Determinants of Reconstruction after Major Earthquakes in Taiwan

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Abstract

Taiwan is located on the Circum-Pacific seismic zone where earthquakes occurred frequently. Some of these earthquakes can be disastrous. For instance, the 1935 Hsinchu-Taichung Earthquake, which measured 7.1 on the Richter scale, caused 3,279 deaths and 61,682 houses damaged; the 1999 Chichi (Jiji) Earthquake (7.3 on the Richet scale) caused 2,505 deaths and 103,961 houses damaged. Moreover, strong earthquakes have also triggered dangerous landslides, which further aggravated victims' misery and complicated relief efforts. This study attempts to make a comparison of the above-mentioned two earthquakes by investigating measures of reconstruction undertaken by both the government and nongovernmental groups. Using general population trends of Taiwan as a background, the focus of this study will be on the resettlement of people in stricken areas, with special emphasis given to villages endangered by landslides triggered by earthquakes and occasional heavy rains.

1. Major Earthquake Disasters in Taiwan

Taiwan is located on the Circum-Pacific seismic zone, one of the three main seismic zones around the world. Before seismographic records were available, abundant historical records made it possible for seismologists to identify major earthquakes that occurred in Taiwan.[1] During 1644-1896, nine earthquakes measuring above 7 on the Richter scale were identified: Taipei 臺北 (1694/4/24-5/23), Chiayi-Tainan 嘉義-臺南 (1736/1/29-30), Chiayi (1792/8/9), Chiayi-Changhua 嘉義-彰化 (1815/10/13), Yilan 宜蘭 (1816/9/21-10/20), Yilan 宜蘭 (1833/12/13-30), Changhua 彰化 (1848/12/3), Taipei-Keelung臺北-基隆 (1867/12/18), and Taiwan 臺灣 (1882/12/9-16). Based on seismographic records during 1898-1997, ten disastrous earthquakes have been

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[1] Tsai Yi-ben 1978; Hsu Ming-tung 1983.

identified as listed in Table 1.[2]

Table 1. Ten Disastrous Earthquakes that Struck Taiwan during 1898-1997

Name of Earthquake	Time	Scale (M_L)	Focus (Km)	Persons Dead	Persons Injured	Houses Damaged*
Touliu 斗六	1904/11/06 04:25	6.1	7.0	145	157	3790
Meishan 梅山	1906/03/17 06:43	7.1	6.0	1,258	2,385	22,017
Nantou 南投 Sequence	1916/08/28 15:27	6.8	45.0	16	159	5,512
	1916/11/15 06:31	6.2	3.0	1	20	1,078
	1917/01/05 00:55	6.2	Very			
	1917/01/07 02:08	5.5	shallow	53	127	3085
Hsinchu-Taichung 新竹-臺中	1935/04/21 06:02	7.1	5.0	3,279	11,971	61,685
	Aftershocks			44	430	8,538
Chungpu 中部	1941/12/17 03:19	7.1	12.0	361	729	78,783
Hsinhua 新化	1946/12/05 06:47	6.1	5.0	74	474	1,971
Hua-Tung Longitudinal Valley Sequence 花東縱谷	1951/10/22 05:34	7.3	4.0			
	1951/10/22 11:29	7.1	1.0			
	1951/10/22 13:43	7.1	18.0	68	856	2,382
	1951/11/25 02:47	6.1	16.0			
	1951/11/25 02:50	7.3	36.0	17	326	1,616
Hengchun 恆春	1959/08/15 16:57	7.1	20.0	17	68	3,720
Paiho 白河	1964/01/18 20:04	6.3	18.0	106	650	39,671
Hualien 花蓮	1986/11/15 05:20	6.8	15.0	15	62	267

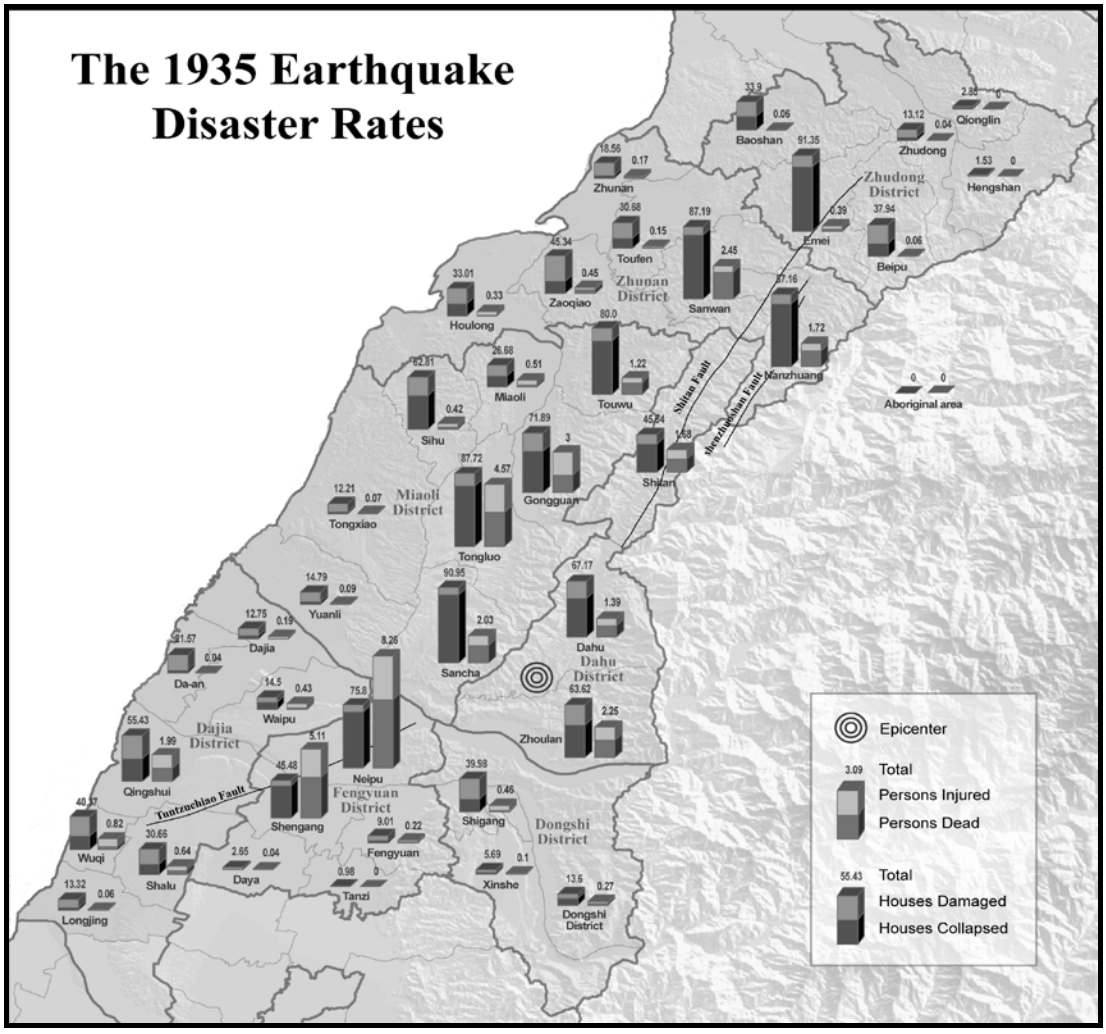
Note: * Including entirely and partially destroyed as well as major and minor damage.

Of these ten major earthquakes, the 1935 Hsinchu-Taichung Earthquake, also known as the Tunzijiao 墩仔腳 Earthquake or the Guandaoshan 關刀山 Earthquake, was the most disastrous with 3,279 persons killed, 11,971 injured and 61,685 houses damaged. The stricken areas in Hsinchu 新竹 Prefecture were located in today's Taoyuan County, Hsinchu City, Hsinchu County, and Miaoli 苗栗 County; those in Taichung Prefecture were in today's Taichung City, Taichung County, Changhua City and Changhua County.

The earthquake disaster records of the Taiwan Governor-General Office reveal that the most seriously stricken places were in today's Miaoli County and Taichung County; the former had 36.9% of all casualties and 49.8% of houses damaged, while the latter had 61.6% and 39.5% respectively.[3] The rates of disaster were calculated

[2] Cheng Shih-nan et al. 1999.
[3] TGO 1936: 20-58.

according to the population and households at each Major Section of Village (*ōaza* 大字, hereafter MSV) under each District (*gun*郡). Among the seven Districts, Fengyuan 豐原 (in today's Taichung County) ranked on the top in terms of all casualties with 3.93% and Dahu 大湖 (in today's Miaoli County) ranked on the top in terms of houses damaged with 61.17%.[4] (See Map 1).

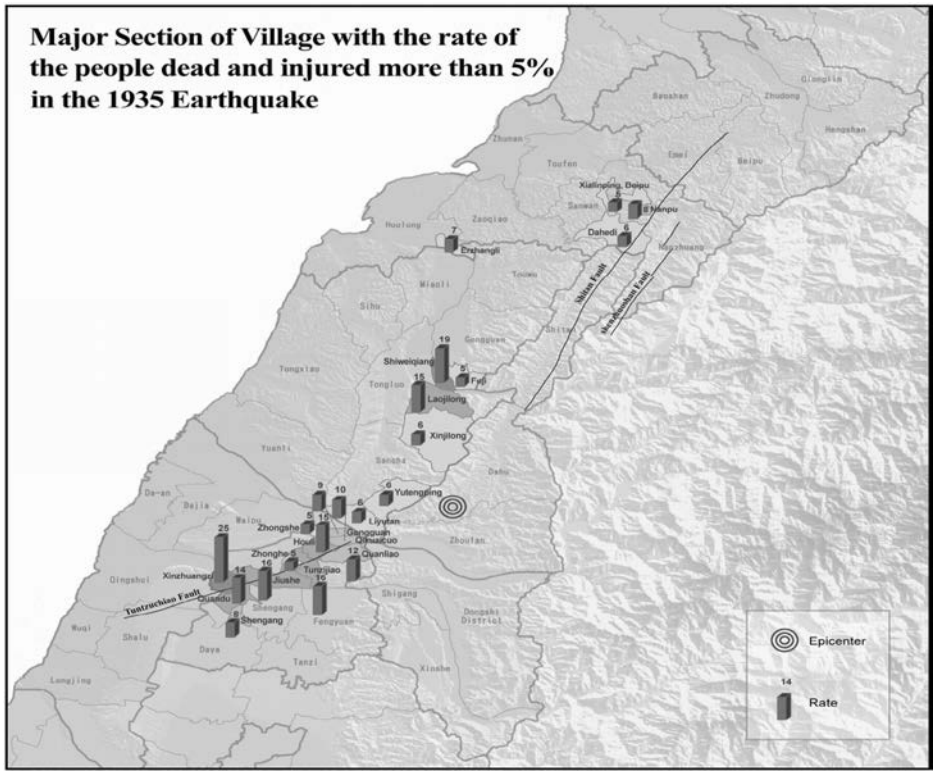


Map 1. The 1935 Earthquake Disaster Rates.

There were 22 MSV suffering more than 5% of the people dead and injured. These MSV made up 7% (22/314) of the total. Fengyuan District had 11 MSV, with Xinzhuangzi 新莊仔 (25%), Tunzijiao 墩仔腳 (16%), Jiushe 舊社 (16%), and Houli 后里 (15%) ranked on the top. Zhunan 竹南 District had 5 and Miaoli District had 6

[4] TGO 1936: 83-100.

MSV; among them Shiweiqiang 石圍牆 (19%) and Laojilong 老基隆 (15%) ranked on the top (See Map 2).



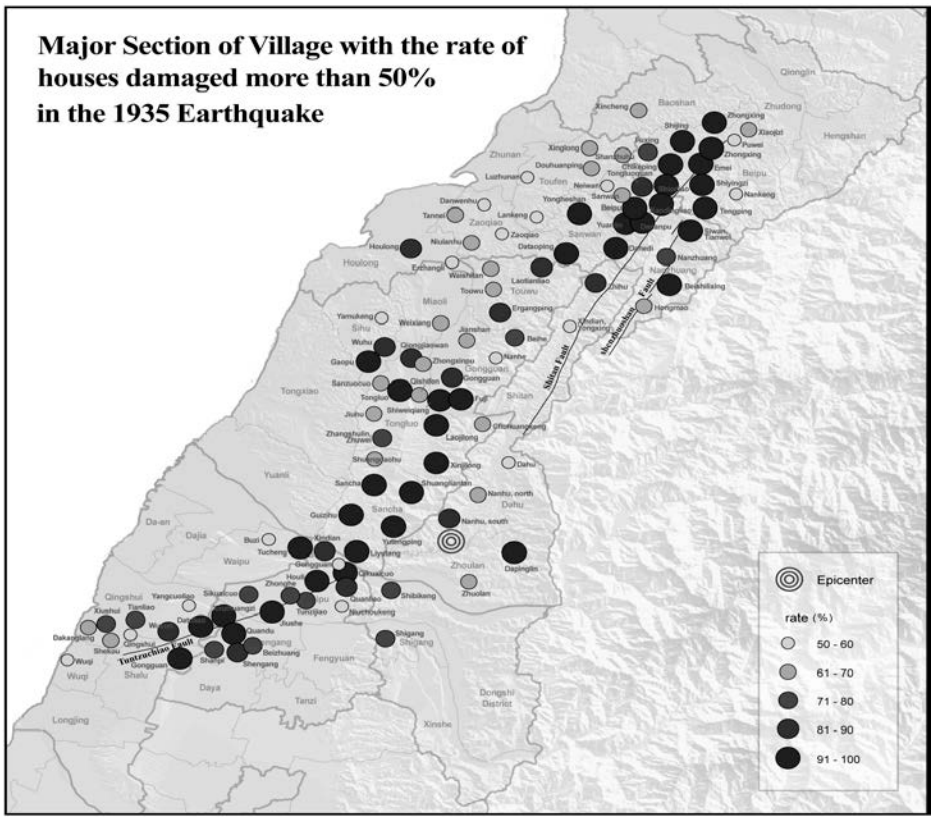
Map 2. MSV with more than 5% of the people dead and injured in 1935

There were 157 MSV (50% of the total) that experienced more than 25% of houses damaged, with 19 of them having rates that reached 100%. Of these 19 MSV, 8 were in Zhunan, 5 in Miaoli, 4 in Zhudong 竹東 (in today's Hsinchu County), and 1 each in Fengyuan and Dajia 大甲 (in today's Taichung County) (See Map 3).

Among the most seriously stricken MSVs, Xinzhuangzi ranked on the top with 25% of the people dead and injured and 100% of houses damaged, while Tunzijiao, the village closest to the epicenter, had 16% and 76% respectively. However, in terms of sheer number, Tunzijiao recorded 641 casualties and 555 houses damaged, while Xinzhuangzi recorded 280 and 150 respectively.

The 1935 Earthquake did not cause any disasters in today's Nantou County, which belonged to Taichung Prefecture at that time. However, four earthquakes struck this area in 1916 and 1917, particularly two very shallow earthquakes occurred on 5 and

7 January 1917 in Puli 埔里 had caused notable damage as shown in Table 1.



Map 3. MSV with more than 50% of the houses damaged in 1935

Another earthquake measuring 7.3 on the Richter scale occurred near the small town Chichi 集集 (Jiji) in Nantou County at 1:47 AM local time on 21 September 1999. It was known as the Chichi Earthquake or the 921 Earthquake. This was a shallow earthquake with the depth of focus measuring 8 kilometers. In total, it caused 2,505 persons to be dead or missing, 758 seriously injured, 50,644 houses destroyed, and 53,317 partially damaged. The stricken area covered 31 townships in 7 counties and 3 cities; of these, Nantou County and Taichung County were most seriously stricken.[5] In terms of people dead and injured, Nantou County's figures were 36.97% and 34.69%, and Taichung County's 47.87% and 52.87% of the total; in terms of houses destroyed and damaged, Nantou County counted for 54.26% and 53.81%, and Taichung County

[5] EYCR 2006: 4.

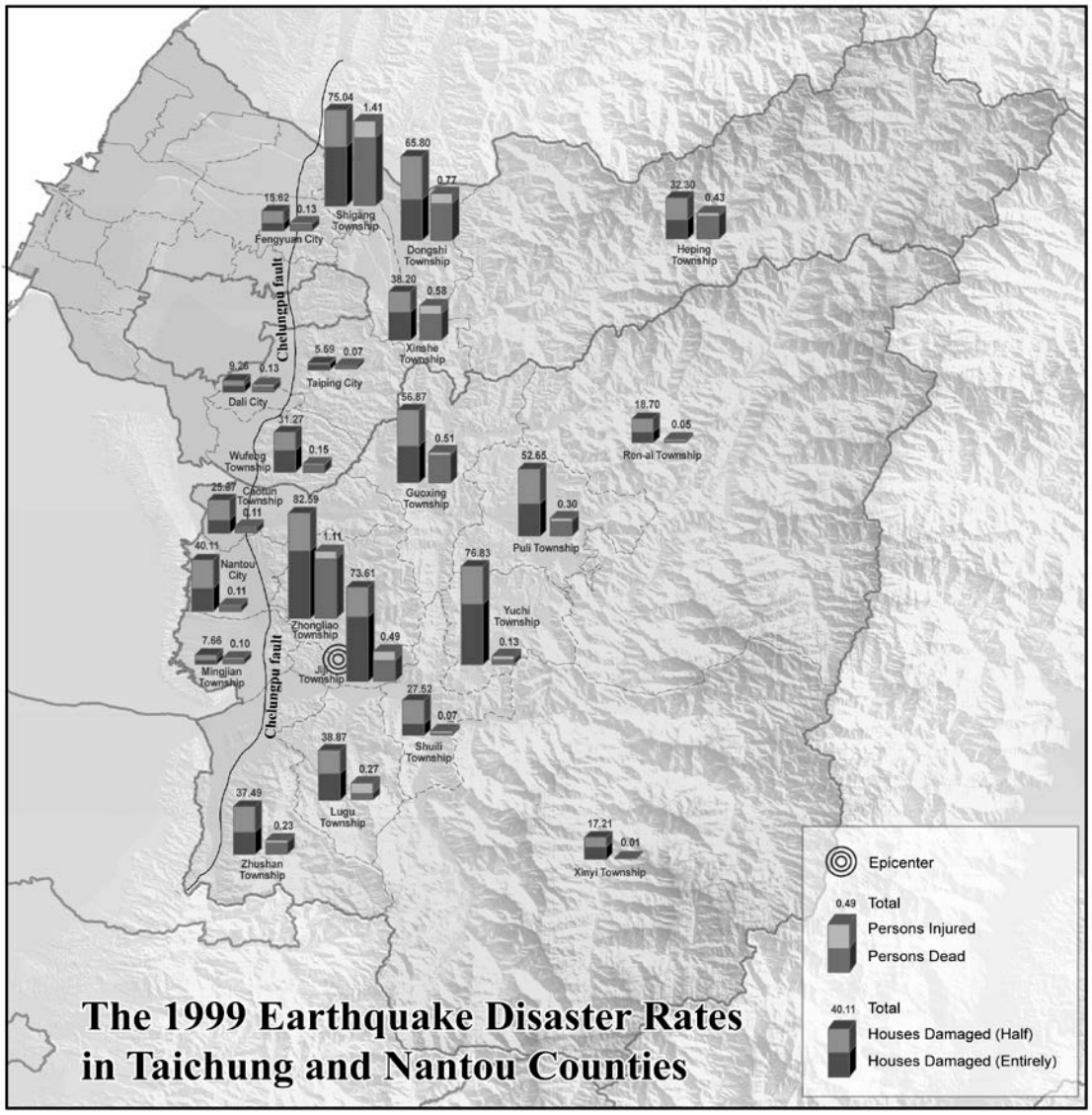
36.21% and 34.53% of the total.[6]

Based on Hsieh's figures and the 1998-99 average population and household data taken from statistical yearbooks, estimated disaster rates in Nantou County show that there were 0.17% of people dead, 0.05% seriously injured, 19.41% of houses destroyed, and 20.02% damaged. The 13 townships in the county all recorded disasters, with those ranking on the top including: Zhongliao 中寮, with 0.99% of people dead, 0.12% injured, 52.94% of houses destroyed and 29.65% damaged; Guoxing 國姓 had 0.46%, 0.05%, 28.76% and 28.11% respectively; Jiji 集集 had 0.34%, 0.15%, 50.26% and 23.35% respectively; and Puli 埔里, where the largest numbers of calamities occurred, had 0.24%, 0.06%, 25.61% and 27.04% respectively. As for Yuchi 魚池, in terms of people dead and injured, it had 0.08% and 0.06 % respectively, but in terms of houses destroyed and damaged, it had 47.38% and 29.45% ranking just below Zhongliao.

In Taichung County, there were 0.08% of the people dead and 0.03% injured, with 4.93% of houses destroyed and 4.89% damaged. Of the 21 sub-divisions, only 9 recorded notable disasters; those ranking on the top included: Shigang石岡, which had 1.12% of fatalities, 0.28% injuries, 45.95% of houses destroyed and 29.09% damaged; Dongshi 東勢 had 0.61%, 0.17%, 31.96% and 33.84% respectively; and Xinshe 新社 had 0.43%, 0.14%, 21.97% and 16.23% respectively. It is notable that these three townships were under Dongshi District in 1935, and reported 0.3% of casualties and 19.5% of houses damaged in that earthquake.[7] (See Map 4).

In addition to dwellings and office buildings, 870 schools suffered damage, including 488 elementary, 168 junior high, 129 senior high and vocational, 4 special schools, and 81 colleges and universities. The loss of destroyed public works, such as electricity and communication facilities, railroads, roads, bridges, dikes, water supply and irrigation systems, could not be easily estimated. Several aftershocks measuring over 6 on the Richter scale accelerated the collapse of mountain slopes and triggered dangerous landslides, which added the misery of disaster victims.[8]

[6] The percentages are calculated using the statistics in Hsieh Chih-cheng 2000: 2-5.
[7] TGO 1936: 96-97.
[8] HRCT 2000: 303-96, 517-766; Hsieh Chih-cheng 2000:1, 208; EYCR 2006: 4-5.



Map 4. The Disaster Rates in Taichung and Nantou Counties in 1999.

2. General Demographic Trends in Taiwan

Did the earthquake disaster induce any demographic responses in Taiwan? In order to address this issue, general trends related to birth, death, marriage, old age, and migration are reviewed below based on available statistics.[9]

Figure 1 illustrates population growth trends in Taiwan in terms of crude birth rates (CBR) and crude death rates (CDR). During 1906-1960, the CBR in Taiwan was usually around or above 40‰, and once reached a peak of 49.9‰ in 1951. After the

[9] NTG, OCET, TCG.

peak, the CBR started to decline, but it became lower than 20‰ only in 1984 and lower than 10‰ in 2002. As for the CDR, there were drastic fluctuations before 1920, but it declined from 33‰ in 1906 to 19.2‰ in 1930, then increased to slightly above 20‰ in 1934-1935, and from 1936 onwards became lower than 20‰. In the post-World War II period, the CDR declined below 10‰ in 1952 and below 5‰ in 1970, but it rose again slightly above 5‰ in 1988 and above 6‰ in 2005. In terms of natural growth rate, despite occasional fluctuations, the difference between CBR and CDR held steady at above 20‰ until 1976 and declined to below 10‰ from 1994 onwards.

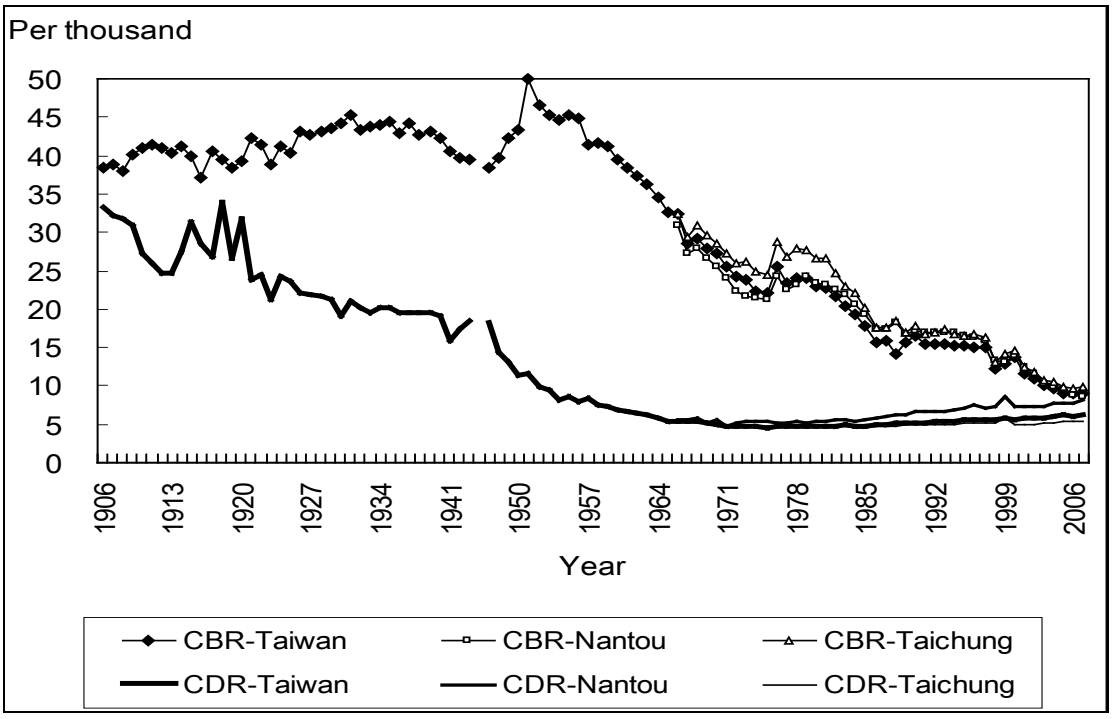


Figure 1. The CBR and CDR of Taiwan's Population, 1906-2007
With Comparisons to Nantou and Taichung County, 1966-2007.

Comparing the CBR and CDR of Nantou County and Taichung County with those of Taiwan during 1966-2007, it is notable that the CBR of Nantou was lower than that of Taiwan during 1966-1978 and then became higher until 2005, while the CBR of Taichung was always higher than that of Taiwan. In contrast, the CDR of Nantou was always higher than that of Taiwan, while that of Taichung was more or less the same of Taiwan until 1987 and then became lower. It is also notable that the CDR reached a peak in 1999, with Nantou's rate (8.7‰) sticking out above those of Taiwan and

Taichung (both 5.7‰).

In respect to marriage, Figures 2 and 3 illustrate the rates of currently married, unmarried, widowed, and divorced people aged 15 and over.

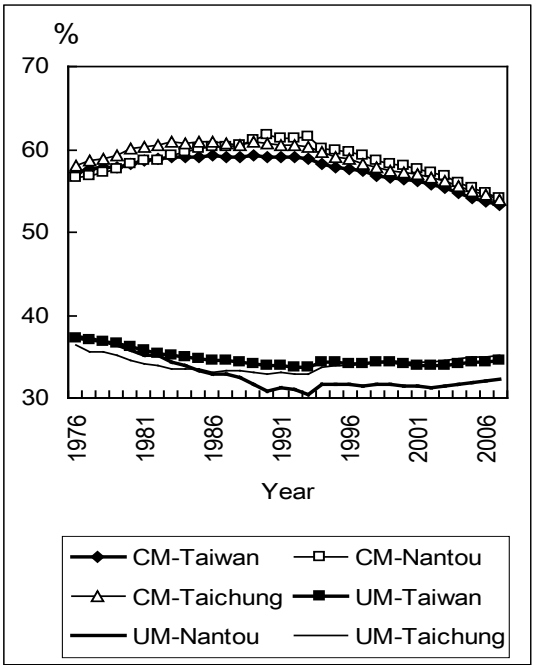


Figure 2. Rates of Currently Married and Unmarried (15 years old and over).

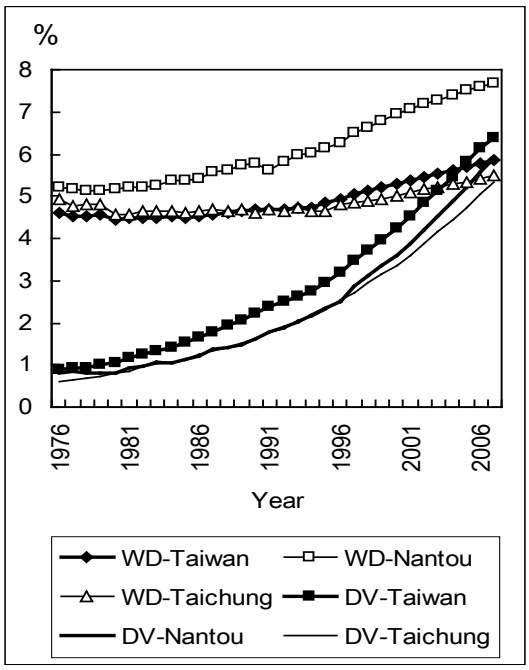


Figure 3. Rates of Widowed and Divorced (15 years old and over).

Figure 2 shows that the currently married rate in Taiwan increased from 57.3% in 1976 and peaked at 59.3% in 1989 before declining to 53.2% in 2007. In Taichung it was slightly higher than in Taiwan, reached a peak of 60.9% in 1989 before declining to 53.9% in 2007. In Nantou it became higher than in Taiwan in 1983, reached a peak of 61.7% in 1990 before declining to 54.2% in 2007. As for the unmarried rate, during 1976-2007, it declined from around 37% to 34% in Taiwan; it was slightly lower in Taichung until 1997, and then became slightly higher; in Nantou it became lower than in Taiwan in 1980, and became much lower after 1989 at around 31%.

Figure 3 indicates that during 1976-2007 the widowed rate was higher in Nantou than in Taiwan and Taichung. In Nantou the rate increased from 5.2% to 7.7%, in Taiwan from 4.5% to 5.8%, and in Taichung from 4.8% to 5.5%. As for the divorced rate, it increased constantly during 1976-2007, with a slightly higher rate in Taiwan than in Nantou and Taichung. The rate in Taiwan increased from 0.9% to 6.4%, in Nantou

from 0.8% to 5.9%, and in Taichung from 0.6% to 5.3%.

Figure 4 illustrates the old age rate (65 years and over) during 1976-2007. The rate in Nantou was the highest, increasing from 4.1% to 13.0%, as opposed to from 3.6% to 10.2% in Taiwan and from 3.7% to 8.5% in Taichung. The benchmark of 7% was reached in 1990 in Nantou, 1993 in Taiwan, and 1999 in Taichung.

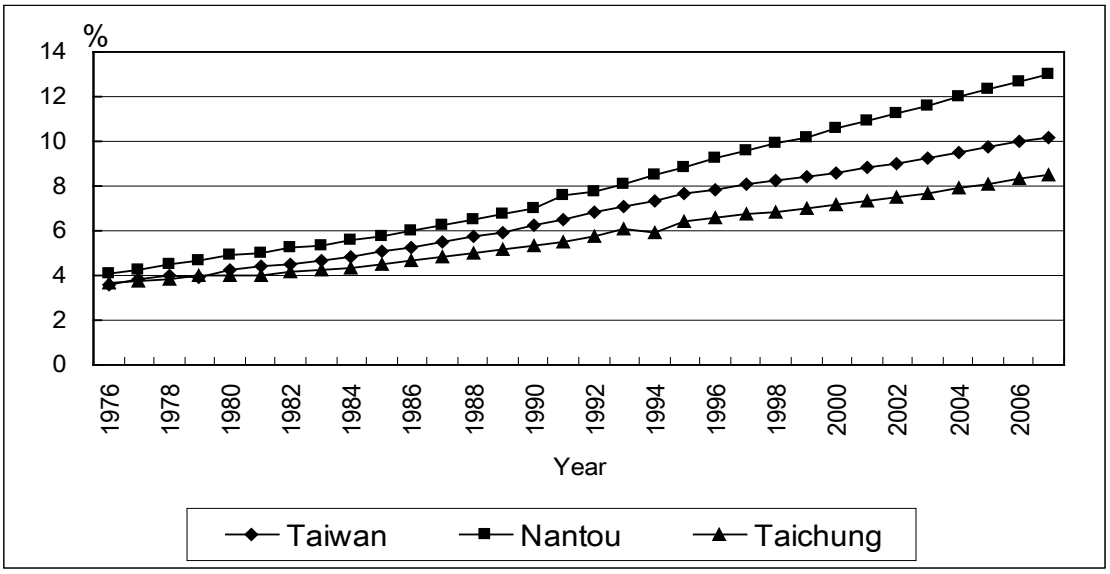


Figure 4. Old Age Rates in Taiwan, Nantou, and Taichung, 1976-2007

Figures 5 and 6 illustrate the in-migration and out-migration rates in Nantou County and Taichung County during 1994-2007, and both reveal a declining trend. It is notable that in Nantou County the out-migration rate was consistently higher that the in-migration rate, but the former increased in 1999-2000 and the latter decreased during 2000-2001. In Taichung County the in-migration rate was higher before 1999 but in contrast the out-migration rate became higher during 2000-2005.

In sum, the demographic trends discussed above reveal that the 1935 Earthquake had an impact on the crude death rate. The 921 Earthquake had two forms of impacts: (1) The crude death rate in 1999 reached a peak, particularly in Nantou County and (2) In Nantou County, the out-migration rate increased during 1999-2000 and the in-migration rate decreased during 2000-2001; in Taichung County, the out-migration rate was higher than the in-migration rate during 2000-2005, in contrast to the previous trend. As for the consistent higher rates of widowed, old age, and out-migration in Nantou County during

1976-2007, they were apparently related more closely to long-term social, economic, and geographic conditions of the County.

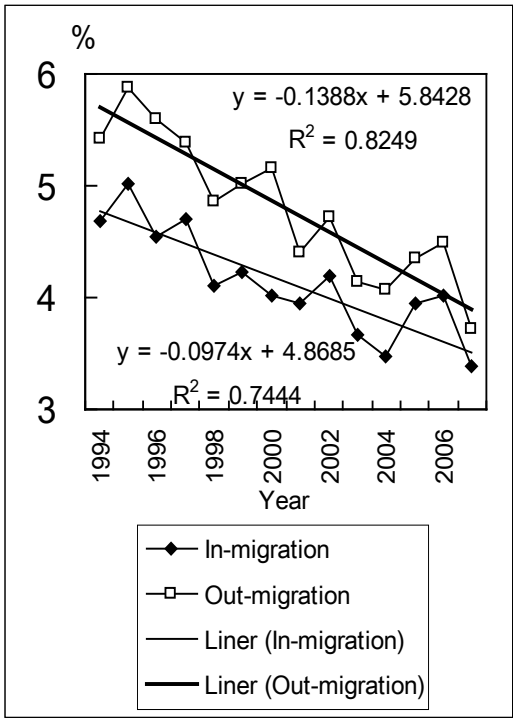


Figure 5. In- and Out-migration Rates in Nantou County, 1994-2007.

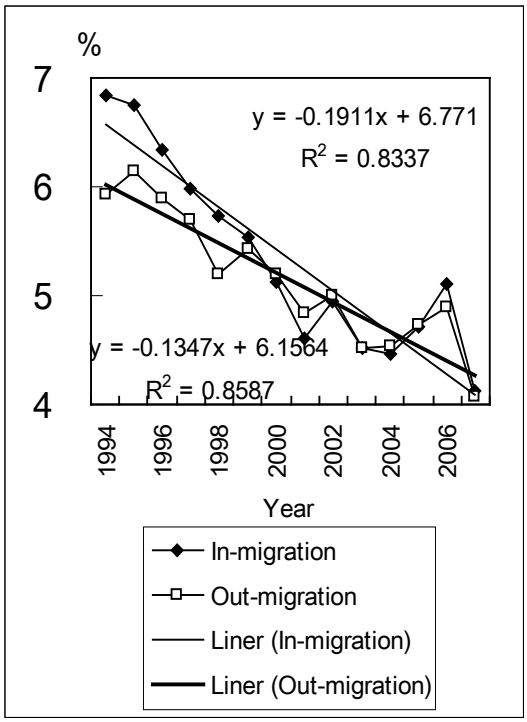


Figure 6. In- and Out-migration Rates in Taichung County, 1994-2007.

It is notable that the *Taiwan Daily News* reported: several hundred people had emigrated by mid July 1935 from the earthquake affected areas to settle in Hualien, Yuli, and Fenglin on the East Coast.[10] An interview at Tunzijiao 60 years after the 1935 Earthquake revealed that in order to provide care for little children, it was not unusual for those who lost their spouses to remarry.[11]

3. Disaster Management after the 1935 and 1999 Earthquakes

Disaster management requires several phases of work: relief, rehabilitation, reconstruction and mitigation, with high levels of local participation proving most effective.[12] In below, the measures adopted after the 1935 and 1999 earthquakes will be presented in parallel as a means of comparison.

[10] *Taiwan Daily News*, 1935/07/21.
[11] Chen Mei-yi 2000.
[12] Özerdem and Jacoby 2006:11-12.

3.1 Government Responses

In 1935, after the earthquake occurred at 6:02 AM on April 21, a meeting was called at the Taiwan Governor-General Office at 3 PM to decide four principles of emergency rescue: (1) The Branch Office of Red Cross, the Health Department of Police Affairs Bureau, and all official hospitals should dispatch emergency rescue groups; (2) Local authorities should assume responsibility for handling donations and rescue materials; (3) A Rescue Fund should be set up at each prefecture for emergency rescue, and the money provided by the national treasury should be used expediently; and (4) The Director of the Domestic Affairs Bureau should visit the stricken area within 3 days to decide tax reductions for victims, and the Director of the Culture and Education Bureau should visit the stricken area on behalf of the Governor-General. The very next day, the Earthquake Rescue Office was set up under the Social Division of Culture and Education Bureau to handle donations, keep close contact with local authorities, decide rescue measures, and regulate supplies of rescue resources such as food, medicine, and construction materials.[13]

In 1999, after the earthquake occurred at 1:47 AM on 21 September, the Executive Yuan set up a Center for Managing the Major Earthquake at 2:30AM and announced 9 points of emergency management. At the same time, the Army was mobilized for emergency rescue. At 4:30 PM, a meeting at the Executive Yuan decided 15 points of emergency rescue. On September 23, a Center for Directing the Rescue was set up at Zhongxing Xincun 中興新村 in Nantou County. On September 25, the President announced 12 points of emergency order for carrying out rescue, rehabilitation, and reconstruction. On September 27, the Executive Yuan Committee for Reconstruction was established. On October 13, the Reconstruction Fund was set up for handling donations. On 3 February 2000, the Provisional Regulations for Reconstruction after the 921 Earthquake were formally announced as bylaws for reconstruction. After the new government was inaugurated following the 2000 election, the Executive Yuan Committee for Reconstruction was reorganized and set up at Zhongxing Xincun on 1 June 2000. Local centers for disaster management were also set up in Taichung County and Nantou County.[14]

[13] TGO 1936: 188-9, 193-196..
[14] Wu Kun-mao 2004: 3-14, 49; EYCR 2006: 5, 22-32, 46-47.

3.2 Emergency Rescue and Medical Care

In 1935, personnel mobilized immediately for emergency rescue included police officers, police doctors, public health staffs, public doctors, local officials and staffs, youth corps, able-bodied corps, fire brigades, reservists, and social service groups. Each group took up different tasks. In addition, during April 21-27, the Army dispatched officers, while military hospitals in Taipei, Tainan, and Keelung sent military doctors to the most seriously stricken villages such as Tunzijiao, Xinzhuangzi, Gongguan 公館, Dahu and Houli. During April 21-26, public hospitals in Taipei, Keelung, Yilan, Hsinchu, Taichung, Chiayi, Tainan, and Kaohsiung, the Branch Hospital of Red Cross and Patriotic Women's Society, and the Rehabilitation Hospital also sent rescue groups to stricken areas; some of these groups stayed until May 18 or June 29. Local official doctors and private doctors from many places also organized rescue groups and stationed at different localities. From April 21 to June 30, a total of 90,901 injured persons and 4,746 other patients received medical treatment. For children needing special care, five temporary nurseries were set up at Miaoli, Neipu內埔, Shengang 神岡, Wuqi 梧棲, and Shigang during the emergency rescue period.[15]

In addition, several measures were taken to ensure public health in the stricken areas: (1) Supplying drinking water quickly at places where water supply systems or wells were damaged; (2) Keeping residential quarters clean; (3) Removing solid waste, as well as cleaning up waste water and sewage; (4) Cleaning up feces and urine; (5) Spreading disinfectant; (6) Eradicating mosquito, flies, and other harmful insects; (7) Paying special attention to toilets and drainages at shelters; and (8) Rigorously looking after the health conditions of people in stricken areas. In order to prevent outbreaks of infectious diseases, special attention was given to stop epidemic meningitis from prevailing again. Attention was also given to typhoid fever and other infectious diseases of the digestive organs. Local official doctors and private doctors were asked to report promptly any occurrence of infectious disease, and to investigate it carefully. Moreover, special attention was given to prevent malaria. Although epidemic meningitis did not occur, there were 55 cases of typhoid fever in Hsinchu Prefecture (22 in Zhudong, 5 in Zhunan, 27 in Miaoli, and 1 in Dahu) and 9 cases in Taichung Prefecture (1 in Dongshi and 8 in Fengyuan). There was also one case of

[15] TGO 1936: 221-234, 264-9, 323-324.

dysentery in Dahu District. The number of people infected with malaria doubled in Hsinchu, although there was no increase in Taichung Prefecture.[16]

Once all efforts were being devoted to emergency care of injured people, from the fifth day after the earthquake a medical group led by Yang Zhao-jia 楊肇嘉 (1892-1976), a leader of local self-governing movement, started to do health examinations for people and to provide free medicine. Still, diseases made people miserable in some places. The principal of a school recalled that malaria prevailed in September-November, with 70% of residents at a village in Zhunan being infected. A school teacher at Neipu said that 10-15% of pupils were absent due to typhoid fever, malaria, and influenza. It is also notable that by mid-May more than 10 cases of mental disorder were found at Neipu and Shengang.[17]

In 1999, more than 400 medical personnel from 50 institutions were mobilized and sent to the stricken areas, while all seriously injured persons were delivered to major hospitals nearby within 12 hours after the earthquake. Within 40 hours, a medical station had been set up at each township. In addition, non-governmental and religious groups recruited more than 20,000 volunteers in just a few days to assist rescue operation. There were also 40 emergency rescue groups with 767 personnel, as well as 99 dogs and equipment dispatched from 19 countries and the United Nations.[18]

In order to prevent outbreaks of epidemics, the Centers for Disease Control formed a guiding group on 22 September, while monitoring groups were set up at each township on 28 September. By the end of November, at Ren-ai 仁愛Township, Nantou County, it was found that cases of bacillary dysentery did not increase significantly compared to levels in previous years. Except for this, no other infectious diseases were found. To ensure a healthy environment, disinfectant was spread immediately and corpses taken care of. Solid waste was quickly removed and more than 3,000 mobile toilets were set up at various places. For protecting high-risk groups, a vaccination station was set up on October 1; people aged 65 and over received the influenza vaccine, while cooks at shelters received the hepatitis-A vaccine. There were also 6,000 doses of tetanus vaccine delivered to major hospitals.

[16] TGO 1936: 307-309..
[17] Sen and Wu 1996: 114, 143, 152, 156-157.
[18] EYCR 2006: 51, 56, 127.

From September 22, psychological consulting services were provided at medical stations, funeral parlors, and shelters; a special 24-hour telephone line was also set up. Some medical schools sent psychiatrists to do surveys within one month after the earthquake, and found that those suffered from symptoms of post-traumatic stress disorder constituted 50-70% of 308 at Yuchi Township and 35.7% of 157 at Xinshe Township. It is also notable that by 19 February 2000, in Nantou County 32 persons had committed suicide.[19]

3.3 Condolences

In 1935, the Emperor of Japan bestowed ¥50,000 each for the afflicted prefectures for condolences. In principle, ¥10 was given for each death, ¥6 for each serious injury, ¥1 for each light injury, ¥1.2 for each destroyed house, and ¥1 for each damaged house. The Emperor's donations were used mainly for memorial ceremonies, medical care, and construction materials. Moreover, Japanese imperial princes and noble families donated ¥1,500 for each of the two prefectures and the Emperor of Manchukuo bestowed ¥10,430 for each as well; these bestowals were used for the relief of poor people.[20]

In 1999, the government provided NT$1 million for each fatality, NT$0.2 million for each serious injury and each destroyed house, and NT$0.1 million for each damaged house. Altogether, NT$18,116.7 million were used for these purposes.[21]

If the wholesale price of brown rice is taken to gauge material value, in 1935 ¥1 could buy 2.8 kg, while in 1999 NT$1 could buy 0.04 kg.[22]

3.4 Relief and Rehabilitation

In 1935, local officials from the Division of General Affairs and the Division of Police Affairs supervised and carried out the relief work with the assistance of various local groups such as the heads of neighborhood systems (*hook* 保甲), reservists, youth corps, able-bodied corps, and social-welfare groups.[23]

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[19] EYCR 2006: 56-61; Huang Hsiu-cheng 2005: 439; Chen Yi-shen 2000: xii.
[20] TGO 1936: 291-296, 301, 318-322.
[21] EYCR 2006: 79.
[22] Liu Ts'ui-jung 2001: 148; Council of Agriculture 2000: 132.
[23] TGO 1936: 184.

In Hsinchu Prefecture, rationed goods included food, clothes, and construction materials. During the first five days, cooked rice was provided to all victims whose houses had been heavily damaged, but afterwards only to the poor people. Water supply systems were restored in three days after rush repairs. Rationed foods like rice, soy sauce, pickled radish, salt fish, and salt, were provided on the first two days to all victims, but from the third day on only to the poor until May 6, when rescue money was distributed. Later, the Taiwan Governor-General Office allocated donations for distribution to the poorest. For shelter, there were 17 public buildings not destroyed by the earthquake, 105 newly built emergency shelters, and 3,773 huts. Town and village authorities also proceeded to build 1,033 dwellings with loans of ¥103,300 provided by the national treasury. Moreover, 358 dwellings for the poor were built at 17 locations with donations of ¥50,000 allocated by the Taiwan Governor-General Office and ¥3,750 by the Prefecture Office.[24]

In Taichung Prefecture, a sum of ¥183,522 was allocated from the Rescue Fund for distributing rationed foods and construction materials. The water supply problem was solved on April 25 after rush repairs. As Taichung City was nearby and resources were relatively abundant in the prefecture, relief work was carried out smoothly and quickly. Cooked rice was provided on April 21-22 at places needed, but in most cases rationed food was provided until early May. It is notable that a survey was conducted by members of social-welfare committees (*hōmen iin* 訪問委員) at many places to identify those really needing relief. As a result, from May 4 to June 3, rationed goods were given only to 1,057 poor households with 4,837 persons. During that period, more detailed surveys were done in order to decide how to distribute money from the Rescue Fund. As the weather was turning warmer, heavy clothes were not needed but shelters and huts were quickly constructed at safe places for rehabilitation; a survey in late April reported that 7,350 units were built at various districts. The victims were also encouraged to rebuild their own houses; those who paid less than ¥300 in household tax had priority for receiving loans. Shortages of building materials like zinc plates were quickly made up through a report to the Taiwan Governor-General Office, and supplies were hastily shipped from Japan. In total, town and village authorities built 1,949 dwelling houses with loans of ¥194,900 provided by the

[24] TGO 1936: 185-186, 309-310, 410-411.

national treasury. Moreover, there were 333 dwellings for the poor built at 8 locations with donations allocated by the Taiwan Governor-General Office.[25]

In 1999, materials such as food, bottled water, clothes, blankets, and tents were sent immediately by various non-governmental and religious groups for the relief effort. While supplies were rather abundant, regrettable problems of uneven distribution, inappropriate hoarding, and wastefulness occurred.[26]

For rehabilitation, a policy of three alternatives was adopted for victims to choose from: (1) To apply to live in temporary assembled houses for a certain period of time, (2) To purchase public housing at a 30% discount, and (3) To apply for a subsidy to rent a private house. For the first alternative, there were 5,854 temporary assembled houses built at 112 locations, of which 4,031 (68.9%) were at 81 locations in Nantou County, 1,481 (25.3%) at 23 locations in Taichung County and the rest in other counties. Of these 112 locations, 39 were built by the government, 56 by philanthropic groups, and 17 by private enterprises. In October-November 1999, the Japanese Government delivered 1,003 assembled houses once used after the 1995 Ōsaka-Kōbe Earthquake; these were reassembled at 10 locations in Nantou County, 2 in Taichung City, and one each at Taichung and Miaoli Counties. Two types of households were qualified to apply for living in the assembled houses: (1) Those whose houses had been damaged and (2) Minority households, such as low and medium income, handicapped, old people living alone, and single-parent families. The government provided them with subsidies for water and electricity fees, management fees, and land rent. The policy adopted was to rebuild damaged houses before demolishing assembled houses. In practice, the allotment started from October 1999 and extended until February 2006. By the end of June 2005, already demolished were 4,393 units (75%), but 807 households, of which 364 (45%) were at Puli, still awaited further arrangements. For ensuring the health of those living in assembled houses, physical examinations were conducted for 28,936 persons up to December 2002.[27]

For the second alternative, from 12 October 1999 to 4 February 2005 those who purchased public housing totaled 1,198 households; among them 628 (52.4%) were

[25] TGO 1936: 186-188, 310-312, 411.
[26] EYCR 2006: 64.
[27] EYCR 2006: 64-74, 297-298..

relocated in Taichung City and 111 (9.3%) in Nantou County. It is notable that 749 (62.5%) of these households completed purchases by 29 October 1999, and another 252 (21%) by 24 March 2000.[28]

The third alternative was carried out over three years (1999/10-2002/10) in different practices. In the first year, each person from a household whose owned house had been damaged was qualified to receive NT$3,000; a total of 316,960 persons received this subsidy. In the second year, 6,307 households were qualified according to the following three categories: (1) Their owned house had been destroyed and they had received the first-year subsidy, (2) Their owned house had been partially damaged and subsequently demolished, so they rented a house with a contract, and (3) Low and medium income households with houses partially damaged. In the third year, the subsidy was only provided for 4,196 minority households to improve their housing conditions. Altogether, these housing subsidies totaled NT$12,168.48 million.[29]

For assisting the unemployed, four measures were adopted: “giving relief by providing labor”, temporary work allowances, employment for reconstruction, and job training. Stations were set up at 25 townships for helping the unemployed to apply for a job. Up to 12 February 2001, there were 9,601 applicants and 3,666 (38.2%) of them got employed. Other results included: (1) From October 1999 to March 2000, the practice of “giving relief by providing labor” recruited 135,794 persons/days to clean up the stricken areas; (2) From February 2001 to January 2004, temporary work allowances were given to 13,157 persons; (3) By the end of March 2000, plans were drawn up at 33 townships to provide work for 135,794 persons; (4) From 2 October 2000 to 10 July 2001, reconstruction work employed 6,515 persons; (5) From 31 October 1999 to 31 December 2003, there were 831 job training classes and 8 special courses, which together benefited 30,533 persons; (6) From late 1999 to the end of 2002, job training for middle-aged people benefited 3,010 persons; and (7) In July-October 2003, 61 programs were approved for minority groups, with 417 persons being employed.[30]

3.5 Reconstruction

In 1935, the Taiwan Governor-General Office organized a Committee for

[28] EYCR 2006: 75-78..
[29] EYCR 2006: 80-83, 271-274.
[30] EYCR 2006: 84-86, 301-311.

Reconstruction on April 29 to handle the task. The first meeting decided that the national treasury should provide loans at low interest rates for the following tasks: (1) The reconstruction of public buildings; (2) The adjustment of prefectural finances; (3) The reconstruction of irrigation systems; (4) Urban planning for small towns and villages, and reconstruction of dwellings at these selected localities; and (5) The revival of the tea, straw hat, and silk manufacturing industries. Moreover, on May 31, a notification concerning dwellings was delivered by the Director-General to the two Prefects, and on July 1 the two prefectures announced their own regulations to stipulate standards for dwellings to be built with concrete in order to replace those mud brick houses destroyed by the earthquake.[31].

A few more words are needed for urban planning and reconstruction. Urban planning involved two types of locations: (1) Small towns that had more than 500 households, of which more than 50% of houses were in dangerous condition and (2) Small villages that had more than 100 households, of which more than 70% of the houses were entirely or partially damaged. There were 11 locations belonging to these categories in Hsinchu Prefecture and 7 in Taichung Prefecture. The urban planning program involved standards for streets, dwellings, sewage, green stretches, parks, and public squares. Total expenditures for urban planning amounted to ¥324,912 in Hsinchu and ¥422,453 in Taichung; both had 40% provided by the national treasury and the rest by the prefecture. As for reconstruction of dwellings, 5,543 (63.6% of the total households) were completed at the 11 locations in Hsinchu and 5,340 (75.7%) at the 7 locations in Taichung. Of these 18 locations, 6 had the rates of reconstruction reaching 100%, namely Tongluo 銅鑼 (583 households), Nanzhuang南庄 (344), Gongguan (405), Tunzijiao (712), Shigang (476), and Shengang (330). The cost of house reconstruction totaled ¥2,851,600, of which 5% were subsidized by the national treasury and another 5% by the prefecture. The subsidies were provided over two years, 60% in 1935 and 40% in 1936. Of the total 10,883 households that needed reconstruction, 3,754 lacked the ability to borrow money and 2,628 (70%) of them were resettled at housing operated by towns and villages with loans of ¥262,800 provided by the national treasury. Apart from these 18 locations, there were 12,723 households (9,531 in Hsinchu and 3,192 in Taichung) that obtained a loan of ¥400

[31] TGO 1936: 355-361, 395-407.

each for rebuilding their homes.[32]

In 1999, seven programs were initiated for reconstruction. Major results by the end of June 2005 are summarized below.[33] (1) A total of 30,757 households completed rebuilding their own houses. (2) There were 139 partially damaged aggregated buildings, comprising 16,891 households, which completed repairs. As for the 162 destroyed aggregated buildings, 44 were rebuilt at their original locations, 5 at other places, 99 as part of the urban renovation program, and 14 still in negotiations for consensus among the households. (3) Old streets at three townships were renovated: Zhongliao had reconstructed 84.7% of the 157 households, Guoxing 83.5% of the 139 households, and Dongshi 97.4% of the 115 households. (4) For the development of new communities, two types of housing were built: one for sale and the other for rent or for helping minority households. Nantou County built 348 and 223 housing units of these two types, Taichung County built 184 and 198 respectively, and Yunlin County built 385 housing units for sale. (5) For rural settlements in Taichung, Nantou, Yunlin, and Chiayi Counties, a total of 1,133 houses were rebuilt, of which 1,068 (94.3%) were in Nantou. (6) For the 12 villages threatened by landslides, safety engineering was completed at 5 villages and thus villagers decided not to move. Otherwise, new communities were constructed for relocation. In Nantou County, Beimei 北梅 New Community was constructed at Puli for accommodating 184 households and Qingfeng 清豐 Community at Zhongliao for 20 households. In Taichung County, Sanchakeng 三叉坑 Community was built at Liberty Village in Heping 和平 Township for 45 aboriginal households. (7) A total of 6 aboriginal villages needed relocation; 2 of them (including Sanchakeng) had completed moving, 3 were under construction, and 1 was in the process of acquiring available land. At another 16 aboriginal villages needing reconstruction, 663 (61.8%) of the 1,072 destroyed houses had been rebuilt and 846 (84.6%) of the 1,000 partially damaged houses had been repaired.

The above seven programs involved 32,735 households and they together applied for loans of NT$57,872.07 million. Of these, 30.7% of the households used 48.0% of loans to purchase houses, 32.6% of the households used 38.8% of loans to rebuilt houses, and 36.7% of the households used 13.2% of loans to repair houses.

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[32] TGO 1936: 392-394, 407-411.
[33] Huang Hsiu-cheng 2005: 22-70; EYCR 2006: 342-434.

A few more words are needed for the relocation of villages that were threatened by landslides. In addition to loans, the Qingfeng Community at Zhongliao was fortunate to receive an overseas donation of NT$10 million from Hong Kong which reduced the average burden of the 20 households to less than NT$1 million. The Community gratefully celebrated relocation on 7 February 2004.[34] The story of moving from Wugong 蜈蚣 Village to the Beimei New Community at Puli did not have such a happy ending. The threat of landslides turned very urgent after heavy rains on 21 February 2000, and a local committee was formed to plan for relocation. After several meetings, a survey was completed on 15 March 2001, and 148 households expressed willingness to move with indications of sizes of houses they desired. On 25 April, a site of 3.4 hectares to be provided by the Taiwan Sugar Company was approved. On 9 July, the Nantou County Government assumed responsibility for construction, but the plan was delayed due to election of a new county magistrate. Finally, Beimei New Community was completed on 28 October 2004; however, many people who had originally planned to move had changed their minds. In fact, 84 of the 184 units were still vacant by March 2008 and by the end of June all were sold off at the same low price of NT$2.62-2.69 million a unit; most purchasers were not local people.[35]

As for the reconstruction of public works, programs included repairs and reconstruction of electrical systems, telecommunications, irrigation, water supply, railroads, roads and bridges, as well as gas and oil. The Construction and Planning Agency at the Ministry of Interior conducted a survey on seismic retrofits for all public buildings during 6-23 October 1999. By the end of 2004, reconstruction of 1,287 office buildings had been completed. Moreover, 185 schools were reconstructed by the central and local governments and 108 by non-governmental organizations. For historical buildings, the Council for Cultural Affairs cooperated with a group of architects from universities to do investigations and proposed that 228 of these buildings should be preserved, and a three-volume report was published in November 2000. As for engineering, two barrier lakes created by the earthquake were under control in due course, and eco-engineering was introduced to reconstruct works

[34] *News Express*; EYCR 2006: 410.
[35] Wei Yu-hui 2002: 70-76; EYCR 2006: 409; Huang Mei-ying 2008: 126-128; *National Property*.

related to water and soil conservation.[36]

3.6 Further Reconstruction

For further reconstruction, the Cultural and Education Bureau initiated a self-reliance program with an order issued on 17 May 1935. This order provided guidelines for the programs regarding community-wide regeneration movements, promotion of folkways, improvement of dwellings, economic revitalization movements, and cultivation of concepts and behavior for public health. Based on this order, the two prefectures also drew up their own guidelines.[37]

After the 921 Earthquake, a four-year (2003-2006) program to revitalize the stricken areas was taken with emphases on: (1) Promoting the tourist industry through creating agricultural parks of tea, bamboo, flower, fruit wine, and holiday market; (2) Raising the competitive capabilities of local products and businesses; (3) Constructing a living environment in harmony with nature; and (4) Continuing to promote community empowerment, a program originated in 1994. The expenditures for this four-year program totaled NT$22,365 million.[38]

3.7 Government Budget and Private Donations

After the 1935 Earthquake, the expenditures of rescue and reconstruction totaled ¥15,798,645, of which 33.5% came from the national treasury, 4.1% from the prefecture, 7.4% from towns and villages, and 55.2% from other public sources. Uses included 5.5% for emergency rescue, 24.2% for rebuilding of railroad, telegraph and telephone systems, and 70.3% for reconstruction of houses, streets, irrigation systems, manufacturing, and self-reliance programs.[39] In addition, private donations totaled ¥1,747,821 (including ¥14,396.4 of interest), of which 25% came from Taiwan; 70% from Japan, Sakhalin, Manchuria and Korea; and 5% from other areas around the world. Uses included 22% for emergency rescue, 5% for shelters, 19% for relief, 6% for condolences for casualties and 30% for houses damaged, 16% for recovery public facilities, and 2% for gifts to schools.[40]

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[36] Lin Hui-cheng 2000; Chen Yi-shen 2001: 63-65; Huang Hsiu-cheng 2005: 590-596; EYCR 2006: 92-112, 186-222, 232-270.
[37] TGO 1936: 464-478.
[38] EYCR 2006: 435-471.
[39] TGO 1936: 531-532.
[40] TGO 1936: 335-339, 345.

In 1999-2001, the government allocated a sum of NT$212,359 million from the budget for reconstruction after the 921 Earthquake. By the end of June 2005, only 80.18% of this amount had been spent. This lag reflected problems of red tape in planning, poor communication between the central and local governments, inexperienced personnel, a lack of integration between the public and private sectors, and difficulties in obtaining suitable sites for constructing new communities.[41]

In addition, private donations totaled NT$37,500 million according to statistics provided by the National Alliance for Post-Earthquake Reconstruction, a volunteer group for supervising the use of donations. Of these donations, 39.5% were handled by 215 non-governmental groups, 35.7% by the central government's Reconstruction Fund, and 22% by local governments. By June 2000, non-governmental groups used donations mainly for school reconstruction (61.74%), assembled houses (11.04%), condolences (5.52%), and medical care (5.35%), with 4.32% remaining unplanned. Local governments used donations mainly for condolences (27.48%), recovery engineering (23.55%), school reconstruction (12.87%), and social welfare (10.43%), with 0.59% remaining unplanned. The Reconstruction Fund used some donations for house reconstruction (17.12%), social welfare (11.63%), and condolences (8.51%), but left 60.56% unplanned by August 2000.[42]

4. Concluding Remarks

In retrospect, the reconstruction experiences after the 1935 and 1999 earthquakes showed similarities in three respects: (1) The government responded quickly and emergency rescue operations worked quite well in providing medical care, temporary shelter, and relief; (2) The government budget was the major source for reconstruction, but private donations were indispensable supplements; and (3) An emphasis was given to revitalizing stricken areas after early reconstruction.

Key differences can be found in means of command and control. In 1935, Taiwan was under Japanese colonial rule, with the Taiwan Governor-General Office playing the main leadership role but the actual work of rescue and reconstruction being carried out by local authorities with the assistance of various local groups operating under the colonial system. In 1999, Taiwan was a democracy. The Executive

[41] EYCR 2006: 139-144; also see Chen Yi-shen 2001: 38, 211-212; Wu Kun-mao 2004: 46.
[42] Hsieh Kuo-hsing 2001: 57-62.

Yuan Reconstruction Committee played a key command role, but the reconstruction process was plagued by poor communication among different levels of the bureaucracy. Furthermore, in 1935 the efforts of a few private groups might symbolize a budding civil society,[43] while in 1999 the enthusiastic participation of a large number of non-governmental and religious organizations reflected a civil society that was becoming mature in postwar Taiwan.[44]

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[43] Sen and Wu 1996: 109, 131-133.
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