Non-wooden multi family houses	5873	5.3	105256	94.7	111129	100
Other houses	1627	18.0	7418	82.0	9045	100
Year of Construction						
Before1945	20196	58.3	14426	41.7	34622	100
1946-1955	9176	48.7	9652	51.3	18823	100
1956-1965	20416	48.7	21511	51.3	41927	100
1966-1975	15665	22.9	52715	77.1	68380	100
1976-1985	4520	6.1	69570	93.9	74090	100
1986-	4261	5.7	70977	94.3	75238	100

[‡‡] Source: www.city.kobe.jp

Damage to infrastructure was severe, in addition to the highways already mentioned, railways, power, water, and communications were disrupted for months after the earthquake. Twenty-eight railway lines (a total 389 kilometers) in the region, including three main railways linking Kobe and Osaka, were disrupted severely and restored gradually over a period of 218 days (Chang 2002, Hakeda, Koshiyama 2003, Lekkas 2000, Palm 1998).

Power failure affected over two million households; city gas services were stopped for approximately 850,000 households. Water services were disrupted at over one million households. And over 280,000 telephone lines were disconnected. These utilities were also restored gradually. Electricity was restored in about a week, telephone lines in a couple of weeks, city gas services by April 11, and water services by April 17th, 1995 (Lekkas 2000, Hirayama 2000, Palm 1998).

Chapter III

Methodology

Research Design

The purpose of this research is to investigate the application of effective planning techniques in response to seismic risk, using Kobe, Japan as a case study. The research is motivated by concern over earthquake damage and loss of life. The application of mitigation measures may prevent some of the devastating effects of future earthquakes and improve planning overall.

A qualitative approach is taken for this investigation, because by using a qualitative approach, one can focus on actual phenomena (i.e. human response to an earthquake) occurring in natural settings. Through this study, the nature of the earthquake, its setting, processes, effects on people and city structure can be revealed. And, the effectiveness of city planning in the recovery period can be evaluated.

A case study is chosen as the research method. By using this method, the recovery from the Hanshin Awaji Earthquake is studied in depth. It is hoped that detailing the cultural context could promote understanding or inform upon similar situations of disaster recovery in Japan and other developed countries.

Qualitative data is collected from a variety of sources: interviews, the internet, and library materials. Books, journals, magazines, and newspapers in Japanese and English provide important information on the Hanshin Awaji Earthquake and its aftermath. For example, 1995-2004 editions of the Yomiuri Shinbun (major national newspaper) and Kobe Shinbun (local newspaper) provided valuable information.

Additional information was obtained from interviews conducted with public officials including Mr. Yosuke Ikenaga (Kobe City Planning Bureau), Mr. Takashi

Yamashita (Urban Planning Bureau, Hyogo Prefecture), and Professor Masaya Kobayashi (Kobe University). The interviews required travel to Japan, however, additional information was obtained through communication by e-mail, and phone calls from Huntington to Japan.

The following questions were posed in semi-structured interviews:

1. What city planning was implemented for preventing earthquake damage both before and after the Hanshin Awaji Earthquake?
    a. Mitigation measures
    b. Emergency infrastructure
    c. Building regulations
    d. Population density
2. What have you learned from this disaster?

The Interviewees

Mr. Ikenaga, Mr. Yamashita

The two officials were interviewed together on December 24, 2003 in Kobe City Hall. Mr. Ikenaga has been working for Kobe City Bureau since 1986. Mr. Yamashita has been working for Hyogo Prefecture since 1981. Because of their close working association and friendship, their interview occurred together.

They discussed a lot of emergency issues and responses revealed in the results section. Right now, they are involved in the program design of improved disaster preparation management for Kobe City. There are seven items for concern: 1) strengthening information gathering, processing and distribution capabilities, 2) strengthening rescue and emergency medical systems, 3) strengthening fire fighting capability, 4) establishing a system for supplying food and emergency supplies, 5)

procurement of sufficient supply of drinking water, 6) maintenance of emergency toilet facilities, and, 7) creation of a secure living environment. Possible means to achieve their goals include creating a comprehensive disaster preventive communications network, installation of large capacity water pipes, the construction of anti-seismic water storage tanks, and the establishment of emergency hotlines to help local people in the event of another disaster. The current plans discussed by Mr. Ikenaga and Mr. Yamashita are still in the planning stage almost 10 years after the Hanshin Awaji Earthquake.

Professor Kobayashi

Professor Kobayashi was interviewed on December 26, 2003 at his office in Kobe University. He is a professor of Kobe University, teaching urban planning.

He provided much information about temporary housing created after the Hanshin Awaji Earthquake. A lot of temporary housing was built for people who lost their houses, located in parks or school yards. Detailed information on the temporary housing are written later in the results section.

Chapter IV

Results

Kobe City Recovery Plan

Many of the planning processes, skills and information available to the people of Kobe after the earthquake existed before the earthquake. It was necessary to use the tools at hand. The problems that were post-disaster problems merged into the pre-disaster problems creating a blur of regular planning and post-disaster planning processes. Post-earthquake city planning in Kobe is another stage in the city's physical development that is growing out of what went before, influenced by economic, political, social, and physical development trends and ideas in Kobe and throughout Japan (Berke 1992, www.city.kobe.jp).

Post-earthquake planning occurred in a general framework established by a committee including officials of the central government, the prefecture governor, and the mayors. These guidelines set a tone for later efforts. Amid general statements about the need to rebuild homes and economies was a recognition that older people were disproportionately affected and that ongoing economic trends needed to be considered in the recovery. The guidelines make explicit the special responsibility felt by the central government for the repair of the transportation infrastructure. They also call out the importance of incorporating disaster resistance into rebuilding and recovery. The central government committed to the funding and necessary legislation to facilitate Kobe's recovery from the earthquake. Nonetheless, differences emerged about the line between rebuilding and improving public facilities. Some felt that the government, with its national responsibilities, sometimes favored the needs of other areas over funding recovery projects in the Kansai Region. In Japan, the national government sometimes

argues that its funding responsibilities end with repair and replacement, not extending to improvement. Local agencies incorporate ongoing local goals into the recovery plans (Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp www.yomiuri.co.jp).

At the time of the earthquake, the City of Kobe had nearly completed the ten-year update of its Master Plan. Afterwards, its energy was, of course, diverted to the preparation of the Recovery Plan, which built on the earlier draft Master Plan. The Master Plan was updated to reflect the developments included in the Recovery Plan and completed in October 1995 (Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp www.yomiuri.co.jp)

Post-earthquake plans produced by Kobe City incorporated disaster mitigation and preparedness concepts in very general terms. In addition to a new emphasis on housing, many of the pre-earthquake economic development ideas were carried over from pre-quake plans. Tourism, fashion, high technology, and international trade were still seen as the promising future efforts. Symbolic projects were proposed, e.g. high-profile projects that would lead the recovery. They include a health science center featuring the World Health Organization (WHO) headquarters, Kobe International Multimedia and Entertainment City, SATY, and an enterprise zone.

Some elements of the plan are controversial. A proposed airport on Port Island has long been controversial locally, but it was incorporated into the Recovery Plan and construction will begin soon. The airport and the enterprise zone were not accepted by the central government as fundable recovery efforts (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp, http://web.pref.hyogo.jp www.yomiuri.co.jp).

Public assistance, largely in the form of consultant services, was available to fund neighborhood plans in any neighborhood that requested it. National money was made

available by the central government for infrastructure repair and other public improvements. As before the earthquake, planning consultants provided technical assistance and design advice, advocated cooperative planning and rebuilding, and served as liaison between residents and city government. Their work was especially critical after the earthquake when city resources were stretched thin. Private planners, architects, and others formed a system to coordinate and support neighborhood planning efforts, and to raise money for neighborhood projects (Ikenaga 2003, Kobayashi 2003 www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

Within six weeks of the earthquake, thirteen areas were identified where reexamination of land use patterns would occur, including the application of urban redevelopment and land readjustment. These city planning area designations were made in consultation with the central government. New plans would include changes in the street network, upgraded infrastructure, changes in density, and new ownership patterns. In addition to the degree of damage, these designations reflected the city's ideas about the future form of Kobe (Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

The earthquake illustrated that the Kobe housing situation had two distinct sides. Those with resources were able, to various degrees, to reconstruct their homes or find suitable housing. But another large segment of the population could not function in the housing market, many of which resided in public housing prior to the earthquake. Without the cheap housing that was destroyed, they could not be housed. Housing provided by the private market did not supply the needs of those outside of the market (Kobayashi, 2003, Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

Not surprisingly, considering the very mixed nature of the Japanese housing

system (private versus public), there were conflicting attitudes about the responsibility for post-earthquake housing. There is no large-scale central government program for subsidizing the rebuilding of privately owned housing. Some say that providing housing assistance to private homeowners is not the responsibility of government or the taxpayers. At the same time, because the central government is a large provider of housing in Japan, its responsibility for providing for those left out of the housing market after the earthquake was assumed (Kobayashi 2003, Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp). The central government supported the local and prefecture governments in providing housing in the recovery period through funding and advising.

The prefecture government took the lead in coordinating public efforts to provide public housing. It's August 1995, Three Year Housing Reconstructing Plan set a goal of 125,00 new units, 80,500 units to be built by public or semi-public agencies including the Japan Housing and Urban Development Corporation. These agencies had long been actively involved in providing high-density urban housing, but their involvement was increased in the prefecture plan (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

The city's new public housing received a larger central government subsidy of eighty percent rather than usual sixty percent. Rent was reduced for those with very low income. A consolidated application process was created for different public housing providers and some private owners. In several projects, public agencies contributed to the rebuilding of multi-unit buildings in exchange for the ownership of units, which could then be administered as public housing (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

Perhaps as a result of the experience with temporary housing, the plan explicitly recognizes the nature and the special needs of the new residents of public housing, many of whom were elderly earthquake victims. It also explores the idea of communal-style housing for the elderly, with supportive services (Hakeda).

To encourage private landowners to rebuild apartment buildings, Kobe City created subsidy programs including five-year loans at low interest rates. The rent of low-income victims of the earthquake were to be subsidized for twenty years (depending on the status of the victim). Short-term rent subsides were available for low-income people in private rental housing (Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

Rebuilding was complicated; cooperation was necessary and economic times were slow. But private housing reconstruction occurred rapidly after the earthquake. There were 138,000 housing starts in the prefecture in 1996. And by January 1998, 78,000 units had been completed, considerably higher than the 44,500 planned in the Prefecture's Housing Plan. Coupled with a population loss of about 10,000 in the two years after the earthquake, this resulted in an oversupply of market-rate housing. The occupancy rate in rental housing reportedly went from ninety-nine percent in early 1995 to sixty one percent at the end of 1996, while rents decreased. Condominium prices, which had reached a peak in the early 1990s at the height of the bubble economy, continued to fall after the earthquake (Ikenaga 2003, www.city.kobe.jp, http://web.pref.hyogo.jp, www.yomiuri.co.jp).

Temporary Housing

The experience in Kobe required simultaneous planning in the short, medium, and long-term, while maintaining a vision of the future. In the earthquake aftermath,

both planners and residents learned that temporary is a relative term. The pre-disaster idea that a temporary structure can remain for only two years was quickly discarded. Public agencies have had to continually adjust to changing circumstances and reexamine ideas of permanence (Hiyayama 2000).

Some disaster issues had planning implications that were not foreseen. One of the most immediate post-earthquake problems was debris and trash from damaged and destroyed buildings. Enormous quantities of debris hindered daily life and the immediate cleanup. Shortly after the earthquake, the city agreed to pay for debris removal to encourage swift rebuilding and to improve morale. Planners now believe that the availability of free debris removal may have encouraged the owners of repairable buildings to demolish rather than to rebuild. The short-term need to remove debris, and the way the project was carried out, had unintended long-term consequences (Hirayama 2000, Kobayashi 2003).

Other problems with recovery efforts emerged, including those associated with temporary housing. National disaster relief law assigns responsibility for providing temporary housing to the prefectures, with some funding and oversight from the central government. Hyogo Prefecture had planned to have local governments take over this responsibility. However, given the unexpected magnitude of the need, a temporary housing program was created as it was implemented by the prefecture (Hirayama 2000, Kobayashi 2003).

In the seven months following the earthquake, 48,300 prefabricated temporary housing units were installed at 634 sites throughout the region by the prefecture government, largely financed by the central government and managed by city governments. About 30,000 units were located in Kobe City. The average cost was

2,867,000 yen, or roughly $28,700. Peak occupancy was about 47,000 units in November 1995 with peak population at about 90,000 (Hirayama 2000, Kobayashi 2003, 6/3/1996 www.kobe-np.co.jp)

Most units were on public land in parks and schoolyards. The largest concentrations of units were away from the central city (and the areas of greatest damage) on Port and Rokko Islands and on land to the west and north that was being prepared for new development (Hirayama 2000, Kobayashi 2003).

Temporary housing (but not utilities) was free to the residents. Before the earthquake, the Building Standard Law specified that temporary meant up to two years. The law was revised to allow these units to be used longer when it became clear that sufficient replacement housing could not be completed sooner (Hirayama 2000, Kobayashi 2003).

Based on a survey conducted by the Prefecture in October 1995, a disproportionate number of the people using temporary housing were elderly, with an average age of over fifty. Almost half were single-person households, and almost half of the heads of household were over sixty-five. A November 1995 survey of residents showed that fifty-five percent of temporary housing residents were amongst the poorest of all families by income. A March 1996 survey of residents found that seventy percent had low incomes (Hirayama 2000, Kobayashi 2003).

The number of units and the speed with which they were build was impressive. However, those living in the temporary units had some specific, well-publicized, grievances. Units were small and inelegant, but the biggest problems experienced by residents were related to poverty, social conditions, and their relationship to the rest of the city. Because of the remoteness of some of the locations, and lack of transit

accessibility, it was difficult for those with jobs to commute, aggravating the economic impacts of the earthquake. Shops and community services were unavailable. The most often heard problem was that a valued sense of community was lost. Important social networks, which had sometimes even survived in the emergency shelters, were disrupted (Hirayama 2000, Kobayashi 2003).

The city assigned units using a lottery system. Preference was given to the elderly and disabled, resulting in large concentrations of elderly. Some felt that the process of assigning units, which had been intended to assure shelter for those in the most need, had the opposite effect by breaking up cohesive communities and leaving the elderly and disabled stranded without the neighbors and institutions on which they depended. The newspapers carried stories of people who committed suicide or otherwise died of despair in the far-flung temporary housing compounds. Many thought that entire neighborhoods should have been assigned together to temporary housing sites (Hirayama 2000, Kobayashi 2003).

Because of the dissatisfaction with the official temporary housing, unofficial camps sprung up in city parks and other open spaces. Some camps were tight-knit ethnic communities whose members were unwilling to leave a familiar neighborhood. Housing activist groups acted as their advocates (Hirayama 2000, Kobayashi 2003).

As problems in temporary housing emerged, there were efforts to make the temporary housing better in order to meet people's needs. Community rooms and public open spaces were created. Planners, residents and other community volunteers organized residents to rebuild relationships and improve the quality of life in the temporary housing complexes. Social services were also provided. Special temporary housing communities were designed for the elderly with on-site support services and

more communal space in Ashiya, to the east of Kobe (Hirayama 2000, Kobayashi 2003).

One year after the earthquake, 46,000 units were still occupied. The numbers declined by over 1,000 a month until the summer of 1996. After that the decline was slower. As of January 1997, two years after the earthquake, 37,000 households still lived in temporary housing. As of February 1998, 50 percent of the units were vacant (Hirayama 2000, Kobayashi 2003, 6/3/1996 www.kobe-np.co.jp). Today all the temporary housing units have been vacated and removed.

District Planning

Not surprisingly, after the earthquake there were a number of issues that surfaced in the rebuilding of heavily damaged areas of the inner city and areas in the periphery. Some of these issues surrounded the future of developments that had been planned prior to the earthquake, such as the Happy Active Town discussed below. Other issues arose in the rebuilding of existing neighborhoods or buildings (land readjustment projects), such as that which occurred in Takatori District also discussed below (Ikenaga, Yamashita 2003).

After the earthquake, Hyogo Prefecture and Kobe City came together and implemented a land readjustment policy in nine areas of the inner city where the earthquake damages were most severe, i.e. damage on more than 80% of their houses or buildings (Figure 6). Most of the land subject to land readjustment is located in Nagata ward, Higashinada ward, and Nada ward. Hyogo Prefecture and Kobe City sent consultants and advisers to community leaders and also sent money to build the new districts. Figure 7 illustrates one of the new districts built after the earthquake in Nagata ward (Mr. Ikenaga 2003, www.city.kobe.jp).

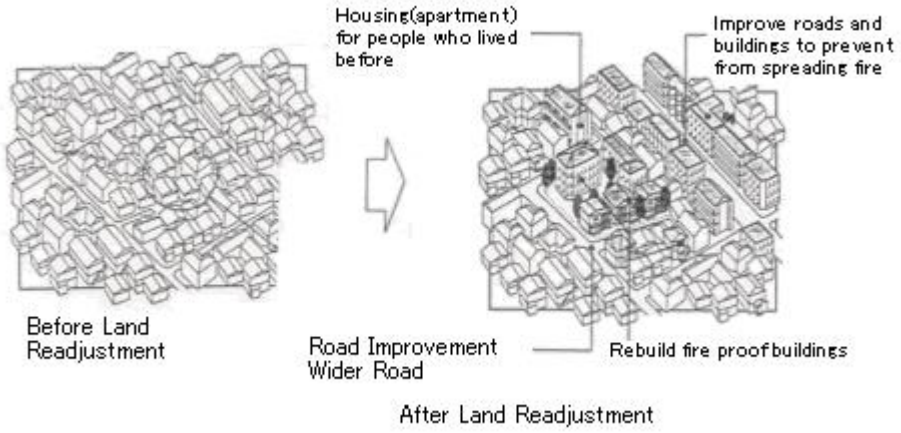
The land readjustment process causes dramatic change to the targeted areas

from heavily damaged traditional areas characterized by high density, wooden structures with limited vehicular access, to restructured and modern urban landscapes designed to mitigate the effects of earthquake disasters. For example, the district illustrated in Figure 7 is about 8.5 ha large, and 97% of this area was destroyed by the earthquake. Through the readjustment process, they have new fixed roads, wider than before the earthquake and able to provide street parking. More importantly, the roads are wide enough to mitigate the spread of fires and easier for emergency vehicle to get to their destination. A number of amenities are included in the new districts, e.g. there are four parks (open spaces) in this area and pedestrian roads. Smaller traditional buildings were replaced by multi-unit structures capable of accommodating high density settlement. Five public housing structures were built for the people who lost their houses because of the Hanshin Awaji Earthquake.

Takatori District

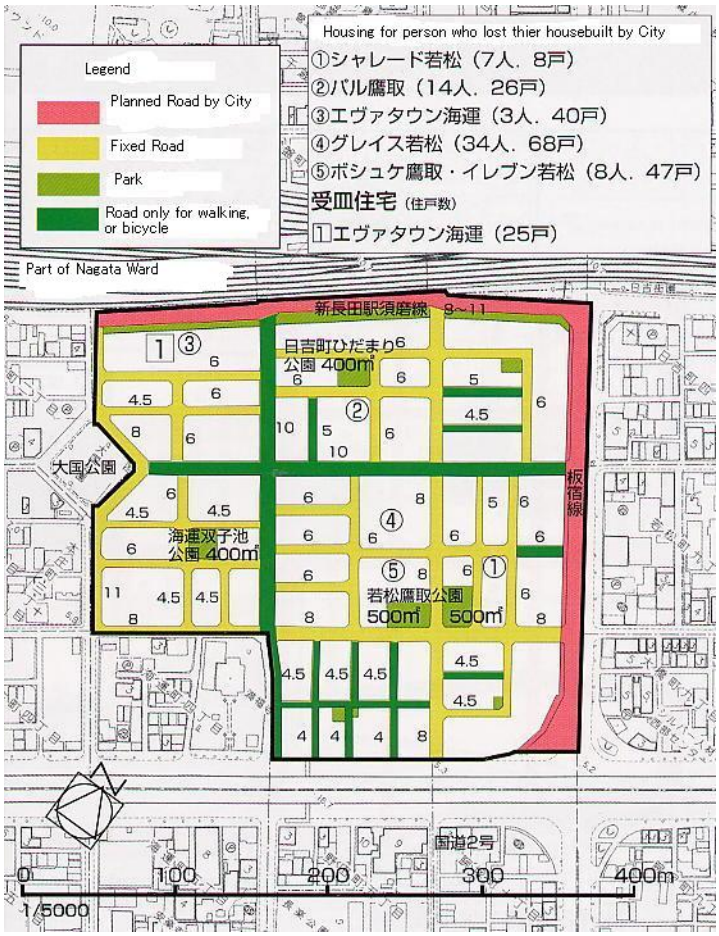
One area subject to land readustment was Takatori District. The area is located in Nagata Ward on the west side of Kobe, it experienced destruction from fire as well as shaking. The district was particularly vulnerable because of the age, density, and structural condition of the buildings, some of which had escaped the destruction of World War II and the subsequent rebuilding. One thousand homes, the neighborhood commercial street, a church, and other institutions were destroyed. Because of the extent of the damage, and a desire to rebuild in ways that would reduce future vulnerability, land readjustment was used in Takatori. Consultants with neighborhood ties led the neighborhood planning groups in drawing new property boundaries resulting in bigger lots and wider streets.

Figure 6: Land Readjustment Process



www.city.kobe.jp

Figure 7[§§]: Land Readjustment in Nagata Ward



Source: www.city.kobe.jp

During the construction period, temporary structures housed businesses and the

[§§] The number which are showed near the road are road width

Catholic Church, which served as a center for ongoing relief activities (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp).

In addition to the property configuration, the consultants engaged in a lot-by-lot examination of the district to identify opportunities for joint building and other improvements. In one case, a group of fourteen landowners pooled their land and the Japan Housing Corporation (JHC) contributed construction funding. The resulting twenty-two unit condominium provided housing for all the landowners and eight units for the JHC (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp).

The neighborhood people and institutions made enormous efforts to maintain normal life during the planning process, a task make more difficult since many residents were living in temporary housing far from their homes. With the support of the church, an artist in the congregation decorated surviving and temporary buildings with cheery cartoon graphics that reflected the institutions and personalities of the district. The community group organized a park improvement project, flower plantings, parties, and festivals. These events provided links to the displaced residents of the neighborhood (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp).

Some parts of the district found it easier to agree on a final plan and subareas were created. By the summer of 1996, approximately one third of the land readjustment plans had been approved by landowners and the city. The city installed infrastructure and owners were free to rebuild on their newly configured lots. The rest were completed in September 1997 (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp).

Happy Active Town: New Eastern City Center

Before the earthquake, plans for new development on the land occupied by Kobe Steel and Kawasaki Steel were underway. Since 1990, Kobe City and the steel

companies had been developing plans to replace the outmoded steel factories with a mixed-use commercial development, The New Eastern City Center, also called HAT (Happy Active Town). The proposed plans usesd land readjustment to reconfigure the land for development, creating lots and setting aside land for roads and open space. The two-phase project was to include about 3,000 market-rate residential units, commercial space, and a research center anchored by a proposed World Health Organization facilities (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp).

After the earthquake these plans were refocused. While still a mixed-use development, post-earthquake plans called for more housing to be built sooner. The project now includes the WHO Kobe Center completed in 1998 and designed by Kenzo Tange (the decision to come to Kobe was made after the earthquake), as well as cultural and educational facilities and 10,000 residential units. The first phase involved the 1) construction of 7,000 housing units, about 4,000 of which were subsidized by various agencies for people with low incomes, and, 2) creation of waterfront open space capable of serving as a disaster transportation base. Temporary housing residents had priority for this housing. The second phase, replacing a Sumitomo Rubber factory, contains 3,000 residential units (Ikenaga 2003, Yamashita 2003, www.city.kobe.jp).

The rapid building of housing at HAT was made easier because the land was in the process of being vacated, there were few owners, and there were no residents to displace. It was also possible because Japanese government agencies and semi- public agencies, like the Japanese Housing Corporation, have long been actively involved in building high-density housing and have the skills to build a lot of housing. No residents of Eastern City Center were displaced by the earthquake (Ikenaga 2003)

Chapter V

Conclusion

Before the 1995 earthquake, experts and government officials understood, to varying degrees, that seismic hazards needed to be mitigated in Kobe City. Many public and private programs resulted in hazard reduction, especially fire hazard, either through the replacement of older buildings and rearrangement of building patterns, or in fewer cases, by retrofitting buildings. New building and construction standards resulted in generally successful new buildings.

However, the places where hazardous conditions remained were the areas where people with the fewest resources lived and worked, where government recovery programs are least effective, and where pre-disaster community planning efforts were weakest. They included areas where the cultural traditions were strong, the population was aging, and change was not always welcome. Before 1995, the financial and social costs of hazard reduction measures in some of these neighborhoods would have been substantial. After the earthquake, recovery was difficult and costly in social as well as economic terms.

In first world societies, engineers, geologists, geographers, and architects have provided the technical ability to reduce earthquake hazards. Their financial and social systems, which place great value on the enormous investments that they have made in their physical cities, present more difficult hurdles for mitigation. Those with the fewest options for reducing risks often face the greatest risks. While they know how to engineer a safer environment, they have not developed the approaches to risk reduction that address these financial and social issues.

Over time the line between post-disaster planning and the regular planning

process fades, and the post-disaster issues merge with pre-disaster issues. An example of this is the master planning process. Kobe City was in the process of preparing a master plan when the earthquake hit. Its goals and projects were reexamined before the master plan was released after the earthquake. However, many of the problems that had been identified still remained: an aging population, obsolete industrial plants, and a need to encourage emerging economic sectors. The city government continued to value many of the goals and projects that had been planned before the earthquake.

Rebuilding emerged from pre-disaster conditions, plans, attitudes, and ideas. The civic decision-making process remained in place, with adjustments. Where there were few decision-makers involved, for example in HAT or the rebuilding of the transportation infrastructure, recovery proceeded quickly. However, when the planning process was a complex one, with many players with different interests, it often took a long time to arrive at a solution. The land readjustment process can be long and contentious. While some short cuts were made in the process, both the short cuts and the usual complexity of land readjustment were resented at times.

In areas where plans for change were already underway, for example HAT, plans could be reexamined in light of new needs and slanted more towards housing. Another example, as mentioned earlier, was the proposed new Kobe airport, a controversial project that many viewed as an expensive and unnecessary pet project of city government. It remained in the Recovery Plan as a way to promote economic recovery. People who think a course of action is wise before a disaster probably favor it after a disaster, those who thought it foolish before the disaster are even more convinced by the new competing needs. For both HAT and Kobe airport, the disaster was one step in a long planning process.

In places where residents have a strong attachment to the way things were and resistance to changes that might have resulted even before a disaster, there are those who will still want to rebuild in the old patterns and will oppose change, even if it might reduce hazards. If a long-term vision can be articulated before a disaster, it might help reduce conflicts and resentments like those that emerged during post-earthquake planning in Kobe. Of course, the survival of ideas from before the earthquake resulted in some blaming the city for using the earthquake as an excuse to push pre-earthquake plans.

The lesson to city planners and government is that planning must be an ongoing process. Having an active planning process that is publicly accepted and in place before disaster will set the stage for effective post-disaster planning. Cities should maintain a comprehensive plan with long-term goals that transcend disasters, and mid-term projects that can be adjusted if conditions radically change.

After a disaster, cities do not have time to develop new planning techniques for recovery. The basic planning infrastructure at hand, including processes, information, and ideas, will form the basis of post-disaster planning. A primary tool of Japanese city planning is land readjustment. This process worked well for Kobe City in the New Eastern City center, where there were few landowners with large holdings. It was more troublesome in neighborhoods with many small landowners, where the decision making process was long, the residents and owners dispersed, and the concept of contributing land for community purposes not always accepted by property owners with very small lots. Because there was no alternative process available for rebuilding shattered neighborhoods in ways that met private and collective needs, the process has been lengthy. Some have argued to keep their old building patterns, which may continue to

present hazards in the future.

A disaster is a blow to an entire community. It is important to recognize the symbols of the community, respect the memory of the disaster, and celebrate the efforts of recovery. It is also important to share information about the community and its experience, both with the local citizens and with people from outside of the area.

Bibliography

Books and Articles

Berke, P. R., Beatley, T.,“A national Assessment of Local Earthquake Mitigation: Implications for Planning and Public Policy.” Earthquake Spectra, Vol. 8, No. 1, 1992, pp1-15

Chang, S.E., “Transportation planning for disasters: an accessibility approach. ” Environment and Planning, Vol. 35, 2003, pp1051-1072.

Comerio, M.C., “Housing issues after disasters.” Journal of Contingencies and Crisis Management, Vol.5, Number 3, 1997,

Copper, J., “Lessons from the Kobe quake.” Public Roads, Autumn, 1995, pp28-37

Evans, N., “Machi-zukuri as a new paradigm in Japanese urban planning: reality or mith?” Japan Forum, 14, 2002, pp443-464.

E.L. LEKKAS, “The role of earthquake-related effects in urban complexes”, Natural Hazards 25, 2002, pp23-35.

Fluchter, W., “Tokyo before the next earthquake.” 2002

Hakeda, J., “Life recovery of 1995 Kobe earthquake suviviors in Nishinoshima city: Total-quality-management-based assessment of disadvantaged population.” Natural hazard 29, pp565-583

Hirayama, Y., “Collapse and Reconstruction: Housing Recovery Policy in Kobe after Hanshin Great Earthquake.” Housing study, Vol15, No.1, 2000, pp.118-128.

Icon Group International, “Post-Earthquake Projects in Kobe, Hyogo in Japan: A Strategic Entry Report, 1997

Koshiyama, M., “Expansion of the Nishinomiya Built Environment Database.” Natural Hazard, 29, 2003, pp501-522

Kumaki, Y., “Earthquake research for disaster prevention with special reference to long-term evaluation of active fault movement.” Transactions, Japanese Geomorphological Union, 20-4, 1999, pp405-418

Masri, A., “Integrated Planning Information System: Disaster Planning Analysis.” Journal of Urban planning and development, 1995, pp19-39.

Masuda, S., and Murayama, Y., “Land use control along active fault.” Transactions, Japanese Geomorphological Union, 1999, 20-4, p387-404

Maruyama, T., “Seismic Retrofitting for bridges in Osaka city.” Civil engineering and environment system, Vol. 18, 2001, pp35-60

Menoni, S., “Chains of damages and failures in a metropolitan environment:some observations on the Kobe earthquake in 1995.” Journal Hazardous Materials, 86, 2001, 101-119.

Nakase, I., “Park and greenery forms through participation of local residents after Great Hanshin-Awaji Earthquake.” Nature and Human activities, 5, 2000,

Pavlenko, O., “Nonlinearity in the response of soils in the 1995 Kobe earthquake in vertical components of records.” Soil Dynamics and Earthquake Engineering, 22, 2002, pp967-975

Palm, R., “Urban earthquake hazards; The impacts of culture perceived risk and response in the USA and Japan.” Applied Geography, Vol.18, No.1., pp35-46.

Tadokoro, T., “Urban planning for the Twenty-first century in Reconstruction and rehabilitation works in urban areas damaged by the Southern Hyogo Prefectural earthquake: reconsidering private and public spaces.” Geographical Review of Japan 69, 1996, pp625-637.

Tanaka, Y., “The behaviour of a man-made island during the great hanshin earthquake,

Japan.” Natural Hazard 16, 1997, pp267-285.

pp41-46.

“Two months after Great Hanshin Earthquake.” Japan 21st, April 1995.

Wisner, B., “Marginality and vulnerability.” Applied Geography, Vol. 18, No. 1, 1998 pp25-33.

Yamada, Y., “A model for urban post-earthquake fire hazard”, Disasters, Vol. 5, Issue 2, 1999, pp125-132

Zhang, P., “Global Seismic Hazard Assessment Program in Continental Asia.” Annali de Geofisica, Vol. 42, No. 6, December, 1999, pp 1167-1190

Website

http://web.pref.hyogo.jp

http://www.city.kobe.jp

http://www.yumiclub.co.jp (Yomiuri News Paper online – Japanese news paper)

http://www.kobe-np.co.jp/sinsai/index.html (Local Kobe News Paper Online – Japanese news paper)

Interviews

Mr. Yosuke Ikenaga, City Planning Bureau, Kobe City

Mr. Takashi Yamashita, Urban Planning Bureau, Hyogo Prefecture

Professor Masaya Kobayashi, Kobe University

CURRICULUM VITAE

ACADEMIC PREPARATION

- B.A. in English, Kansai Gaidai Univerity, 2001

LANGUAGE SKILLS

- Fluent in Japanese and English

PRPFESSONAL EXPERIENCE

- Teacher in WV International school 2001- Present
  - Teach Japanese students using Japanese curriculum every saturday
- Translator 2003—Present
  - Diamond Electric Manufacturers