

Study on Reconstruction from a Natural Disaster and the Progress of Urban Shrinkage

— The Case of the Eruption Disaster of Mt. Unzen-Fugendake
in Shimabara, Japan —

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Abstract

Natural Disaster gives serious impact and damage to city structure not only by disaster itself but also by reconstruction project after this. In depopulation era like in Japan, it is necessary to consider reconstruction plan in urban shrinking context with future low demand. This study clarifies reconstruction situation after eruption disaster of Mt. Unzen and recent urban shrinking in Shimabara City in order to consider urban resilience lesson. This study takes empirical method with official planning documents research, interview to key persons, questionnaire survey, and so on, and clarifies as follows. Since the residents' intention and consciousness for reconstruction needs to be intensified in reconstruction from a large-scale disaster, the reconstruction plans tend to be expansion-oriented. However, it is an illusion that temporary reconstruction projects bring the recovery of population in local cities in Japan. As the case from Shimabara, the followings can be pointed out as the concrete necessity. First, it is necessary to prepare a plan for housing developments for survivors which considers the future maturation of the development areas (especially the selection of their locations and the necessity of public transportation) and to carry out land readjustment considering demand for land after completion. In addition, as symbolically indicated by the abolishment of a Shimabara Railroad line after its reconstruction, it is necessary to prepare reconstruction plans of public transportation based on a strict demand forecast. Furthermore, reconstruction projects should be incorporated into city planning considering its sustainability.

Keywords: Natural Disaster, Reconstruction, Urban Shrinkage, Resilience, Eruption Disaster of Mt. Unzen-Fugendake

1. Background and Objective of Study

A large-scale natural disaster is thought to be one of the causes of urban shrinkage, which later leads to population decrease and industrial decline in the disaster area,¹⁾ and the importance of urban resilience of such areas have been pointed out.²⁾ Urban resilience against disasters includes not only measures against human damage, such as disaster drills, but also general preventive measures which include both structural and nonstructural measures for supporting the maintenance and swift reconstruction of the community after the disaster. In addition to damage caused by the disaster itself, a large-scale natural disaster greatly influences the urban structure, population movements and the industrial structure of the disaster area in its subsequent reconstruction. For example, the urban structure of the area is largely changed by the extensive infrastructure development and the sites of restoration housing in reconstruction. On the other hand, if a disaster occurs in an underpopulated area or local city with decreasing population, the

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disaster further accelerates population decrease. It seems thus necessary in the reconstruction of an underpopulated disaster area to develop a reconstruction plan which considers the subsequent progress of urban shrinkage. This is because it is normally unlikely that the population of an area whose population has been decreasing starts to increase by reconstruction after a disaster. It is namely one of the important things to be considered for urban resilience. Since urban shrinkage resulting from population decrease is now a problem in many local cities in Japan, it is important to study how the past urban reconstruction from large-scale disasters influences urban development in the present age of population decrease.

Shimabara City in Nagasaki Prefecture, being studied here, experienced the eruption disaster of Mt. Unzen-Fugendake 1991 through 1995, and its reconstruction included extensive erosion and sediment control for the volcanic disaster area, road reconstruction, elevated land readjustment and housing development subsidized by the Development Promotion Project for Housing Developments for Disaster Survivors. While the population of Shimabara continues to decrease like other local cities, the progress of its reconstruction has not been fully elucidated yet 27 years after the disaster. The objective of this study is to clarify how the reconstruction projects influenced the city planning and urban structure of Shimabara City and to analyze the past reconstruction projects from the viewpoint of resilience to today's urban shrinkage by clarifying the problems in the living environment of the permanent housing developments for disaster survivors.

The Eruption Disaster of Mt. Unzen-Fugendake was reported everyday by the media partly because there were journalists and overseas seismologists among those killed by the pyroclastic flows which occurred in June 1991. The past studies of the disaster include many studies on the situation of damage and reconstruction. In the area of construction and city planning, there are studies on housing restoration and disaster housing construction^{3),4)} and those on the influence of setting restricted areas based on the Disaster Countermeasures Basic Act on the local industries.⁵⁾ Furthermore, Nagasaki Prefecture and Shimabara City published commemorative books of the disaster,^{6),7)} and comprehensive reviews of the disaster from its onset through reconstruction have also been issued.^{8),9)} In this way, many studies were done until about year 2000, when a series of reconstruction work was completed. In recent years, however, only a study on the disaster remains has been reported,¹⁰⁾ and there are few other studies. On the other case of large-scale natural disaster, lots of studies on the Great East Japan Earthquake, for example, have been done but almost all focus on reconstruction process methodology, contribution of citizen's activity for reconstruction or collaboration methodology connecting many kinds of stakeholders, and so on. Among them the study clarifying long term process of settlements reformation after past tsunami disaster would be interesting on the viewpoint that the sustainability of built environment could be pointed out with empirical method¹¹⁾. But it doesn't discuss the resilience from such a past context. There is less study done from the viewpoint of urban resilience, either.

2. Method of Study

This study consists of a survey of various statistical data, a survey of administrative documents, a hearing survey and a questionnaire survey as well as on-site surveys. We have obtained statistical data of populations and industries collected by the government, the prefecture and Shimabara City for our statistical survey, and documents related to city planning, such as the latest and the former City Planning Master Plans and city planning maps, and documents related to the reconstruction projects for our survey of administrative documents. In our hearing survey, we

inquired staff of the City Planning and the Policy Planning Sections of Shimabara City about the progress of various projects and the situations at the time of disaster, and also interviewed the resident representative coordinator for the town development of the Annaka Area and the housing relocation project for survivors about the situation at the time of disaster. ⁽¹⁾ We conducted a questionnaire survey of the residents living in three housing developments constructed in the reconstruction project and the land readjustment area, so-called Annaka Triangle Zone, in Shimabara on their living environments (described in detail in Chapter 5).

This report describes our study as follows. In Chapter 3, we summarize the course of the Eruption Disaster of Mt. Unzen-Fugendake and review the progress of urban shrinkage and the influence of the eruption disaster in Shimabara in terms of population and industrial trends based on basic statistical materials. In Chapter 4, we first outline the reconstruction projects and then analyze the influence of the reconstruction projects on the city planning and urban structure of Shimabara in view of the transition of the City Planning Master Plan and the changes of city planning maps. In Chapter 5, we clarify the survivors' present perception of their housing and their future issues based on the result of the questionnaire survey of the residents of the permanent relocation housing. Following the above chapters, we discuss in Chapter 6 the relation between the reconstruction after the disaster and sustainable city planning under population decrease.

It is noted here that we use the word "urban shrinkage" in a wider sense, expressing the declining trend of cities grasped in terms of indices related to population and industrial trends. While "urban shrinkage" in a narrow sense means the substantial shrinkage of city areas or the increase of spongy areas due to the increase of vacant houses and land, such a phenomenon in the narrow sense is not the direct object of analysis in this study.

In addition, urban resilience is quite an abstract conception but in the past last 20 years, resilience has not only become a popular policy metaphor but also an increasingly politicised concept. For example, Rockefeller Foundation has clarified the assessing index of urban and city resilience with three typologies or qualities of resilient system¹²⁾ and British Broadcasting Corporation (BBC) also has opened 31 indications of four domains (Business, Community, People, Place) in order to rank local community districts.²⁾ Among them, by taking 'Equilibrism' or 'Evolutionary' approach concept as typical two urban resilience approaches for planning practice, which highlighted by White and O'Hare¹³⁾, Shimabara lesson is discussed in the viewpoint of urban resilience in Chapter 6.

3. Eruption Disaster of Mt. Unzen-Fugendake and the Population Migration and Industrial Trends of Shimabara City

3.1 Overview of the Eruption Disaster of Mt. Unzen-Fugendake

Shimabara City is located in the Shimabara Peninsula, located in Western Kyushu. It is a typical small local city facing the Ariake Sea and having a population of more than 50,000 (Figure-1). Mt. Unzen-Fugendake is located nearly at the center of the peninsula. The eruption activity of the mountain started in November 1990, for the first time in 198 years since "Shimabara Taihen" (Shimabara

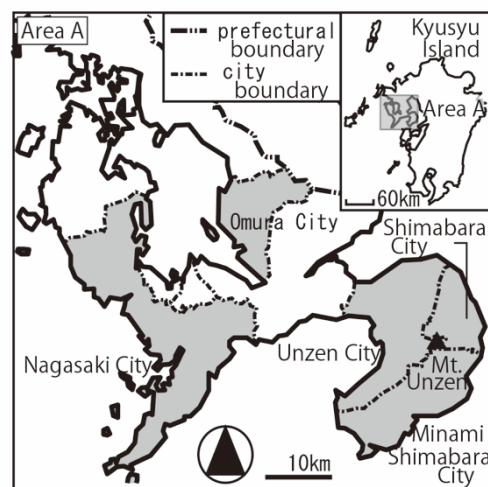


Figure-1 Nagasaki prefecture

Catastrophic Eruption) in 1792, and continued for more than four years until it was declared to have stopped by the Institute of Seismology and Volcanology of Kyushu University in March 1995 (Table-2). The main hazards during the period were firstly pyroclastic flows. Starting from the first pyroclastic flow in May 1991, a total of 9,432 pyroclastic flows occurred until the last flow in May 1996. Especially, the pyroclastic flow on June 3, 1991, resulted in 43 deaths and missing persons.⁶⁾ These pyroclastic flows completely destroyed the Kamikoba and the Senbongi Districts (Figure-5). The hazards also include the occurrence of debris flows containing volcanic deposits. Deposits of pyroclastic flows flew down with debris flows caused by heavy rainfalls and buried the basins particularly of the Mizunashi River and the Nakao River. According to the headquarters for disaster control at the time, the number of destroyed houses (totally, half and partially destroyed, and flooded) reached 1,399 as of June 1994.

3.2 Influence of the Disaster on Population

Table-1 Changes in population since 1980 by the National Census

population transition have, except for a slight degree of difference, a shape similar to those of Nagasaki Prefecture and Nagasaki City, and show a temporary population drop during the period affected by the disaster and then return to a shape similar to other cities. The same trend is seen in the transition of households. Namely, the disaster increased the degree of population decrease.

On the other hand, there are two main causes of recent population decrease (or urban shrinkage). The first is the decrease of birthrate and the increase of mortality. In the case of Shimabara City, the birthrate⁽⁴⁾ in 2015 was 8.74 while that in 1995 was 9.04, showing a decreasing trend. On the other hand, the mortality⁽⁵⁾ rapidly increased from 9.12 in 1995 to 14.42 in 2015. The second is

the increase of residents' moving-out to other cities in other prefectures. In the case of Shimabara City, the total balance of moving-outs and moving-ins in 10 years from 2005 to 2015 was an excess of 28 moving-ins (5,009 moving-outs and 5,037 moving-ins) for moving from or to other cities inside the prefecture, while it was an excess of 1,355 moving-outs (4,341 moving-outs and 2,986 moving-ins) for moving from or to other cities outside the prefecture. The largest destination of moving-out is Fukuoka City, which is the center city in the Kyushu area. The tendency of moving-out is especially strong in the age group of 18 through 25, which is related to entering colleges and employment. The trend arising from these two causes is typical for local cities in Japan.

3.3 Influence of the Disaster on Industrial Trends

The influence of the disaster on the industrial trends of Shimabara City is examined here in terms of the annual retail sales of goods, the shipment of manufacturing products and the amount of agricultural production.⁽⁶⁾ While industrial characteristics differ from city to city, the cities and the prefecture for comparison are the same as in Table-1. In the amount of agricultural production (Figure-2), Shimabara

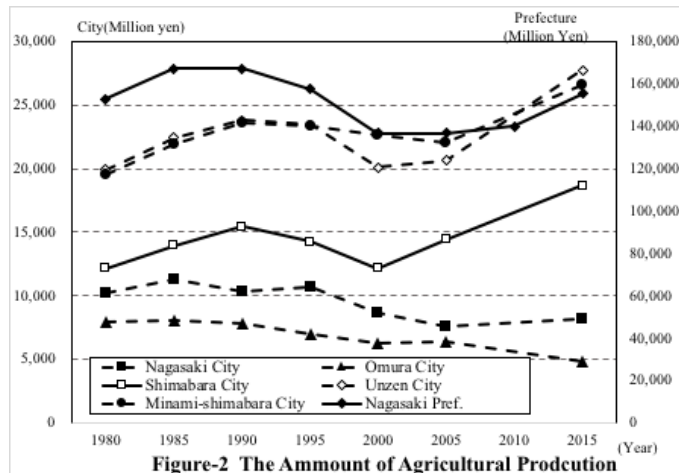


Figure-2 The Amount of Agricultural Production

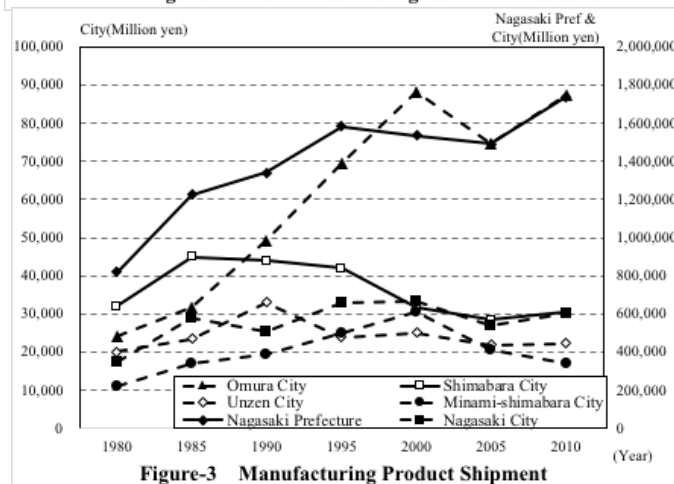


Figure-3 Manufacturing Product Shipment

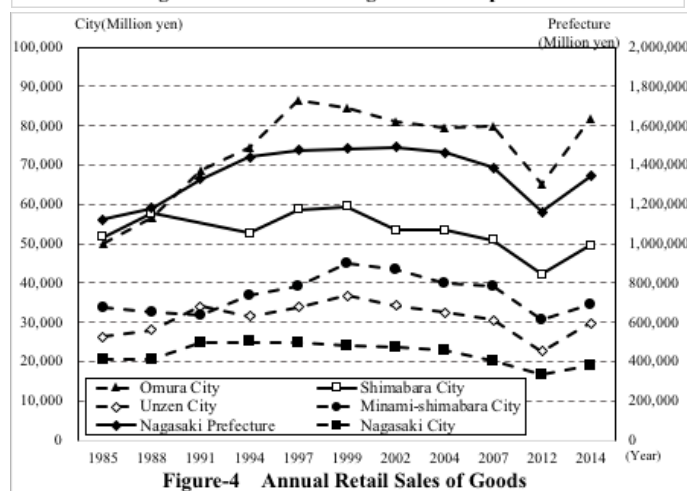


Figure-4 Annual Retail Sales of Goods

City shows a drop from 1990 to 2000. However, the influence of the disaster is not seen in this statistical data because the curve of Shimabara has almost the **similar** shape as that of Nagasaki Prefecture and no conspicuous drop is seen in the period of the disaster in the curve of Minami-Shimabara City. **From the shipment of manufacturing products (Figure-3)**, manufacturing power is weak in the three cities (Shimabara, Unzen, Minami-Shimabara) located in the Shimabara Peninsula, and their curves are different from those of Nagasaki Prefecture and Ohmura City, which show an increasing tendency. When compared with these three cities, Shimabara does not show an apparent drop due to the disaster. In the annual retail sales of goods (Figure-4), on the other hand, Shimabara City shows a slight drop in 1994, though data of 1991 is missing. Thus, statistical data of industrial production shows an influence of the disaster in retail sales but not in agriculture and manufacturing. It has also been shown that industrial trends do not simply decline following the today's trend of population decrease.

Thus, it has been shown that the Eruption Disaster of Mt. Unzen-Fugendake temporarily enhanced the tendency of population decrease and that the reconstruction projects after the disaster did not recover population. It has also been shown that, since the damaged areas were relatively limited, the disaster did not affect industry much and that the recent decreasing birthrate and aging population and the migration of population is accelerating urban shrinkage as in other local cities in Japan.

4. Influence of the Reconstruction Projects on the Urban Structure and Planning

4.1 Course of Setting Reconstruction-Related Plans

After the eruption disaster, Shimabara City set the first reconstruction plan "Shimabara City Reconstruction Plan" (Reconstruction Plan hereafter), whose basic policy was to rebuild residents' life, to construct a disaster prevention city and to vitalize the area, in March 1993, which was before the volcanic activity was declared to have stopped (Table-2). In view of the reconstruction of the basin of the Mizunashi River and the settlement of land utilization of the basin of the Nakao River, the city prepared the "Shimabara City Reconstruction Plan (Revised)" in March 1995 to present the basic policy of reconstructing Shimabara City after the disaster. A month later, in April, "The Plan for Promoting City Conditions of Shimabara City" was prepared. It was a general plan based on the Local Government Law and the fourth plan for Shimabara City. The plan offers comprehensive plans for the whole city regarding life, welfare, health, education, culture, commerce and industry, tourism, administration and public finance, which had been insufficiently considered in the Reconstruction Plan.

In March 1997, Nagasaki Prefecture and Shimabara City led other cities to prepare the "Action Plan for Restoring the Shimabara Area," which presented the restoration schedule of the whole area of the Shimabara Peninsula by substantiating the project schedule of the reconstruction plans. In addition, the national government (the former Ministry of Construction) clarified the direction of utilizing large designated areas of soil-erosion control by preparing the plan for utilizing designated areas of soil-erosion control in 1997. In this way, the national government, the prefecture and the city prepared reconstruction-related plans one after another from 1992, soon after the disaster, to 1997 and started reconstruction projects.

4.2 Outline of the Reconstruction Projects

The main reconstruction projects for the eruption disaster are the disaster prevention projects (A), such as the construction of check dams and training levees for the Mizunashi River, the land elevation and readjustment projects in the Annaka Triangle Zone (B), the housing construction

Table-2 Chronology of the Shimabara Volcanic Disaster and Reconstruction

Year	Volcanic Disaster	Reconstruction Plans	Disaster Prevention and Restoration Projects (Mizunashi River Basin)	Disaster Prevention and Restoration Projects (Roads and Railroad)	Housing Restoration	Projects for Annaka Triangle Zone
1990	• Eruption after 198 years (Nov)					
1991	• Lives were lost by pyroclastic flows. (Jun)	• Designation of the restricted areas based on the Disaster Countermeasures Basic Act. (Jun)				
1992			• Plan of Soil-Erosion Control Facilities • Subsidizing Project for Mizunashi River Disaster Restoration (~ 1995)	• Landfill of the Antoku Shore (~1995) • Construction of the Shimabara-Fukae Road (Route 57) (~ 1998)	• Announcement of the housing development plan (Funadomari Danchi, Nita Danchi)	
1993		• Reconstruction Plan (Shimabara City) • Unzen Disaster and Shimabara Peninsula Reconstruction and Promotion Plan (Nagasaki Pref)		• Farmland Restoration and Reconstruction Project(~2001)	• Funadomari Danchi was constructed. • Construction of Nita Danchi started.	• Elevation project started. (Survey)
1994			• Construction of Mizunashi River Training Levees (~2000)		• Sale of lots in Funadomari Danchi started. • Nita Danchi was completed.	
1995	• Volcanic activity ended.	• Revised Reconstruction Plan (Shimabara City) • Plan for Promoting City Conditions (Shimabara City)	• Construction of Mizunashi River Check Dam No. 1 (~ 1997)	• Elevation of Shimabara Railroad (~ 1995) • Construction of the Shimabara Mayuyama Road (~ 1999)	• Sale of lots in Nita Danchi started.	• Project of Elevating the Annaka Triangle Zone (~ 2000)
1996						• Plan of the land readjustment project was set. (~ 2002)
1997		• Plan for Utilizing Specified Areas of Soil-Erosion Control (Former Ministry of Construction) • Action Plan for Restoring the Shimabara Area (Nagasaki Pref, Shimabara City, Minamitakaki District Municipalities Assoc)	• Soil Erosion Control of the Mizunashi River Basin (~ 1998) • Construction of Mizunashi River Check Dam No. 2 (~1999)		• Construction of Uto Danchi started. • Sale of some lots in Uto Danchi started.	• Project of Disaster-related Land Readjustment for Farmland (~1998)
1998		• Urban Planning Master Plan (Shimabara City)			• Uto Danchi was completed.	
1999				• Construction of the Shimabara Reconstruction Arena (~ 2000)		
2000				• Construction of the Mt. Unzen Disaster Memorial Hall (~ 2002)		
2001		• Some areas are still (in 2018) designated as a restricted areas.	• Construction of Mizunashi River Check Dam No. 3 started.	• Construction project of the Shimabara Road (Route 251: Gamadasu Road)		

projects (C), the development projects for education/tourism facilities (D) and the road development projects (E) (the letters in parentheses corresponds to those in Figure-5).⁽⁷⁾ In the reconstruction projects (A), the national government and Nagasaki Prefecture led the construction of training levees and check dams mainly in the basins of the Mizunashi River and the Nakao River, whose levees were destroyed by debris flows (Table-2 and Figure-5 show the places and the progress described hereafter). The check dams were constructed in the Kamikoba and the Senbongi Districts, which were devastated by pyroclastic flows and debris flows. The national government purchased these areas after designating them as soil erosion control areas and carried out the projects. As of April 2017, 15 check dams have been constructed in Shimabara City, and their reinforcement and improvement are continued today.¹⁴⁾ In the land elevation project of the Annaka Triangle Zone (B), land of about 93.4 ha bounded by the Mizunashi River and its training levees was elevated. The project was originally proposed by survivor residents, and Shimabara

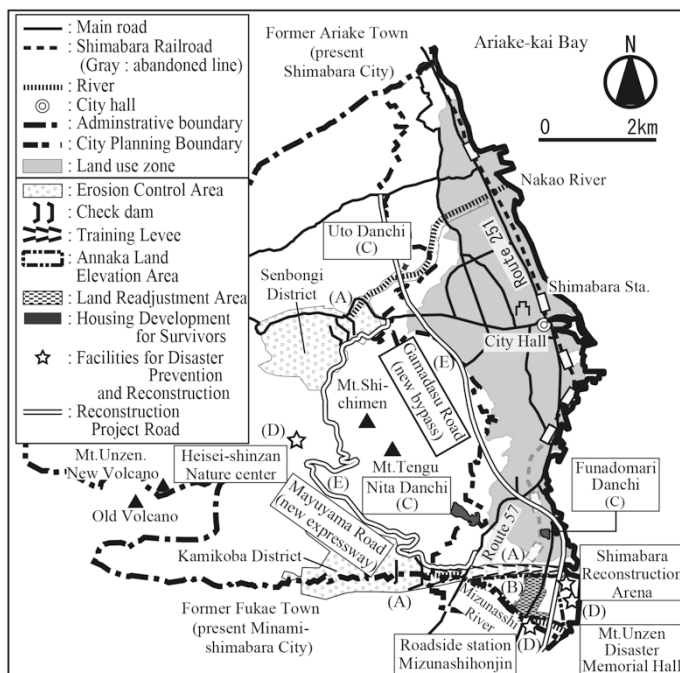


Figure-5 Reconstruction projects in Shimabara City

Funadomari Danchi (Housing Development) and the Nita Danchi were constructed by the Nagasaki Prefectural Housing Supply Corporation as permanent relocation measures for survivors in the disaster area of the Mizunashi River basin, and the Uto Danchi was constructed as housing for survivors in the Senbongi District. Since all these housing developments were for survivors, the construction was carried out as a public project which was considered to be a group relocation promotion project for disaster prevention.¹⁶⁾ In the development projects for education/tourism facilities (D), the Mt. Unzen Disaster Memorial Hall, the Shimabara Reconstruction Arena and a Michi-no-Eki (Roadside Station) were constructed in and around the Annaka Triangle Zone, according to the Action Plan for Restoring the Shimabara Area. In the road development projects (E), the Shimabara Road (the bypass for Route 251) and the Shimabara-Fukae Road (Route 57) were developed as regional high-standard roads mainly by the national government, and the Senbongi-Shimabara Port Road (Mayuyama Road) as a general road by Nagasaki Prefecture. The section damaged by the eruption disaster of the Shimabara-Fukae Road, or Route 57, which is about 4.6 km between Shimabara City and Fukae Town, was redeveloped. The Shimabara Road was designated as a regional high-standard road in 1994 by the national government, and its redevelopment was carried out as a national project.

In addition to these projects, the elevation of the Shimabara Railroad in the Mizunashi River Basin area was completed in 1996. In April 2008, about 10 years later, however, its section between Kazusa and Shimabara Outer Port was abolished because of the decrease of passengers, and the restored section, which was in this section, was thus discontinued.

4.3 Population target in City Master Plan of 1998

Urban planning master plans of municipalities are based on the revision of the Urban Planning Act in 1992. In Shimabara City, its first City Planning Master Plan was set in March 1998. Following the progress of the reconstruction-related plans described in Section 4.1 above, the Master Plan of Shimabara strongly reflects them. 18 years later, in January 2016, the Master Plan was revised. Firstly, we focus on the population target in this first Master Plan because another future target index like housing, infrastructure or industry weren't set in this plan. While in 1998

City cooperated with them in carrying it out as part of the Shimabara Reconstruction Project. A large amount of soil and sediment produced as a result of the eruption was used to elevate the land, and later the land was used to build houses in the land readjustment project and to restore farmland in the disaster-related farmland readjustment project.¹⁵⁾ In the housing construction projects (C), 842 houses were built as public housing for survivors by Nagasaki Prefecture, Shimabara City and private companies. Among the housing construction projects, the

Shimabara City hadn't consolidated with former Ariake Town yet, its population was 40778 in 1995. Putting this population in 1995 as the basis, the target of 2005 (10 years after) was set as 43000, the one of 2010 (15 years after) as 44000. Each rate against the population in 1995 corresponds to 105.4% (2005) and 107.9% (2010). But the actual population in former Shimabara City of 2005 was 38316 (-2462 from the target) and 36456 (-4322) in 2010. This difference clearly could show how the target was too large and overestimated. Moreover, the first master plan hadn't revised until 2016.

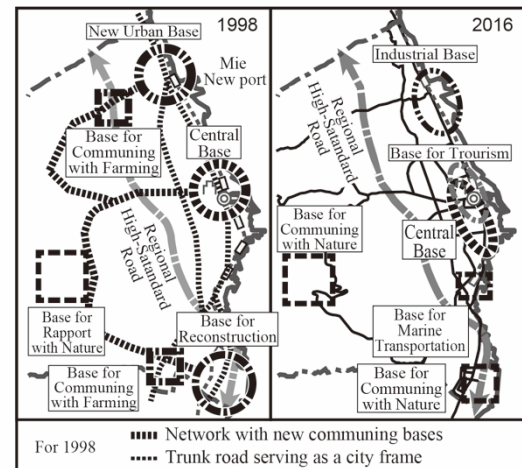


Figure-6 Transition of Urban Bases in the Master Plan

4.4 Transition of the City Planning Master Plan

Figure-6 compares the future images of city structure in the two Master Plans. The Master Plan of 1998 sets, in addition to the existing central urban base consisting of Shimabara Station and the City Hall, two landfill sites of the Reconstruction Project as urban bases comparable to the former (the "Base for Reconstruction," consisting of the Antoku Shore landfill site and the planned site of the Annaka Land Elevation Project, and the "New Urban Base," or the Mie Shore landfill site) and the "Network Connecting New Bases," or circular trunk lines, such as the north-south regional high-standard road (Shimabara Road) and the Mayuyama Road. The Master Plan was thus strongly expansion-oriented. While the development of a section of the Shimabara Road, the facilities construction project at the Antoku Shore landfill site (Mt. Unzen Disaster Memorial Hall and the Shimabara Reconstruction Arena), the land elevation project of the Annaka Triangle Zone and the development of the Mayuyama Road and the Heisei-Shinzan Nature Center were carried out, the road development project for the northern circular trunk lines was not. In addition, the initial urban base plan for the Mie landfill site was downgraded to a project of land utilization as an industrial site. As a result, the north-south regional high-standard road was the only trunk line and the "New Urban Base" was downgraded to an industrial base in the Master Plan of 2016. Furthermore, two "Bases for Communing with Farming" were omitted. In addition, the city planning master plans of many cities in Japan have adopted the idea of compact cities or intensive urban structure as the urban structure in the age of decreasing population since 2000, and the 2016 Master Plan of Shimabara City also states the idea. Consequently, the urban bases were reduced to only one base, and the "Base for Reconstruction" was downgraded to the "Base for Communing with Nature," although the facility in the base was completed (simply a facility set as a base). In other words, the Master Plan of 2016 does not set the reconstruction projects as projects for developing urban bases for expansion but sets as those for developing use-specific bases considering sustainable facility operation. Thus, although Shimabara City once sought an expansive city planning based mainly on the reconstruction projects, it has recently been changed.

4.5 Influence of the Reconstruction Projects on the Statutory City Planning

Figure-7 shows the modifications between the city planning map in 1987 and one in 2017. As for city planning roads, a high-standard road based on a reconstruction project was added as an city planning road, and a few of city planning roads were also added in the Annaka land readjustment area in South Shimabara. On the other hand, the addition of a high-standard road

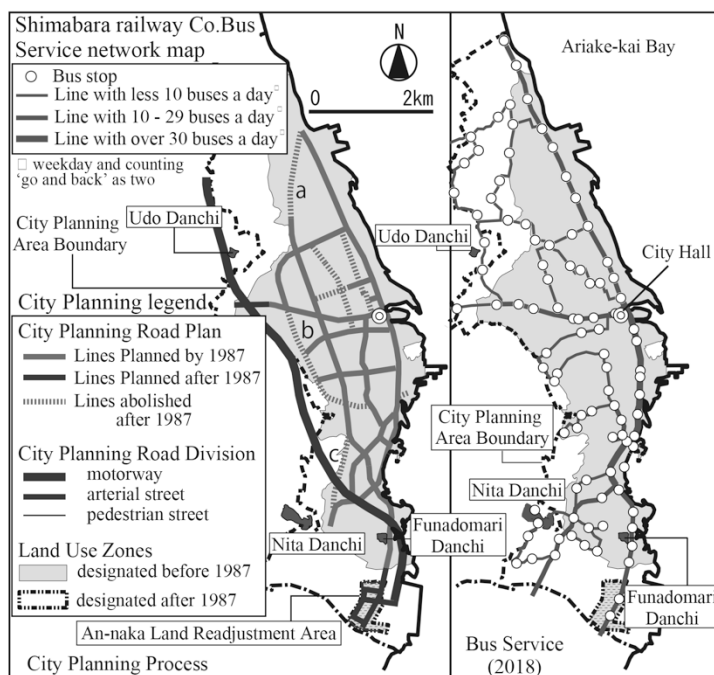


Figure-7 Map of City Planning Process And Bus Service in Shimabara

led to the abolishment of old north-south trunk roads (a, b, and c in Figure-7), causing the network breakage of trunk roads (the end of a road not connected to another). Although the trunk roads were abolished to prevent the redundancy of roads having similar functions, ⁽⁸⁾ the high-standard road is an expressway running outside the city planning area and does not fit in the road network constituting the city infrastructure because it has a character different from other city planning roads.

As for land utilization, only the Annaka land readjustment area in South Shimabara was added to the land use zones, with no other changes. Particularly, the three areas developed as permanent housing development for survivors, except for Funadomari Danchi, are located outside the city planning area and are not considered as part of city planning. This indicates that appropriate land of a certain size for housing developments for survivors could not be found readily inside the city planning area in a short period of time and that the later expansion of the city planning area did not include these areas. While these housing developments are considered to be permanent, the two areas remain to be special development areas isolated from the city planning area. Although both housing developments are connected to the bus line network, their access to other public transportation is poor, the service frequency of their lines being both less than 10 buses a day. This shows thus that city planning status is totally different between the Annaka land readjustment area, where land readjustment was carried out as a city planning project, and the housing developments for survivor relocation, or Nita Danchi and Uto Danchi.

Considering the relation with the City Planning Master Plan, the reconstruction projects were added as projects to the existing city planning and gave influence to the framework of urban structure, such as urban bases and trunk roads but not much to the land utilization plan. Thus, the addition of the projects was simply an addition at the time of emergency and did not extend to the land utilization plan, which is a city planning at ordinary times.

5. Current Situation of the Housing Developments for Survivor Relocation

Table-3 Overview: Housing Developments and Land Readjustment Area									
Project		Uto Danchi		Funadomari D.		Nita Danchi		Annaka Triangle	
		Project of Housing Developments for Survivors						Land Readjustment	
Size	Area (ha)	2.3		2.5		13.0		32.6	
	No. of Lots	32		51		141		407 (Reserve: 38)	
Period		1997 ~ 1998		1993		1993 ~ 1994		1996 ~ 2002	
Sale Started		Oct. 1, 1997		Jan. 31, 1994		Feb. 1, 1995		2002	
Rate of Use	Year	2005	2015	1996	2015	1996	2015	2005	2015
	Lots with houses*	31	31	48	51	73	109	151 (15)	182 (21)
	%	96.9	96.9	94.1	100.0	51.8	77.3	37.1	44.7
* The value in () under Land Readjustment is the number of reserved lots									

* The value in () under Land Readjustment is the number of reserved lots.

5.1 Overview of the Development of Housing Developments for Survivors

Based on the result of the questionnaire survey, this chapter clarifies the current situation of the housing areas for survivors. Table-3 shows the overview of the areas surveyed. As described before, the three housing developments of Funadomari, Nita and Uto were supported by the Development Promotion Project for Housing Developments for Disaster Survivors. They were completed and their houses were started to be sold in a relatively short time after the disaster. Funadomari Danchi and Uto Danchi were for survivors in the Kamikoba Area and the Mizunashi River Basin Area, and Uto Danchi for those in the Senbongi District. On the other hand, the Annaka Triangle Zone was developed based on the land readjustment project, and the project was completed later in 2002 because of, for example, the time necessary to consolidate the land owners' opinions.

The Annaka Area has a very low rate of used lots, being 44.7% even in 2015. While the sale of land in an area of land readjustment might depend the land owners' intentions, the rate of used lots is only 55.3% (21 lots out of 38 lots have been sold) even for the lots reserved for sale to supplement the project. Thus, even though the area was the central area assumed to be the "Base for Reconstruction," its urbanization has not progressed much because of recent urban shrinkage.⁽⁹⁾ On the other hand, while the housing developments for survivors were developed relatively earlier, the rate of used lots of Nita Danchi remained being 77.3% even in 2015. This seems to be because Nita Danchi has a large area (13 ha) and poor access to it, being located on a skirt slope of Mt. Tengu (Figure-5), as described below. Table-4 shows the overview of the questionnaire survey.

Table-4 Overview of the Questionnaire Survey

Target	All households in the areas of resident relocation and the Annaka Triangle				
Method	Direct distribution and collection by mail				
Period	July, 28 ~ August 25, 2017				
Areas	Areas of Relocation			Annaka Triangle*	Total
	Uto Danchi	Funadomari Danchi	Nita Danchi		
Distribution	28	51	109	151	339
Collected	10	17	15	42	84
Collected rate (%)	35.7	33.3	13.8	27.8	24.8

Table-5 Family Structure and Membership

		Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
		No	%	No	%	No	%	No	%	No	%
Structure	Single	1	10.0	0	0.0	1	6.7	3	7.1	5	6.0
	Couple only	1	10.0	5	29.4	5	33.3	13	31.0	24	28.6
	Parents and children	2	20.0	6	35.3	4	26.7	16	38.1	28	33.3
	Other	6	60.0	6	35.3	5	33.3	10	23.8	27	32.1
	Respondents	10	100	17	100	15	100	42	100	84	100
Membership	1	1	11.1	0	0.0	1	11.1	1	3.1	3	4.6
	2	0	0.0	3	20.0	3	33.3	10	31.3	16	24.6
	3~4	4	44.4	9	60.0	4	44.4	13	40.6	30	46.2
	5~6	2	22.2	2	13.3	1	11.1	8	25.0	13	20.0
	7 or more	2	22.2	1	6.7	0	0.0	0	0.0	3	4.6
	Respondents	9	100	15	100	9	100	32	100	65	100

Table-6 Time of Starting Residence (after the Disaster)

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
1991~1995	0	0.0	5	38.5	3	27.3	3	7.9	10	14.5
1996~2000	4	57.1	2	15.4	6	54.5	2	5.3	15	21.7
2001~2005	1	14.3	1	7.7	0	0.0	19	50.0	21	30.4
2006~2010	2	28.6	4	30.8	2	18.2	6	15.8	14	20.3
2011~2015	0	0.0	1	7.7	0	0.0	6	15.8	7	10.1
2016~	0	0.0	0	0.0	0	0.0	2	5.3	2	2.9
Respondents	7	100	13	100	11	100	38	100	69	100

Table-7 Place of Residence Before the Disaster

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Kamikoba District	0	0.0	4	23.5	2	15.4	1	2.4	7	8.6
Within the Annaka Area	0	0.0	11	64.7	8	61.5	24	58.5	43	53.1
Senbongi District	9	90.0	0	0.0	0	0.0	0	0.0	9	11.1
Other damaged areas	1	10.0	1	5.9	0	0.0	1	2.4	3	3.7
Old Shimabara City beside the above	0	0.0	0	0.0	1	7.7	7	17.1	8	9.9
Old Fukae Town	0	0.0	0	0.0	0	0.0	1	2.4	1	1.2
Old Ariake Town	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other than the above	0	0.0	0	0.0	2	15.4	6	14.6	8	9.9
Other	0	0.0	1	5.9	0	0.0	3	7.3	4	4.9
Respondents	10	100	17	100	13	100	41	-	81	-

There were a few of multiple answers of relocation areas under the Annaka Triangle.

5.2 Attributes of the Respondents

The attributes of the respondents of the survey are explained here in terms of the family structure, the initial time of residence at the present place and the place of residence before the disaster. Regarding the family structure (Table-5), while the family membership at Uto Danchi is slightly larger, no difference is seen among other areas. Thus, the main family

structure is either a nuclear family or a nuclear family living with the householder's parents (the membership being 3 ~ 6), followed by a married couple. The data of the initial time of residence at the present place reflects the time of completion of each housing development, showing that the number of households increased after completion (Table-6). The data of the Annaka Area reflects the characteristic of an area of land readjustment, showing that families continue to move in even in recent years. Furthermore, the data of the place of residence before the disaster (Table-7) shows that, while the place of residence before the disaster is mostly within the area of the current residence in each of the three housing developments, as described in the previous section, the Annaka Area has two groups: those who seem to be land owners and whose response was the "Within the Annaka Area" (58.5%) and those who purchased reserved lots and moved in ("Old Shimabara City beside the above" (17.1%), "Other than the above" (14.6%), etc.).

5.3 Overview of Houses and Lands and Changes of Family Structure

The area of the housing lot (Table-8) is mostly more than 200 m² in all housing areas, and a response of "300 ~ 500 m²" is the most (41.8%). This area size is fairly large even if low land prices in those local areas are considered. This is because the previous houses of many residents were farmer's houses in farming areas, and the areas of their previous lands were mostly "300 ~ 500 m²" (Table-8) in any housing areas. Therefore, the size of each lot was made somewhat larger, though not as large as the size of the previous land, in developing these housing developments. Among the

Table-8 Land Areas of the Present and the Previous House

	(m ²)	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
		No	%	No	%	No	%	No	%	No	%
Present	Under 150	0	0.0	2	14.3	1	8.3	0	0.0	3	4.5
	150-200	0	0.0	1	7.1	2	16.7	3	8.8	6	9.0
	200-300	1	14.3	9	64.3	3	25.0	6	17.6	19	28.4
	300-500	6	85.7	2	14.3	6	50.0	14	41.2	28	41.8
	Over 500	0	0.0	0	0.0	0	0.0	11	32.4	11	16.4
	Respondents	7	100.0	14	100.0	12	100.0	34	100.0	67	100.0
Previous	Under 150	0	0.0	2	14.3	0	0.0	3	11.5	5	9.4
	150-200	1	16.7	0	0.0	2	28.6	2	7.7	5	9.4
	200-300	0	0.0	1	7.1	0	0.0	3	11.5	4	7.5
	300-500	2	33.3	5	35.7	3	42.9	5	19.2	15	28.3
	Over 500	3	50.0	6	42.9	2	28.6	13	50.0	24	45.3
	Respondents	6	100.0	14	100.0	7	100.0	26	100.0	53	100.0

Table-9 Asset Price (land and building)

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Under 10 million yen	0	0.0	0	0.0	1	16.7	1	5.3	2	5.1
10-20 million yen	2	50.0	7	70.0	2	33.3	9	47.4	20	51.3
20-30 million yen	2	50.0	2	20.0	3	50.0	6	31.6	13	33.3
Over 30 million yen	0	0.0	1	10.0	0	0.0	3	15.8	4	10.3
Respondents	4	100.0	10	100.0	6	100.0	19	100.0	39	100.0

Table-10 Change of Family Membership

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Increase	3	30.0	1	5.9	7	46.7	6	15.8	17	21.3
Decrease	6	60.0	13	76.5	6	40.0	20	52.6	45	56.3
No change	0	0.0	1	5.9	1	6.7	8	21.1	10	12.5
Members changed but the same total	1	10.0	2	11.8	1	6.7	2	5.3	6	7.5
Other	0	0.0	0	0.0	0	0.0	2	5.3	2	2.5
Respondents	10	100.0	17	100.0	15	100.0	38	100.0	80	100.0

Table-11 Changes in the Family Structure after the Disaster (multiple responses)

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Child	6	85.7	12	80.0	5	71.4	17	77.3	40	78.4
Grandchild	0	0.0	0	0.0	0	0.0	1	4.5	1	2.0
Husband or wife	0	0.0	2	13.3	1	14.3	2	9.1	5	9.8
Brother or sister	0	0.0	0	0.0	0	0.0	3	13.6	3	5.9
Parent	4	57.1	9	60.0	2	28.6	13	59.1	28	54.9
Grandparent	1	14.3	1	6.7	0	0.0	3	13.6	5	9.8
Great grandparent	0	0.0	0	0.0	0	0.0	1	4.5	1	2.0
Other	0	0.0	0	0.0	1	14.3	1	4.5	2	3.9
Respondents	7	-	15	-	7	-	22	-	51	-

Table-12 Reasons of Leaving the House after the Disaster (multiple responses)

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Going to high school	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Going to college	1	14.3	3	20.0	1	14.3	3	13.6	8	15.7
Employment	3	42.9	10	66.7	2	28.6	9	40.9	24	47.1
Job change	0	0.0	0	0.0	0	0.0	1	4.5	1	2.0
Other job-related reasons	0	0.0	0	0.0	0	0.0	3	13.6	3	5.9
Narrowness of house	0	0.0	0	0.0	0	0.0	1	4.5	1	2.0
Moving in a welfare facility	0	0.0	0	0.0	1	14.3	0	0.0	1	2.0
Moving to a relative's house	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Death	5	71.4	10	66.7	2	28.6	15	68.2	32	62.7
Other (marriage)	0	0.0	3	20.0	2	28.6	4	18.2	9	17.6
Respondents	7	-	15	-	7	-	22	-	51	-

responses to the price of house and land after moving in, "10 million yen to 30 million yen" is the largest (Table-9). It has been reported that in some cases the sum of the support money from the prefecture and the city and donated money for the eruption disaster reached even 10 million yen per household.³⁾ This is possibly the reason why the residents could purchase expensive residence.

Table-10 shows the change of family membership after moving in the present place. The membership decreased in 56.3% of the households, much larger than the percentage (21.3%) of those of increased membership. While the percentages of increase and decrease are nearly equal in Nita Danchi, the percentage of decrease is considerably larger in all other housing areas. Table-11 shows changes in the family structure. Those who left the house are mostly child (78.4%) or the householder's parent (54.9%). The reasons of leaving the house (Table-12) are mainly death (62.7%), employment (47.1%), marriage (17.6%) and going to college (15.7%). It is seen in this data that the maturation of the housing areas for survivors is progressing about 25 years after the disaster. It is also seen that the number of young families, in which children can be expected in the future, is small in those areas and that the aging of families is rapidly progressing. The families whose responses are "Couple only" in Table-5 seem to include many of those who became couples alone because their children or parents had left the houses.

5.4 Residents' Evaluation of the Living Environment and Recognition of Problems

The reasons of moving in the present place (Table-13) are "Near from the previous house" (45.1%), being the largest, followed by "Reasonable price of land and house" (23.2%) and "Community remains the same as before" (19.5%). "Near from the previous house" has larger percentages in Funadomari Danchi and the Annaka Triangle Zone, and the response of land and house price and that of community maintenance have larger percentages in Uto Danchi and Nita Danchi. On the other hand, the items concerning the living environment, such as the size of land or house, the number of nearby stores and bus services, have very low percentages.

The evaluation of the present living environment was surveyed in terms of 16 items as shown in Table-14. The residents' evaluation is highest in Uto Danchi, followed by Funadomari Danchi. Uto Danchi was evaluated high for its

Table-13 Reasons of Moving in the Present Place (multiple responses up to five)

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
No other possible choice	2	20.0	4	23.5	2	13.3	4	10.0	12	14.6
Near from the previous house	3	30.0	10	58.8	4	26.7	20	50.0	37	45.1
Safty from volcanic and flood disaster	2	20.0	2	11.8	3	20.0	2	5.0	9	11.0
Larger land	0	0.0	0	0.0	0	0.0	3	7.5	3	3.7
Larger house	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Near to stores	1	10.0	2	11.8	1	6.7	0	0.0	4	4.9
Community remains the same as before	4	40.0	3	17.6	4	26.7	5	12.5	16	19.5
Wider roads for easy driving	0	0.0	1	5.9	0	0.0	7	17.5	8	9.8
Reasonable price of land and house	5	50.0	2	11.8	5	33.3	7	17.5	19	23.2
Good landscape	1	10.0	0	0.0	1	6.7	2	5.0	4	4.9
Near to workplace	1	10.0	1	5.9	1	6.7	4	10.0	7	8.5
Good bus service	0	0.0	1	5.9	0	0.0	0	0.0	1	1.2
Near to own farmland or other land	0	0.0	2	11.8	0	0.0	9	22.5	11	13.4
Other	4	40.0	2	11.8	5	33.3	3	7.5	14	17.1
Respondents	10	-	17	-	15	-	40	-	82	-

Table 14 Evaluation of the Present Living Environment

	Uto Danchi	Funadomari Danchi	Nita Danchi	Annaka Triangle	Total
Area of the site	3.9	3.4	3.2	3.6	3.5
Floor space	4.3	3.6	3.6	3.6	3.7
Quietness	2.9	3.9	3.4	3.7	3.6
Plenty of sunshine to house	3.9	4.1	3.5	4.1	4.0
Traffic safety	4.0	3.9	2.9	3.6	3.6
Convenient public transportation	3.2	4.1	1.8	3.0	3.1
Convenience of using a car	3.9	4.1	3.4	3.7	3.7
Near to daily stores	3.2	3.2	2.3	3.2	3.1
Surrounding landscape	4.0	3.4	3.6	3.7	3.6
Public order	4.1	3.8	3.5	3.7	3.7
Surrounding greenery	4.0	3.4	3.6	3.6	3.6
Wideness of roads	4.4	4.1	3.5	3.9	4.0
Playgrounds for children	3.3	3.1	2.9	3.2	3.2
Community closeness	3.6	4.1	2.7	2.6	3.1
Safty from disasters	4.2	3.6	2.6	3.4	3.4
Living comfort for seniors	3.5	3.6	2.5	3.5	3.3
Simple average	3.8	3.7	3.0	3.5	3.5
Respondents	10	17	13	40	80

* Each item is evaluated on the scale from 1 being very bad to 5 being very good. The values of 4 or more are shaded.

surrounding landscape, abundance of greenery and public order. Its location of being in a farming area outside the city planning area is evaluated high in terms of traffic safety. Since Nita Danchi is located on a mountainside of Mt. Tengu and cannot be approached in reality without a vehicle, its evaluation is low on the convenience of public transportation and the living comfort for seniors. In addition, the lack of stores inside the area has led to the very low evaluation on "Near to stores."⁽¹⁰⁾ These poor locational conditions have led to the lowest total evaluation of Nita Danchi,

and it is why the percentage of used lots is low. While the Annaka Triangle Zone has mostly average evaluations, its evaluation on the community closeness is low because new residents joined the community as a result of selling reserved lots.

Table-15 shows the recognized problems of the present living environment. "Inconvenient without a car" (63.8%), "Fewer children" (52.5%) and "Poor public transportation" (45%) mostly show large percentages in every area. In addition, some problems are unique to housing developments: high percentages of "Households only of seniors increased" (62.5%) in Funadomari Danchi and "Steep slopes for walking" (50%) in Nita Danchi. Thus, it can be said that, while the renewal of the family membership is scarce, the decrease of children and the aging of residents have rapidly progressed in the housing areas for survivors and the problems on living convenience for seniors are particularly focused. On the other hand, Table 16 shows that the positive prospect of the household successor is only 47% in total, combining "Already determined" and "Has a likely successor," while it is especially low (35.7%) in Nita Danchi, which has a low evaluation of the living environment. Maintaining these housing areas seems to be an issue in the future.

6. Summary and Discussion

Below, we summarize the obtained knowledge of this study and discuss the desirable form of the reconstruction project after a large-scale disaster while chronic urban shrinkage is expected.

1) Although the area directly damaged by the Eruption Disaster of Mt. Unzen-Fugendake was limited, its influence lasted for a long period of time. While the population of Shimabara City at the time was already in a decreasing trend, the disaster accelerated the trend. Although the population trend was returned to one similar to those of other cities by a series of reconstruction projects after the disaster, it was never recovered to a level of increasing population. It is also notable that restricted areas, where general people including the residents were strictly restricted for the first time in Japan, and that the Kamikoba Area and the Senbongi District, which were

Table-15 Recognized Problems of the Present Living Environment (multiple responses up to five)

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Inconvenience without a car	5	50.0	7	43.8	12	85.7	27	67.5	51	63.8
Poor public transportation	4	40.0	4	25.0	6	42.9	22	55.0	36	45.0
Steep slopes for walking	1	10.0	0	0.0	7	50.0	1	2.5	9	11.3
Households only of seniors increased	3	30.0	10	62.5	3	21.4	15	37.5	31	38.8
Vacant houses increased	0	0.0	0	0.0	1	7.1	0	0.0	1	1.3
Fewer children	7	70.0	11	68.8	8	57.1	16	40.0	42	52.5
Poorer public order	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Inconvenience for shopping	0	0.0	5	31.3	2	14.3	4	10.0	11	13.8
Difficulty of keeping the community	1	10.0	2	12.5	1	7.1	4	10.0	8	10.0
Insufficient playgrounds	1	10.0	3	18.8	2	14.3	5	12.5	11	13.8
Less lively	4	40.0	1	6.3	0	0.0	6	15.0	11	13.8
Other	0	0.0	0	0.0	0	0.0	1	2.5	1	1.3
Respondents	10	-	16	-	14	-	40	-	80	-

Table-16 Prospect of the Household Successor

	Uto Danchi		Funadomari Danchi		Nita Danchi		Annaka Triangle		Total	
	No	%	No	%	No	%	No	%	No	%
Already determined	2	20.0	6	35.3	2	14.3	9	21.4	19	22.9
Has a likely successor	2	20.0	4	23.5	3	21.4	11	26.2	20	24.1
Has no likely successor	3	30.0	4	23.5	5	35.7	4	9.5	16	19.3
Not considered yet	3	30.0	3	17.6	3	21.4	16	38.1	25	30.1
Other	0	0.0	0	0.0	1	7.1	2	4.8	3	3.6
Respondents	10	100.0	17	100.0	14	100.0	42	100.0	83	100.0

directly damaged by pyroclastic flows, were later designated as soil-erosion control areas, where no one is allowed to live.

2) The preparation of reconstruction plans started as early as 1992, when the eruption disaster still continued, and most of the various reconstruction plans prepared by the national government, the prefecture, the city and other municipalities were set by 1997. The reconstruction projects include the construction of check dams and training levees (the disaster prevention projects), the land elevation and readjustment projects in the Annaka Area, the housing construction projects including the construction of housing developments for disaster survivors, the development projects for various education/tourism facilities, such as the Shimabara Reconstruction Arena, and the road development projects, for example, the project of the Shimabara Road. While there still are ongoing projects (disaster prevention projects), they were mostly completed by the first half of 2000.

3) These reconstruction projects have brought changes in the future urban structure of Shimabara City by adding a new urban frame (the Shimabara Road as a high-standard road) and urban bases (the utilization of landfill sites and elevated land using volcanic ash soil produced in a large amount) and greatly influenced the city planning of Shimabara City. Particularly, the Shimabara Road and the Infrastructure Development Project of the Annaka Area (such as land readjustment and landfill) were completed, having brought changes in the urban structure. On the other hand, the land utilization planning was not changed much, and many of the housing developments for survivors have not been considered as part of city planning. While the large-scale projects at a time of emergency overrode the existing city planning, the construction of housing developments for survivors was not incorporated into the land utilization planning.

4) About 25 years after the disaster, the maturation of community is progressing in the housing areas for survivors. Especially in the housing developments for survivors, where the sale of lots was mostly limited to survivors, the influence of the decrease of children and the aging of residents is conspicuous, and securing living convenience for seniors, such as the convenience of public transportation, easy access to daily stores and the easiness of moving about, is an urgent issue. On the other hand, although new residents from other areas who bought reserved lots joined the community of the Annaka Area, such actions are weak under recent population decrease, and some lots remain unsold. In an area of large-scale land readjustment and a housing development with poor locational conditions, many lots remain unused.

Since the residents' intention and consciousness for reconstruction needs to be intensified in reconstruction from a large-scale disaster, the reconstruction plans tend to be expansion-oriented. In particular, the main projects for roads and facilities for reconstruction have the effect of adding new trunks and bases to the urban structure and easily bring the expansion of the outer area of the city as being an area where land acquisition in a short time is possible. As the case of Shimabara City shows, however, it is an illusion that temporary reconstruction projects bring the recovery of population in local cities in Japan, where population decrease is progressing on the whole, and it is important to devise reconstruction projects suitable for an age of urban shrinkage. Lessons we have learned from Shimabara City are as follows. First, it is necessary to prepare a plan for housing developments for survivors which considers the future maturation of the development areas (especially the selection of their locations and the necessity of public transportation) and to carry out land readjustment considering demand for land after completion (prospects for selling reserved lots and the occupation percentage of lots for landowners). In addition, as symbolically indicated by the abolishment of a Shimabara Railroad line after its reconstruction, it is necessary

to prepare reconstruction plans of public transportation based on a strict demand forecast. Furthermore, while it was before the idea of compact cities was incorporated in city planning when the disaster occurred, reconstruction projects should be incorporated into city planning considering its sustainability. Although the Master Plan of 2016 was changed to a plan of intensive urban structure, the operation and maintenance of the expansion-oriented large reconstruction-related facilities in the Annaka Area and the Antoku Shore Area will possibly be a serious problem in the future.

It is criticized that Japanese way of reconstruction from large-scale natural disaster is typical 'Equilibrist' approach⁽¹¹⁾ in the viewpoint of urban resilience against 'Evolutionary' approach.⁽²⁾ Like Japan, in disaster prone country and under the condition where many people demand faster recovery with the safer environment at the same place with before the disaster in many cases, it could be inevitable way. But in the case of 'Equilibrist' approach, it would be more difficult to fit the appropriate scale and to satisfy the rational demand from not only direct survivors but also many stakeholders without overestimation and overplanning, under quite a strong emotional tendency. In order to keep sustainable way discussed above concretely in the process of disaster reconstruction, we need to consider to turn to 'Evolutionary' approach.⁽¹²⁾ It might not be necessary to change drastically but it would be better way to add evolutionary approach policy on the basis of equilibrist way, it is considered.

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Notes

- (1) The dates of the hearing survey were December 1, 2016, February 6 and March 21 (also for the Policy Planning Section), 2017, for the City Planning Section of Shimabara City. We also inquired Mr. Tatsuro Ohmachi, as the resident representative coordinator for the reconstruction projects. The activity of the area by the Annaka Town Development Promotion Council and other groups received the Prime Minister's Award of the 19th Disaster Prevention Town Development Awards (Cabinet Office of Japan) in 2015, and Mr. Ohmachi received the award as the representative of the Council. We interviewed him on February 6 and March 21, 2017.
- (2) Based on Article 63 of the Disaster Countermeasures Basic Act. Once a restricted area is established, access to the area is restricted or prohibited with penalty for any persons other than those engaged in emergency measures.
- (3) These areas were later purchased for maintenance by the national government as erosion-control designated areas based on the Erosion Control Act.
- (4) The birthrate is the number of live births per 1,000 of the population. The national birthrate in 2015 is 8.0.
- (5) Mortality is the number of deaths per 100,000 of the population. National mortality in 2015 is 10.3.
- (6) The data for 1991 of Shimabara City in the annual retail sales of goods (Figure-4) was not collected because of the disaster. The data for 1980 of Minami-Shimabara City in the

shipment of manufacturing products (Figure-3) has not been revealed.

- (7) There were also farmland restoration projects, which are omitted in this report.
- (8) Tomohiro Yoshida, Sub-division Director of Shimabara City Planning Department, mentioned that the reason of abolishing these truck roads is the addition of new high-standard road called as 'Gamadas Road'(the nickname for this section of Shimabara Road), in the interview by the author.
- (9) Although a line of the Shimabara Railroad and its station together with a station plaza were developed in the land readjustment area, the line was abolished in 2008, and the sites of these facilities remain today as vacant land (Section 4.2).
- (10) Bus service in Nata Danchi hardly changes between the beginning and today. Because the nearest grocery store was closed around at the completion of Nita Danchi, shopping convenience is also the same situation, comparing those days and now. In sum, residents have been much dependent on their own car so that they feel inconvenient as they get older, it is considered.
- (11) Equilibrist approach is characterized as 'existing normality', 'preserve' or 'stability' etc. for aims, 'short term', 'reactive' or 'atomised' etc. for focus, 'techno-rational', 'vertical integration (top down style with state-support)', 'building focus' or 'homogeneity' for planning approaches¹³⁾.
- (12) Comparing with equilibrist, Evolutionary approach is characterized as 'new normality', 'transform' or 'flexibility' etc. for aims, 'medium to long term', 'proactive' or 'abstract' etc. for focus, 'sociocultural', 'horizontal integration', 'societal focus' or 'heterogeneity' etc. for planning approaches.

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