https://doi.org/10.20965/jdr.2012.p0147

Paper:

Analysis of Description of Local Disaster Management Plan for Smooth and Effective Wide-Area Support System During Large-Scale Disaster

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[Received September 13, 2011; accepted January 26, 2012]

This paper gives attention to the phase of safety of work in wide-area support and considers differences in description in local disaster management plans drafted by supporting local governments and supported ones, assuming that standardization of such descriptions could bring more smooth and effective implementation of plans. This paper targets desirable directions toward arrangement for a highly effective wide-area cooperation system. A framework is introduced in examining on what wide-area support should be like, referring to previous studies on actual situation of the support at the time of the 1995 Southern Hyogo Prefecture Earthquake and of the 2004 Mid Niigata Prefecture Earthquake. Then the disaster response activities in wide-area support are examines and local disaster management plans among different local governments are compared and differences in descriptions in plans. Necessary information for supporting sides and introduces the exchange of opinions with Kawasaki City that stood on the supporting side after the 2011 Great East Japan Earthquake is discussed. To make cooperation among the Japanese Government, prefectures, and municipalities more effective, the description of local disaster management plans should be standardized to some degree.

Keywords: local disaster management plans, wide-area support, large-scale disaster, the 2011 Great East Japan Earthquake

1. Introduction

At 14:46 on March 11, 2011, the 2011 off the Pacific coast of Tohoku Earthquake (Mw9.0) caused multiple disasters ranging from destruction by a tremendous tsunami to structural damage by seismic motion. It also triggered a nuclear plant disaster. Damage from the earthquake affected both the Tohoku region and Japan's northernmost island of Hokkaido and areas such as the Kanto region where Tokyo is located. Damage can be variously classified from direct, such as the destruction of buildings, to indirect, such as long-term economic stagnation.

In Otsuchi Town, Iwate Prefecture, for example, more than 30 local government officials, including the mayor, were killed by the tsunami and the functions of the town office were lost. The malfunction of municipalities that should have fulfilled major roles in responding to the disaster is characteristic of this earthquake. Another characteristic is the halting of activities in response to the disaster beyond the boundaries of prefectures due to the tremendous damage suffered simultaneously in the three prefectures of Iwate, Miyagi, and Fukushima.

Responding to the unprecedented situation, support has been provided based on various schemes nationwide. For support at the prefectural level, the National Governors' Association set up headquarters for emergency measures for wide-area disasters to inquire of the governors of the affected prefectures about the items of support required and to request that all governors nationwide prepare for the swift implementation of wide-area support such as the dispatch of staff for aid and relief and the provision of machinery and materials [1]. The Ministry of Internal Affairs and Communications of Japan issued a "notification on human support from other local governments to local governments affected by the earthquake." This requested every prefecture and every city designated by ordinance to provide cooperation in terms of dispatch of staff and to prepare to establish short-term human support in cooperation with the Japan Association of City Mayors and the National Association of Towns and Villages (**Fig. 1**) [2, 3].

In disasters that cause tremendous damage as in the case of this earthquake, the primary objective of wide-area support is the support of victims, i.e., the phase in terms of saving human life such as relief and aid. The safety of work, i.e., mitigation of the burden on officials of affected local governments, in the next phase of restoration and reconstruction is also expected to be aided by wide-area support.

For the support for victims, organized wide-area support has been provided by Japan's Self-Defense Forces,

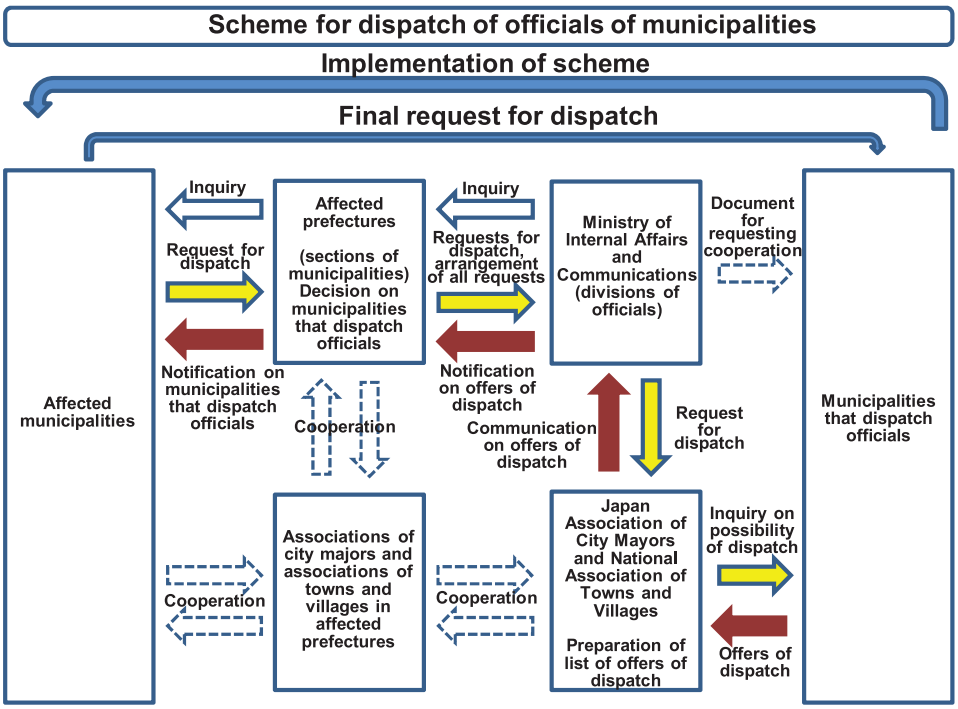

Fig. 1. Scheme for dispatch of officials of municipalities [3].

fire-fighters, the police, etc. For the safety of work, health examinations [4] that the branch of Miyagi Prefecture of the All Japan Prefectural and Municipal Workers Union conducted for union workers of local governments gives the following different view. According to results, officials who did not take any holiday for one month after the occurrence of the earthquake account for 12.7%, those who took less than two holidays (including under the previous item of 21.7%), and those who worked overtime more than 100 hours, 13.4%. Officials who indicated "slight to moderate inclination of depression" based on the judgment of mental health examinations account for nearly 50%. As seen from these results, although wide-area support has been provided, this could not lead to the sufficient mitigation of the workload of the officials of the affected local governments. This is thought to be related to the problem recognized in the 1995 Southern Hyogo Prefecture Earthquake where, although support was provided by wide-range organizations, many local governments could not manage to respond to the daily changing situation of the disaster-stricken area, because no official in charge of disaster management had been appointed in advance [5].

The causes of these problems have been rarely analyzed in previous studies. The following causes can, however, be mentioned: 1) lack of necessary resources due to an imbalance in supply and demand, 2) increase of labor hours due to examination and coordination on how to respond to the disaster because both supported and supporting officials of local governments have no experience in this field, 3) overlapping of work due to instructions to inexperienced officials or groups working with them, even if either of supported or supporting officials had such experience.

For cause 1), a study on the actual conditions of supply and demand of support in disaster-stricken areas after the 1995 Southern Hyogo Prefecture Earthquake [6] can be given. This study pays attention to the changing pattern of support in the disaster-stricken area in the passage of time, for example, the demand of some support is large immediately after the occurrence of the earthquake, but is not needed after a time, or demand for other support increases immediately after the occurrence of the earthquake and decreases as time passes.

For causes 2) and 3), almost no study has been conducted so far on these themes. It can be easily guessed that many officials of local governments have no experience in response to disaster except for a limited number of local governments, so it would be difficult for inexperienced officials to understand and grasp how to respond to disaster in disaster-stricken areas. As a result, officials of the affected local governments must act and work together with support of inexperienced officials who could not lead to mitigation of the workload. Under these circumstances, wide-range cooperation cannot to be said to produce satisfactory results. In order to realize effective and wide-ranging cooperation and mitigate the workload of supported officials in disaster-stricken areas, a system should be established for supporting officials to take over work smoothly and effectively.

For this purpose, the idea of standardization of united and common work to respond to disaster irrespective of the location of the disaster-stricken area [7] and that of local disaster management plans to work in cooperation [8, 9] have been proposed. This is not, however, an easy approach at all.

Table 1. Framework for wide-area support.

<table>
<tr><th>Classification</th><th>Outline</th></tr>
<tr><td>Supporting subject</td><td>●Public support by central and local governments
●Support by nongovernmental organizations (NGO) such as the Japanese Red Cross Society and academic societies, and private enterprises
●Support by volunteers</td></tr>
<tr><td>Contents of support</td><td>Kinds of support
●Human support: provision of human resources for promotion of relief activities and restoration work
●Material support: covering of lack of food, drinking water, clothes, and every kind of machinery and materials in disaster-stricken areas
●Provision of facilities: provision of facilities and land possessed by local governments such as space for living and residences such as housing and schools, and space for activities and work
●Economic support such as sending of gift of money

Kinds of support and phases
<table>
<tr><th rowspan="2">Phase</th><th colspan="3">Restoration period</th><th rowspan="2">Reconstruction period</th></tr>
<tr><th>Short-term</th><th>Medium-term</th><th>Long-term</th></tr>
<tr><td>Human support</td><td>Disaster relief
Medical activities
Survey of disaster</td><td>Restoration of lifelines</td><td>Consultation
General office work</td><td>Consultation on planning of reconstruction project</td></tr>
<tr><td>Material support</td><td>Food and water
Medicine
Blankets and clothes
Machinery and materials for relief</td><td>Water supply vehicle
Garbage vehicle
Rescue vehicle</td><td>-</td><td>-</td></tr>
<tr><td>Provision of facilities</td><td>Hospital
Crematorium</td><td>Housing and schools
Retirement homes</td><td>-</td><td>Vacant land</td></tr>
<tr><td>Economic support</td><td>-</td><td>-</td><td>-</td><td>Reconstruction fund</td></tr>
</table></td></tr>
<tr><td>Motivation for support</td><td>●Request
Requests are reported from higher organizations such as government ministries and agencies and prefectures to various kinds of other organizations and carried out through administrative procedures to communicate the items required for support such as disaster situations, reasons for requests, and periods of dispatch.
●Prior agreement
Agreement is made with multiple local governments for support among others at the time of disasters.
●Independent decision making
Supporting side makes decisions on support based on judgment of damage situations, unlike for cases of requests and prior agreement, however, although opinions in disaster-stricken areas are checked in advance.</td></tr>
</table>

Accordingly, this paper gives attention to the safety of work in wide-area support and considers differences in description in local disaster management plans drafted by supporting local governments and supported ones, assuming that standardization of such descriptions could bring more smooth and effective implementation of plans. This paper targets desirable directions toward arrangement for a highly effective wide-area cooperation system.

In Chapter 2, a framework is introduced in examining on what wide-area support should be like, referring to previous studies on actual situation of the support at the time of the 1995 Southern Hyogo Prefecture Earthquake and of the 2004 Mid Niigata Prefecture Earthquake. Chapter 3 examines the disaster response activities in wide-area support. Chapter 4 compares local disaster management plans among different local governments and differences in descriptions in plans. Chapter 5 takes up the theme on necessary information for supporting sides and introduces the exchange of opinions with Kawasaki City that stood on the supporting side after the 2011 Great East Japan Earthquake.

2. Framework for Wide-Area Cooperation

Table 1 shows the framework for wide-area cooperation, referring to previous studies on the wide-area support at the time of the 1995 Southern Hyogo Prefecture Earthquake and the 2004 Mid Niigata Prefecture Earthquake.

In the survey on actual conditions and analysis of factors of support at the time of the Great Hanshin-Awaji Earthquake [10], the forms of support are classified into three categories, namely, supporting subjects, contents of support, and motivation for support. Supporting subjects refers to the following three: public support, nongovernmental organizations (NGOs) and private enterprises, and volunteers. Contents of support are classified into human support providing human resources for the promotion of relief activities and restoration work; material support making up for the lack of food, drinking water, clothes, and every kind of machinery and materials in disaster-stricken areas; provision of facilities providing facilities and land possessed by local governments such as space for life and residence such as housing and schools, and space for activities and work; and economic support such

as the sending of money. In the study, each category of contents of support is arranged corresponding to each phase for restoration and reconstruction. Motivation for support is lastly classified into requests from higher organizations such as government ministries and agencies, and prefectures to various kinds of organizations; prior agreement agreeing for multiple local governments to support others at the time of disaster; and independent decision making in which the supporting side makes the decision on support based on its own judgment of the disaster situation.

In the case study on the 2004 Mid Niigata Prefecture Earthquake [11], wide-area support is classified into contents and IT systems and considered focusing on IT systems.

3. Disaster Response Activities in Wide-Area Cooperation

In order to implement support smoothly and effectively, it is important to create consistency in the contents of support between work on the supported side and work on the supporting side.

In this chapter, focusing on standardization of disaster response activities such as clear definition and systematization of activities and local disaster management plans that were made by local governments, problems are identified and directions are proposed toward realization of disaster response activities arranged for wide-area cooperation.

(1) Standardization of disaster response operation

In order to realize effective wide-range cooperation and mitigate the workload of officials in disaster-stricken areas, the system should be established for supporting officials to take over work more smoothly and effectively. For this purpose, common work is needed for responding to disasters irrespective of location of disaster-stricken areas, in other words, standardization of disaster response activities.

In a previous study [7], disaster response activities were classified into three categories by analyzing work in basic disaster management plans using flowcharts and graphs of procedures for information processing. These categories were 1) work specific to individual organizations, 2) work having common procedures for implementation, and 3) work needing cooperation among organizations. In order to promote the standardization of disaster response activities, training should be provided and conferences should be held for coordination corresponding to the categories of the above classified work.

For standardization of disaster response activities, work should be classified into 1) that in need of judgment based on the situation and 2) that without need for judgment, i.e., unskilled work. Furthermore, it is also important for standardization of activities to prescribe from this work the information necessary for implementation of the input information to be transmitted and organizations or to post conducting of such work. For the realization of such a way of thinking, for example, the method of standardization of the production process in the manufacturing industry, would be helpful [12].

Theoretically, standardization of activities enables work to be implemented uniformly nationwide. Damage, however, presumably differs with the region, therefore all kinds or patterns of damages that each local public organization need to prepare and all differences in regional characteristics must be taken into consideration, so this actually means that the standardization of activities is not actually an easy approach at all.

(2) Local disaster management plans

a) Tolerance of local disaster management plan of municipalities

Local disaster management plans are constrained by basic disaster management plans, and operational plans for disaster management. In the process of consultation on revision of local disaster management plans of prefectures, opinions are inquired from all government ministries and agencies through the Fire and Disaster Management Agency. For local disaster management plans of municipalities, consultation on revision is to be conducted with governors (Art. 42 Sec. 3, Disaster Countermeasures Basic Act). Accordingly, it is assumed that tolerance in establishing local disaster management plans for municipalities is larger than in the case of such plans for prefectures [13].

In order to make wide-area cooperation among municipalities more effective, it is important to promote the standardization of operational plans for disaster management between supporting sides and supported sides and to attempt to unify local disaster management plans as much as possible, if any agreement on support is made between municipalities.

b) Local disaster management plans for mutual cooperation

In the case of a large-scale disaster beyond the boundaries of prefectures, Art. 3 Sec. 2 of the Disaster Countermeasures Basic Act stipulates “implementation, promotion, and general coordination of activities or work in which local public organizations, designated public organizations, and designated local public organizations are involved” and indicates the coordination function fulfilled by the central Government. The basic disaster management plan, however, describes such activities or work abstractly and entrusts concrete contents to local disaster management plans and operational plans for disaster management. Under the circumstances, the central Government is not expected to coordinate various local disaster management plans [13].

Being aware of the above problems, the special committee on earthquake disaster management of the future of the Central Disaster Management Council mentions

the following proposal as a possible practical system for risk management: for the purpose of establishment of the arrangement for wide-area disaster management, the arrangement for mitigation of an earthquake disaster beyond the boundaries of prefectures should be improved by making out plans for wide-area disaster management activities beyond the boundaries of municipalities, unifying and standardizing the various systems for disaster management, information, equipment, and machinery and materials and implementing wide-area relief activities correctly and swiftly, and emergency routes should be established to support such arrangement [8]. The Fire and Disaster Management Agency of the Ministry of Public Management, Home Affairs, and Telecommunications also published guidelines for planning local disaster management plans for wide-area disaster management in areas beyond the boundaries of prefectures [9]. According to findings about problems of local disaster management plans used among municipalities in this report, the significance and necessity for making out local disaster management plans used among municipalities is indeed referred to, but the following problems are also pointed out: at the first stage of a volcano disaster, the individual municipalities, not the council for volcano disaster management, must respond to the disaster, referring to the Disaster Management Plan on the Usu Volcano, or how new disaster management plans and every kind of manual should be drafted, referring to the Disaster Management Plan on the area affected by the Komagadake Volcano.

(3) Significance of standardization of description in local disaster management plans

In order to ensure more tolerance in contents and procedures, more action programs that are administrative documents showing the work each local government should accomplish based on each objective comprehensively and systematically have been made out in addition to local disaster management plans [13]. Many manuals have been drafted that describe the details of procedures of individual work to be implemented, and these manuals have been often used for implementation of work at the time of a disaster. Under the current situation, local disaster management plans, disaster management plans for mutual cooperation, action plans, and every kind of manual coexists in the same local public organization. All documents are termed "disaster management plan" hereafter in this paper. To raise the unique effectiveness of work of each local government, action programs and every kind of manual, rather than local disaster management plans, have often been revised.

Seen from the viewpoint of effectiveness of wide-range cooperation, the coexistence of every kind of disaster management plan with high individuality is likely to cause ineffectiveness and friction due to differences in the recognition and understanding of disaster response activities between supporting sides and supported sides in fields of work other than those within the range of ordinary procedures. This could hamper the smooth implementation of wide-area support.

In action programs and every kind of manual, the concrete situation of individual local governments such as the supposed disaster is reflected. Standardization of these individual documents for the purpose of wide-range support would deprive of the functions they are originally expected to fulfill by local governments. As mentioned above, standardization of disaster response activities is actually not an easy approach and the workability of disaster management plans for the mutual cooperation of local public organizations is still low under current conditions.

In the United States, disaster response activities are classified into 15 categories and defined in the framework of emergency support functions (ESF) in national response plans (NRP). Individual US states stipulate disaster response activities within frameworks similar to ESF. Even if there is no methodology for standardized disaster response activities in Japan, any formal framework on disaster response activities such as ESF could be promoted to grasp the correspondence of work among local governments as exemplified by the question, "What part is the same, and what is different?"

Therefore, in order to realize more smooth and effective arrangements for wide-area support in local disaster management plans that are master plans for local governments and the action programs and every kind of manual describing concrete guidelines and procedures for implementation of master plans, it is important to promote consistency and standardized description of local disaster management plans as master plans. This is because even if action program or manuals are revised for improvement in implementation, differences of master plans that constitute the base for such action programs and manuals would hamper the realization of more smooth and effective arrangement for wide-area support.

Many local governments have already published their local disaster management plans on the web site, so local disaster management plans of both supporting sides and supported sides can be grasped in advance. In this regard, the promotion of the consistency and the standardization of descriptions in local disaster management plans are considered to be significant.

4. Comparison and Analysis of Local Disaster Management Plans

Although the significance of the consistency and standardization of descriptions of local disaster management plans is mentioned above, the following problems have been pointed out in current descriptions of disaster response activities in local disaster management plans: 1) the mutual relationship among descriptions of each work is unclear and 2) the degree of minuteness and roughness of descriptions is uneven [14]. Accordingly, local disaster management plans of local governments are compared and analyzed in this chapter. As the object of comparison and analysis, local disaster management plans of Yokohama City, Kawasaki City, and Sagamihara City, all in

Table 2. Comparison of lists of contents of local disaster management plans (extract).

Phase	Item	Yokohama City		Kawasaki City		Sagamihara City		Sendai City	
		Chapter	Section	Chapter	Section	Chapter	Section	Chapter	Section
Emergency response	Headquarters for disaster response	Chapter 2 Establishment of headquarters for disaster response	Section 1 Establishment of headquarters for disaster response of Yokohama City	Chapter 1 Organization	Section 1 Headquarters for disaster response	Chapter 1 Activities of headquarters for disaster response of the city	Section 1 Arrangement of organizations	1 System for disaster response activities	1 System for disaster management organizations
			Section 2 Abolition and reduction of headquarters for disaster response of Yokohama City	Chapter 3 System for initial response (Part 3 Plan for initial disaster response)	Section 1 System for initial response of staff of headquarters for disaster response				2 System for communication
			Section 3 Organization and management		Section 2 System for initial response of headquarters for disaster response and headquarters of ward				3 Warning system
					Section 3 Initial response of headquarters for disaster response and headquarters of ward				4 Headquarters for disaster warning of Sendai City
									5 Headquarters for disaster response measures of Sendai City
	Evacuation	Chapter 8 Evacuation and acceptance of victims	Section 1 Evacuation plan	Chapter 4 Measures for evacuation	Section 1 Evacuation plan	Chapter 2 Measures for fire-fighting and evacuation guidance	Section 2 Measures for evacuation guidance	7 Evacuation plan and plan for management of shelter	1 Organizations and businesses involved
			Section 2 Evacuation and acceptance of victims		Section 2 Establishment and management of shelter	Chapter 6 Management of shelter	Section 1 Measures for management of shelter		2 Implementation of recommendation of evacuation
									3 Designation of warning areas
									4 Evacuation guidance
									5 Evacuation of residents
									6 Evacuation to designated shelters
									7 List of shelters
									8 Establishment of shelter and accommodation of victims
									9 Management of shelter
			Section 3 Measures for evacuation and support of those who need protection			Chapter 12 Support of those who need protection at the time of disaster	Section 1 Support of those who need protection at the time of disaster	19 Plan to respond to those who need protection at the time of disaster	1 Organizations and businesses involved
									2 Principles for response
									3 Emergency measures for the aged and the handicapped at home
									4 Emergency measures for social welfare facilities, etc.
									5 Measures for support of non-Japanese citizens
									6 Care at shelter
									7 Care for inhabitants in temporary housing
			Section 4 Establishment and management of special shelter						
			Section 5 Measures to prevent confusion at main stations, etc.	Chapter 5 Prevention of confusion, support of commuters	Section 1 Measures to prevent confusion caused by inappropriate information	Chapter 2 Measures for fire-fighting and evacuation guidance	Section 3 Support of commuters	7 Evacuation plan and plan for management of shelter	
					Section 2 Measures to prevent confusion at terminal stations, etc.				10 Measures for evacuation guidance for tourists
					Section 3 Support of commuters				
	Transportation	Chapter 10 Safety of transportation	Section 1 Safety of transportation route	Chapter 8 Transportation plan	Section 1 Goods to be transported and transportation methods			11 Plan for emergency transportation	1 Organizations and businesses involved
			Section 2 Safety of transportation system		Section 2 Safety of roads for emergency activities				2 Goods to be transported
					Section 3 Base for collection and delivery of relief goods				3 Safety of road traffic
					Section 4 Location and coordination of airplane arrival and departure				4 Safety of transport vehicles
									5 Transportation by airplane
			Section 3 Improvement in marine transport						6 Transportation by watercraft
			Section 4 Base for collection and delivery of materials						
									Coordination on emergency transportation at the time of disaster
	Stability of social life	Chapter 12 Stability of social life	Section 1 Emergency water supply	Chapter 7 Supply of drinking water, food, and commodities	Section 1 Supply of drinking water	Chapter 7 Support of life of victims	Section 1 Measures for emergency water supply	9 Emergency water supply and restoration plan	1 Organizations and businesses involved
									2 Emergency system at the time of disaster
									3 Plan for emergency water supply
									4 Plan for emergency restoration
									5 Method of communication under emergency system
									6 Request for support of organizations
									7 Other measures for emergency water supply
			Section 2 Food supply		Section 2 Food supply		Section 2 Measures for food supply	8 Plan for food and relief goods	1 Organizations and businesses involved
									2 Relation to Disaster Relief Act
									3 Food supply
			Section 3 Supply of commodities		Section 3 Supply of commodities		Section 3 Measures for supply of commodities		4 Supply of commodities
					Section 4 Request for support				5 Stability of supply
			Section 4 Acceptance and distribution of relief goods		Section 5 Safety of drinking water and food for staff engaged with disaster response activities				6 Acceptance and distribution of relief materials
			Section 5 Disposal of disaster waste such as sewage and garbage	Chapter 10 Plan for disposal of disaster waste	Section 1 Disaster waste to be treated	Chapter 9 Measures for cleaning	Section 1 Cleaning and disposal of rubbles etc.	17 Plan for cleaning	1 Organizations and businesses involved
					Section 2 Organizations engaged with disposal of disaster waste				2 Basic policies on cleaning plan at the time of disaster
					Section 3 Basic policies on disposal of disaster waste				3 Improvement in emergency system
					Section 4 Business of general affairs team				4 Collection and transportation of general garbag
					Section 5 Business of disaster waste disposal team				
					Section 6 Business of garbage collection team				5 Disposal of the rubble
					Section 7 Business of garbage disposal team				6 Collection and disposal of livestock corpses

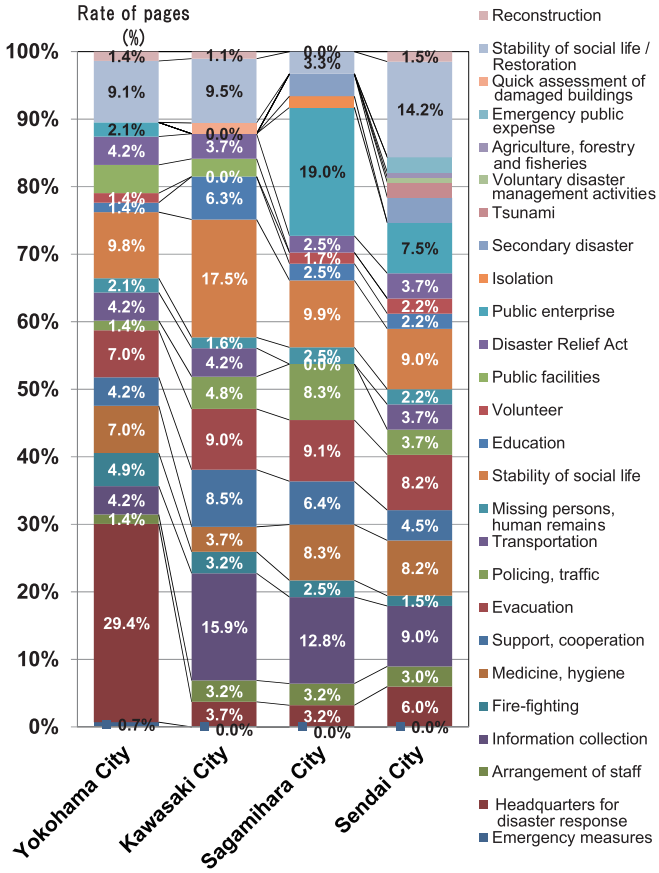

Fig. 2. Comparison of rate of pages in local disaster management plans of municipalities.

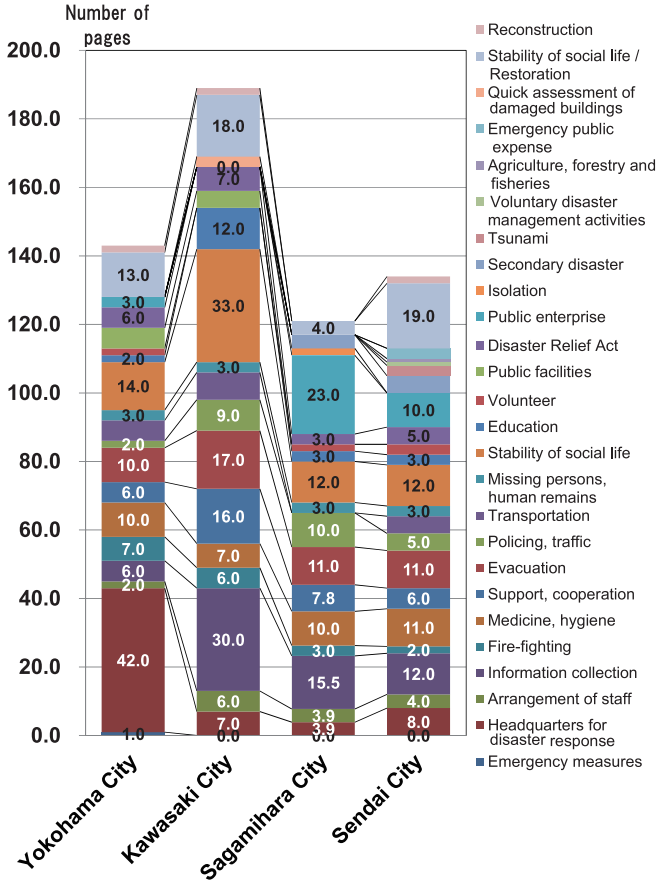

Fig. 3. Comparison of number of pages in local disaster management plans of municipalities.

Kanagawa Prefecture and standing on the supporting side at the time of the Great East Japan Earthquake and that of Sendai City, Miyagi Prefecture, standing on the supported side are selected. The themes of emergency measures, restoration, and reconstruction are taken up from the chapter on measures for earthquake disasters. As reasons why these cities were selected as supporting sides in comparison and analysis, the following conditions can be given: they actually provided wide-area support at the time of the Great East Japan Earthquake, sizes of local governments are similar, and large-scale damage is supposed in Yokohama City, Kawasaki City, and Sagamihara City at the time of the scenario Tokyo Metropolitan Earthquake, so they have the possibility to stand on the supported side in the future.

4.1. Analysis of Contents

For problem 1), mutual relationships among descriptions in each work of local disaster management plans is unclear, the basic disaster prevention plan shows the outlines of basic disaster activities or response, however this plan does not show concrete content in terms of the individual work. It seems that this problem is reflected typically in tables of contents of current local disaster management plans.

Accordingly, we compared tables of contents in order to grasp the whole structure of local disaster management plans.

Table 2 compares contents in local disaster management plans of Kawasaki City, Sagamihara City, and Sendai City, taking the plan of Yokohama City as standard. Diagonal lines in the table indicate that there is no corresponding counterpart. **Table 2** shows that descriptions are different in all items, even in evacuation, which seems to be related to wide-area support, transportation related to commodities, and stability of social life.

The number of pages corresponding to each item shown in **Table 2** is totaled up and the percentage of this number to that of all pages is shown in **Fig. 2**. **Fig. 2** makes clear the differences in the volume of each item and that items are treated in a concentrated way. For stability of social life, this item accounts for 9.8% in Yokohama City, 17.5% in Kawasaki City, 9.9% in Sagamihara City, and 9.0% in Sendai City. For evacuation, this item accounts for 7.0% in Yokohama City, 9.0% in Kawasaki City, 9.1% in Sagamihara City, and 8.2% in Sendai City. From **Fig. 3** showing the numbers of pages for each item, it can be seen that Kawasaki City uses as much as 17 pages for the item of evacuation, but this is because the list of shelters is printed there. There thus seems to be significant difference in the volume of this item among these cities.

Yokohama City assigns as much as 29.4% to the item of headquarters for disaster response, but this can be explained by the fact that all of the functions of each post are listed there.

Table 3. Comparison of keywords related to "evacuation."

Keyword	sequence of appearance	Yokohama City	Kawasaki City	Sagamihara City	Sendai City	Keyword	sequence of appearance	Yokohama City	Kawasaki City	Sagamihara City	Sendai City
Evacuation	141	31.9	16.3	25.5	26.2	Tsunami evacuation	1	100	0	0	0
Shelter	112	2.7	21.4	47.3	28.6	Appropriate shelter	1	0	0	0	100
Recommendation to evacuation	55	23.6	20	1.8	54.5	Second evacuation	1	0	100	0	0
Evacuee	55	27.3	10.9	20	41.8	Flowchart for evacuation	1	0	0	0	100
Evacuation guidance	36	22.2	2.8	63.9	11.1	Support of evacuation	1	0	0	0	100
Special shelter	14	100	0	0	0	Commencement of evacuation	1	0	0	0	100
Evacuation route	13	15.4	0	23.1	61.5	Activities for evacuation	1	100	0	0	0
Official in charge of shelter	12	0	0	100	0	Evacuated residents	1	0	0	0	100
Evacuation facility	11	27.3	72.7	0	0	Evacuation planning	1	0	0	100	0
Situation on evacuation	9	11.1	44.4	0	44.4	Instruction on evacuation	1	0	0	0	100
Welfare shelter	9	0	0	100	0	Confirmation of evacuees	1	0	100	0	0
Place for evacuation	8	50	12.5	0	37.5	Table for confirmation of evacuees	1	0	100	0	0
Place to be evacuated	8	12.5	0	37.5	50	Evacuees themselves	1	0	0	0	100
Management of shelter	7	0	0	85.7	14.3	Evacuated inhabitants	1	100	0	0	0
Place for wide-area evacuation	6	0	66.7	33.3	0	Figure of shelter	1	0	100	0	0
Action for evacuation	6	0	0	33.3	66.7	Committee on shelter management	1	0	0	0	100
Designated shelter	5	0	20	0	80	Meeting for shelter management	1	0	100	0	0
Evacuation plan	5	20	20	40	20	General management of shelter	1	0	0	100	100
Committee on shelter management	4	0	0	0	100	Staff for establishment and management of shelter	1	0	0	0	0
Number of persons to be evacuated	4	50	0	0	50	Arrangement for establishment of shelter	1	0	0	100	0
Temporary place for evacuation	3	0	66.7	33.3	0	Shelter facility	1	0	0	100	0
Shelter for accommodation	3	0	0	0	100	Other than shelter facility	1	0	0	100	0
Resister of evacuees	3	0	0	33.3	66.7	Self-governing organization of shelter	1	0	100	0	0
Manual on shelter management	3	0	0	0	100	District around shelter	1	0	0	100	0
Council on shelter management	3	0	0	100	0	Information on shelter	1	0	0	100	0
Life of evacuation	3	66.7	0	0	33.3	Measures for shelter	1	0	100	0	0
Area for evacuation	3	0	0	0	100	Official in charge of shelter	1	0	0	100	0
Residents to be evacuated	3	0	0	0	100	Department in charge of shelter	1	0	0	100	0
Road for evacuation	3	0	0	100	0	List of shelters, etc.	1	0	0	0	100
Temporary tent for evacuation	2	0	0	0	100	According to shelter	1	0	0	0	100
List of places for wide-area evacuation	2	0	0	50	50	Management of place for evacuation	1	100	0	0	0
Number of evacuees	2	0	50	50	0	Information on evacuation	1	100	0	0	0
Accommodations for evacuation	2	50	0	0	50	Evacuated households	1	0	100	0	0
Facility for accommodations for evacuation	2	0	50	0	50	Evacuation measures	1	0	100	0	0
Establishment of shelter	2	0	0	50	50	Arrangement for evacuation	1	0	0	0	100
Manager of shelter	2	0	0	0	100	Object of evacuation	1	0	100	0	0
Complementary facility to shelter	2	0	100	0	0	Number of households to be evacuated	1	100	0	0	0
Measures for evacuation	2	0	50	50	0	District to be evacuated	1	0	100	0	0
Within area to be evacuated	2	0	0	0	100	Area to be evacuated	1	0	0	100	0
Method for evacuation	2	0	100	0	0	Location for evacuation	1	0	0	100	0
Activity to guide evacuation	2	0	0	100	0	Within district to be evacuated	1	100	0	0	0
Complementary place for evacuation	2	100	0	0	0	Measures against lengthening of evacuation	1	0	0	0	100
List of temporary places for evacuation	1	0	0	100	0	On way to evacuation	1	0	0	0	100
Each shelter	1	100	0	0	0	Staff in charge of evacuation guidance	1	0	0	100	0
Emergency evacuation	1	0	0	0	100	Person in charge of evacuation guidance	1	0	0	100	0
Evacuation team at ward branch	1	100	0	0	0	Arrangement for evacuation guidance	1	0	0	0	100
Evacuation on warning	1	0	0	0	100	Measures for evacuation guidance	1	0	0	0	100
Wide-area evacuation	1	0	0	100	0	Between headquarters and shelter	1	0	0	0	100
List of designated shelters	1	0	0	0	100	Other measures for evacuation	1	0	0	100	0
Evacuation in advance	1	0	0	100	0	Large number of evacuees	1	0	0	0	100
Evacuation on own	1	0	0	100	0	List of places for evacuation in region	1	0	0	0	100

4.2. Comparison of Keywords

For problem 2), the degree of minuteness and roughness of description is non-uniform, keywords used in local disaster management plans are analyzed. It is thought that the outlines of the degree of minuteness and roughness of description could be grasped by comparing the frequency in use of keywords.

Taking evacuation as a basic keyword, evacuation plan, management of shelter, and response to those who need protection were analyzed. Keywords used in each local disaster management plan consisting of more than two Japanese characters, whether Chinese, katakana, or hiragana, are extracted, collected, and ordered in sequence of high frequency in columns in **Table 3**. The number of uses of keywords in each local disaster management plan is counted and the rate of the number to all is shown in ranks of **Table 3**. The keyword "evacuation," for example, is used 141 times in all local disaster management plans: Yokohama City accounts for 31.9%, Kawasaki City 16.3%, Sagamihara City 25.5% and Sendai City 26.2% respectively. Accordingly, it can be seen that the frequency in use of this keyword in Yokohama City is high in comparison to other cities. Taking another example, the keyword "special shelter" is used 14 times in all, but Yokohama City accounts for 100%. It can be judged that this is a keyword that is not used in cities other than Yokohama City.

Among 102 keywords selected in analysis, the number of keywords used in common in all four cities is 6, or 5.8%, that of the keywords used in common in three is 5, or 4.9%, and that of keywords used in common in two is 13, or 12.7%. Of all keywords, 76.5% are used individually in each city. Keywords that indicate at least the same content could be unified into single terms. This seems to be the first step toward more smooth management of wide-area cooperation, leading to the standardization of disaster response activities in the future.

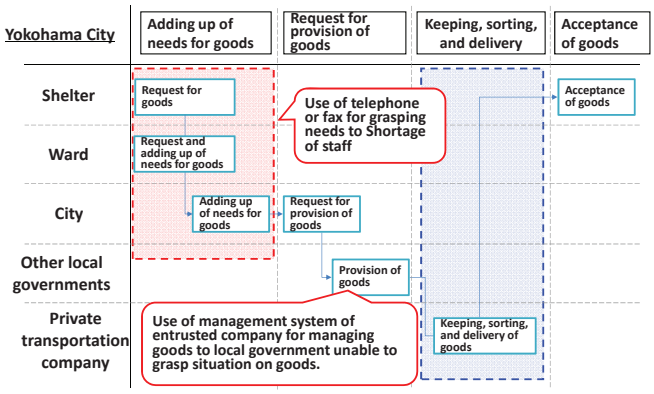

Fig. 4. Work flows of relief goods in Yokohama City.

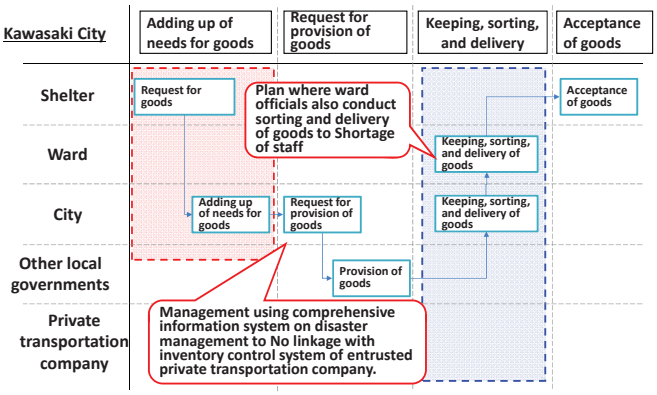

Fig. 5. Work flows of relief goods in Kawasaki City.

4.3. Comparison of Work Flows of Relief Goods

In addition to the above analyses of tables of contents and degrees of minuteness and roughness of description in local disaster management plans, the work flow is also analyzed. Relief goods are taken up as the work to be analyzed and a comparison is made between Yokohama City and Kawasaki City. A work flow is drawn both to show the flow of work and to clarify the exchange of information accompanying each work.

Figures 4 and **5** show the work flows of relief goods in Yokohama City and Kawasaki City, respectively. In these charts, flows of main work are extracted from local disaster management plans. More detailed work flow charts have been drawn separately, but only **Figs. 4** and **5** are shown due to space limitations. The flow of "Adding up of needs for goods" and "Request for provision of goods" are same for the two cities. The large difference can be found in the point that the work of "Keeping, sorting, and delivery of goods" is accomplished by ward in Kawasaki City, while Yokohama City has entrusted this work to a private transportation company. According to the interview on Kawasaki City conducted by the authors after the 2011 Great East Japan Earthquake, ward had not been equipped with fork lifts and appropriate space for sorting goods, so it took much time for many ward officials to sort goods, hindering other work and increasing the workload of officials. The current situation has been made clear, where keeping and sorting of relief goods are difficult to be implemented by ward. After conducting interview from the official in charge of risk management at Kawasaki City, we concluded that standardization of work flow for wide-area support could lead to more smooth and effective delivery of relief goods.

5. Problems of Arrangement of Wide-Area Support Seen from Supporting Side

Kawasaki City stood on the supporting side after the Great East Japan Earthquake. Accordingly, Kawasaki City and the authors discussed necessary information to be shared with the supported side in providing support. First, support provided by Kawasaki City was outlined, then the theme was examined of what is necessary information for the supporting side. It was also discussed from the supported side what kind of information should be sent. In discussions, standardization of description in local disaster management plans was also taken up as a theme.

(1) Outlines of support from Kawasaki City to affected cities

a) Relief goods

Immediately after the earthquake disaster, Kawasaki City provided support responding to a request from Sendai City based on the agreement among the 20 largest cities, that from Chiba Prefecture based on the agreement among 9 prefectures and cities in the Kanto region, and that from Hanamaki City based on an individual agreement. Next, support was requested via the route from the Japanese Government through prefecture to city, and Kawasaki City sent relief goods to Miyagi Prefecture. Kawasaki City had difficulty, however, in grasping correct information on transportation routes to disaster-stricken areas at that time. In such circumstances, Kanagawa Prefecture informed Kawasaki City that relief goods could be sent by freight so Kawasaki City transported 31,500 portions of pregelatinized rice by freight from Yokosuka City to Miyagi Prefecture. Along with this request, based on a direct request from the Japanese Government to Kanagawa Prefecture on March 16, 5 days after the earthquake and tsunami, Kawasaki City transported blankets to Ibaraki Prefecture by truck. Relief goods were then requested directly from Fukushima City. Although no agreement on emergency relief had been concluded with Fukushima City, Kawasaki City transported the requested goods on March 17, because the mayor of Kawasaki City comes from Fukushima City.

b) Dispatch of human resources

The first request was related to water supply. Trucks for water supply were dispatched continuously in rotation to Ichikawa City, Chiba Prefecture, and Kawauchi Town,

Ibaraki Prefecture, from March 12, to Koriyama City, Fukushima Prefecture, from March 14, and to Kawauchi Town, Ibaraki Prefecture, again from March 17. Officials were dispatched to Urayasu City, Chiba Prefecture, for the restoration of water pipes and to Morioka City, Iwate Prefecture, for a survey on damage to water pipes. For doctors and nurses, doctors of hygiene and public health nurses were dispatched via the Ministry of Health, Labor, and Welfare to Sendai City. A quick assessment of damaged buildings was requested through the Cabinet Office and three officials in charge of assessment were dispatched in rotation to Sendai City. Toilets were requested through the Ministry of Health, Labor, and Welfare and about 200 toilets were sent to Fukushima Prefecture. In relation to the emergency fire response team of the Fire and Disaster Management Agency, staff members were dispatched for rescue in the first stage and for response to the concomitant nuclear disaster in the next stage.

c) Acceptance of refugees

Kawasaki City accepted refugees mainly from Fukushima Prefecture. First, ward offices were opened for refugees, but ran out of space on March 16. Then, the Kawasaki City Gymnasium was opened to them, but it had no air conditioners and power outages occurred, so refugees had to be moved to the Kawasaki Todoroki Arena. As of March 25, 108 refugees of 35 households were accepted there.

(2) Problems of arrangement of wide-area support seen from supporting side

Based on the above outlines of support from Kawasaki City to the disaster-stricken area, problems in the arrangement of wide-area support seen from supporting side are listed below.

a) Understanding cities for support and actual situations

- Kawasaki City was affected only slightly by the earthquake, so it could arrange support swiftly. No necessary information for sending relief goods could be obtained except for through Sapporo City from Sendai City based on the agreement among the 20 largest cities.
- For Hanamaki City with which a mutual support agreement had been concluded, information was gathered swiftly based on a one-to-one response. Because Hanamaki City played the role for collecting information on neighboring local governments, information on the damage situation of municipalities around Hanamaki City could be also obtained via Hanamaki City.
- In relation to the 9 prefectures and cities in the Kanto region, information on Chiba Prefecture and Chiba City could be collected relatively swiftly, but that on other cites could not obtained at all.
- Relief materials were requested from Kanagawa Prefecture, but provision of relief goods was requested after a considerable time, so the result of inquiry could not be communicated. Under such circumstances, Kawasaki City could not determine what was really needed. For the time being, Kawasaki City prepared rice as relief foods, but it was unclear how it could be sent.
- Without appropriate information, there are limitations on the provision of relief goods. Basically, information does not come directly from affected prefectures, but from Kanagawa Prefecture. Inquiries came, but it was still unclear what information inquiries were based on and what actual situations in disaster-stricken areas were. An inquiry on how many blankets could be provided was made to Kawasaki City, and Kawasaki did respond to the inquiry even though it was unknown what kinds of blankets were really needed. Relief goods were indeed provided, but more detailed measures could not be taken. Similar situation of this problem were seen in the dispatch of human resources.
- For core cities other than government-ordinance-designated cities and small-sized municipalities that had no agreements with mutual support, it was difficult for Kawasaki City to respond disasters. There are higher organizations for such municipalities, namely the Japan Association of City Mayors and the National Association of Towns and Villages, but these organizations could not manage the total coordination of municipalities well, so no information on municipalities came to Kawasaki City via Kanagawa Prefecture other than Sendai City and Hanamaki City, for which Kawasaki City had concluded the necessity of agreements on mutual support.

b) Inadequate arrangement for acceptance of refugees

- Arrangement for the acceptance of refugees is not specified in the disaster management plan of Kawasaki City. In the case of the Miyake-island Eruption, the acceptance of refugees became confused.
- After parking lots of ward offices, places for the acceptance of refugees, became full and there was no concrete plan to accommodate surplus refugees, so Kawasaki City could not respond to the situation swiftly and information on parking lots in wards was not available.
- There was no correct information on the moving of the refugees. When Kawasaki City suddenly had to accept refugees, rumors originating in the mass media indicated that thousands of refugees would come and Kawasaki City was sometimes made to be confused.
- Kawasaki City wanted to refer to the situation on acceptance of refugees in Saitama City where refugees

would pass through, but could not obtain correct information. As a result, an evacuation place became full, another one was added. Kawasaki City thus had to respond to the emerging situation without planning. Similar problems are expected to occur at the time of the scenario Tokyo Metropolitan Earthquake because the capacity of acceptance of refugees is not specified in local disaster management plans of Kawasaki City.

c) Information on refugees

- There was no method for delivering registers on medical histories and information on family registers of refugees to affected local governments.
- Registers were made by paper form, so although inquiries came from Kanagawa Prefecture, there was no way to search the refugee information quickly.
- Almost no information could be obtained on refugees who did not go to evacuation shelters and, particularly information on those who had gone to hospitals, homes of relatives, and residences of volunteer could not be determined.

d) In relation to local disaster management plans

Local disaster management plans are effective tools for determining the required disaster response activities of the supporting side for the supported side. It was not actually easy, however, to understand the work of the supported side given the limited time and human resources after the earthquake because the descriptions of local disaster management plans on both sides were different. Such unfavorable situations sometimes occurred where different understanding and recognition of work was found between both sides after explanations on work by the supported side to the supporting side, hampering efforts due to friction and coordination in how to accomplish work, and implementation was not smooth as a result.

This is a typical case in the standardization of description of local disaster management plans between supporting and supported sides that could lead to smooth implementation of wide-area support.

The arrangement for support could function well when agreement on mutual support had been concluded in advance. It seems that pairing is an effective method, where the particular local government continues to provide support for the particular affected one. This method could make the clear responsibility for the work and trigger productive competitive consciousness. This could also bring the advantages of useful training in disaster response activities for the supporting sides. Taking into consideration the effectiveness of this system at the time of earthquake disasters, it is desirable that pairing cover all local governments in Japan in advance. The balance of the size of municipalities between accepting and providing sides should, however, be kept in mind. Standardization of description in local disaster management plans could conceivably improve the effectiveness of this system.

The problem of lack of stocks of relief materials by the supporting local government could be solved if the counterpart has been specified in advance. This problem is triggered in situations where relief materials are sent at random without understanding the capacity of the counterpart. In the case of the system of pairing, overlapping and redundancy of relief goods can be solved because of considering the capacity of the counterpart in advance at the preparation stage before disaster. Understanding of the population and damage situation enables swift disaster response activities.

The theme of manuals on backup logistic support was also taken up in the discussions by Kawasaki City. Currently, such manuals are not prepared in Kawasaki City. It seems that local governments are generally ready for the situation where they would suffer from disaster, but not for manuals on backup logistic support, even though such manuals could enhance the effectiveness of backup logistic support.

6. Conclusions

This paper has considered differences in descriptions in local disaster management plans made by supporting and supported local governments assuming that standardization of such descriptions could bring more smooth and effective implementation of disaster plans. This paper proposed desirable directions toward arrangements for wide-area cooperation systems with high effectiveness.

In the scenario Tokyo Metropolitan Earthquake, limited numbers of officials of local governments would have to implement disaster response activities. Support based on wide-area cooperation is thus important in cases in which sufficient numbers of officials could not be ensured. Standardization of descriptions of local disaster management plans is thus significant in order to construct effective support systems such as smooth and effective acceptance of support.

It is expected that taking the 2011 Great East Japan Earthquake as an opportunity, more local governments would conclude agreements on mutual support in the time of disaster and revise existing local disaster management plans. To make cooperation among the Japanese Government, prefectures, and municipalities more effective, the description of local disaster management plans should be standardized to some degree.

Acknowledgements

This study was conducted as a part of commissioned science technology research of the Ministry of Education, Culture, Sports, Science and Technology of Japan, the study on construction of arrangement for wide-area risk management and mitigation of disaster. We are indebted to Toshihiko Sasaki, chief secretary of the Miyagi Prefecture branch of the All Japan Prefectural and Municipal Workers Union, for sending us results on medical examinations conducted on union workers. We also thank Nobuo Hagiwara, Yuka Akabane, Masatoshi Haruyama of Kanagawa Prefecture, Tetsuya Majima of Kawasaki City, and Masaru Onodera of Yokohama City for cooperating in our activities.

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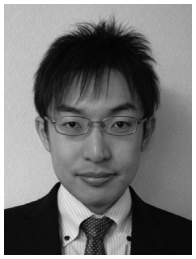

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