Research on a concrete plan and problems to realize the rapid disposal of debris generated in case of huge earthquake and tsunami

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***ABSTRACT*:** "Promotion of recycling resources" was settled as the policy for disposal of debris which were generated in the Great East Japan Earthquake in 2011. Disposal of debris are implementing to meet the dead-line in March 2014. In disaster-hit areas, a massive amount of debris had been piled up for long period on stock yards in city area until plant operation for crashing, sorting, recycling and incineration disposal of debris got into full swing. Site selection of debris stock yards should have combination with site selection of temporary housing. Schedule and method of disposal of debris takes big impact for revive of disaster-hit areas. Rapid disposal of debris is indispensable for early revival. In addition, cross-departmental study in municipality organization is also essential matter. Measure for disposal of debris without stock yards is studied to realize rapid disposal in this research. Preparing shore landfill area with double sheet pile bulkhead is proposed as concrete measure and technical, systematical and organizational problems are sorted out to realize this proposal.

KEYWORDS: disposal of debris, municipality

1. INTRODUCTION

Over two years have passed since the Great East Japan Earthquake and public authorities, including municipal governments, have been making continued efforts for early restoration of the life of local residents and general recovery thereafter. Restoration and recovery start with the disposal of debris and it makes progress with activities, such as the search for missing people, the construction and habituating in temporary housing, relocating buildings to higher ground, and the re-development of submerged areas, while inter-relating with them temporally and spatially. Initial response to the disposal of debris affects the schedule of regional recovery.

As for disposal of debris generated by the Great East Japan Earthquake, approximately two months after the disaster, on May 7th, 2011, the Ministry of the Environment set a goal to complete disposal in March of 2014. The basic policy of debris disposal issued by the Ministry of the Environment on May 16, 2011 was "promotion of recycle use". Was this initial response appropriate for disposal of debris which requires prompt action more than anything else?

Under the "promotion of recycle use" policy, the debris in the affected areas is the temporarily stored mainly on public lands, which undergo thorough sorting, resource recovery, and incineration. In this process, many problems, such as odor, gas generation, fires, outbreak of pests accompanied by

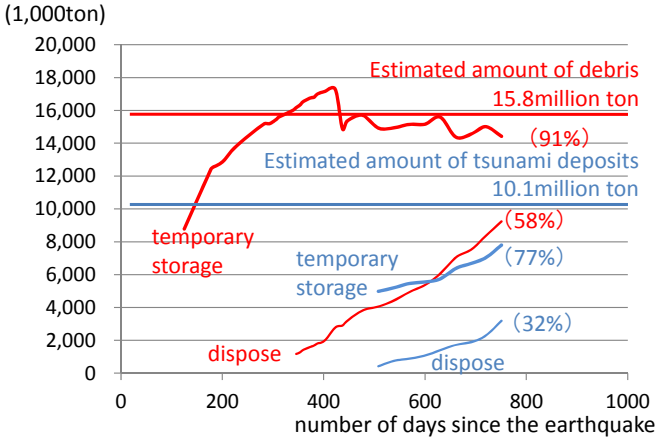

Figure-1 Transition of amount of disposed debris

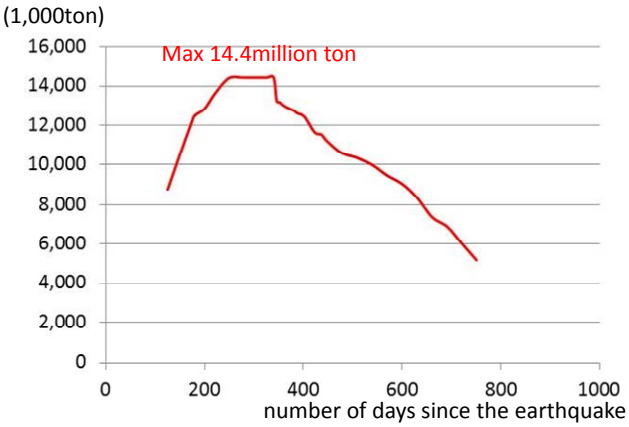

Figure-2 Transition of amount of disposed debris

the prolonged storage of debris at the temporary storage site, as well as concerns about the air pollution due to incineration of a vast amount of debris have been raised.

The Miyagi Prefectural Assembly, which suffered from the earthquake, passed a resolution for creating a “seawall of wood to protect life” This method is different from debris disposal which is currently underway and the Assembly is asking the prefectural authorities to pursue discussions with the Japanese government and local governments as it promotes the recycling of debris without incineration.

Thus, various different opinions and suggestions have been proposed in regard to the current debris disposal plan. It would appear that the government needs to re-consider whether they should firmly adhere to the basic policy of “promotion of recycle use” throughout the nation for the Tokai Earthquake, Tonankai Earthquake, and Nankai Earthquake which are expected to occur in the future.

Debris disposal policy should be formed based on the conditions that are unique to the region to comply with the purpose of local government because restoration and recovery, including debris disposal, are anchored by the local governments. To achieve this, not only should many other disposal options, including the current one, be suggested, but also a system where we can choose the right method for the region should be prepared. This study will contribute to the future approaches taken by coastal local governments, which are expected to possibly suffer from massive earthquakes and Tsunami damage in the future, by suggesting prompt debris disposal methods and also by suggesting issues to be solved to achieve this goal.

2. Current Situation of Debris Disposal Effort

2.1 Transition of Waste Generation and Disposal Amount

In Figure-1, horizontal axis indicates the number of days since the occurrence of the earthquake and vertical axis indicates the amount of disaster waste brought to the temporary storage site and its disposed amount (red line) and also indicates the amount of Tsunami deposits brought to the temporary storage site and its disposed amount (blue line). There is a phase that seems to be declining in the amount of temporary stocked disaster waste on around the 400th day, but this is due to the limit of estimated accuracy. It appears that it was difficult to acquire accurate value of waste generation due to the chaotic situation when the disaster first hit and inadequate unified measuring system. This is a task for future improvement.

The disposed amount as of March 31, 2013 is 9.24 million tons of disaster waste and 3.19 million tons of Tsunami deposits. 83% of disaster waste has been disposed in the form of recycling and usage as fuel according to the Ministry of the Environment’s

policy.

The amount of disposal started showing rapid progress around the 600th day (October – November 2012). Disposal of both disaster waste and Tsunami deposits will be possibly completed within the set period if it continues to make progress if the lines of transition in Figure 1 simply continue to extend. For instance, shredding/separating plants and temporary incinerators in Ishinomaki city started fully operating around October 2012 (approximately 600th day from the occurrence of the disaster). It appears that disposal of debris made rapid progress as the recycling and incinerating process shifted into full swing.

2.2 Disaster Waste Piled Up in the City

Transition of the amount of disaster waste piled up at the temporary storage site is shown in Figure 2. From the transition, disposal of disaster waste appears to have been in the situations as follows;

①From the date of the disaster through the 400th day, removing debris from the living environment was the highest priority and debris continued to be piled up at the preliminary temporary storage sites which were public lands.

②Disposal of debris began around the 350th day at the secondary temporary storage sites. While constructing temporary incinerators, crushing/separating plants, debris that were already brought in were carefully separated and disposed mainly for recycle use. The amount of debris piled up at the preliminary temporary storage sites did not decrease at all until the 400th day.

③ Shredding/separating plants and temporary incinerators gradually started operating around the 400th day. They were fully operating around the 600th day, which visibly started decreasing the amount of debris piled up at the preliminary temporary storage site.

④Around the 700th day the amount of debris to be disposed became less than 7 million tons, which was half of the maximum amount and disposal is still underway at this rate.

It would appear that maximum efforts are being made according to the basic disposal policy set forth by the Ministry of the Environment, but the problem is the fact that debris were kept piled up in the city for over two years. The period where over 10 million tons of debris was piled up in the city ranges from the 180th day to the 550th day. It experienced two summers and the government had to deal twice with the problems of odor, gas generation, fire, and pests.

2.3 Basic Disposal Policy and Actual Operation

As mentioned in the beginning of this study, the basic disposal policy initially directed by the Ministry of the Environment was “promotion of recycle use”. Was the initial response reasonable?

The policy directed by the Ministry of the Environment enshrines “lowering total disposal cost and reduction of final disposal amount”, “recycling of recyclable materials as much as possible”, and “the necessity to consider slow disposal depending on demand for recycle use” and suggests detailed disposal methods, including recycling methods by item. This policy shows no intention of keeping debris away from the residents’ living space and dispose of them at all at the time of emergency. Rather, it seems that the routine idea to recover resources and maintain remaining capacity at the final disposal site was simply applied.

In the material flow of actual site, preliminary temporary storage site is established first, and then temporary incinerators and, shredding /separating plants are set up on the secondary site and intermediate processing site. After all the preparations have been done, a full-scale operation is supposed to start. This would work favorably if the preliminary and secondary sites and intermediate processing site can be located far away from the

living environment, but if that is not the case, the amount of disaster waste piled up on the preliminary sites in the city will not easily decrease, leaving debris in the living environment for an extend period of time. It is hard not think that the current situation was caused by a flaw in the initial response to “promote recycle use”.

3. Suggestions for Debris Disposal Methods

Along with raising concerns about the currently undergoing debris disposal method as described in the last chapter, some alternative methods have been suggested. For example, Ikeda (2011) suggests creating a dam or breakwater-type disposal site, which is categorized as a controlled disposal site made of a concrete structure on the landward tip in the coastal regions. The Society for Lifecycle Infrastructure Management (2012), a non-profit organization, suggests “3.11 Green Hill Concept” which seals debris in the soil mortar and covers it with dirt to create a green hill as quick and simple removal of debris is essential. The concept of “seawall of woods to protect life” of which the Miyagi Prefectural Assembly passed by resolution, suggests construction of a hill using debris without incinerating and also planting trees on it. Although it is not local disposal, the mayor of Urayasu city in Chiba came up with an idea to take debris from Iwate and Miyagi prefectures and use it for landfill around Tokyo Bay in the City without incinerating it to create a large park.

These suggestions centering on landfills are for disposal of debris generated by the Great East Japan Earthquake and feature methods that basically do not require temporary storage sites in the city which are needed for resourcing and recycling. That is, debris is removed from the residents’ living environment at the time of removal of debris from the disaster site, which virtually means completion of disposal for the residents. For example, in Figure 1, most temporary storage is completed around the 400th day. If a landfill-centered measure was taken, disposal should be virtually done by this time. Then they can start working on revitalization activities from this point on. Of course, some minimum measures need to be taken, such as removing hazardous objects which are not suited for landfill. However, it is hard to imagine there would be a major difference if you considered the necessity for equal or greater consideration for the temporary storage in the city. When considering the fact that it took a long time to secure land for temporary storage sites, it can be reduced to less than 400 days.

These suggestions are extremely effective measures from the standpoint of promptness, but debris is being disposed with a goal of completion in the end of March of 2013 without being implemented. In order for the effects intended by these suggestions, such as reduction of time for disposal and prevention of diffusion of radioactive materials accompanied by incineration, to be fully effective, it is necessary to lay out a landfill policy at the disaster location from the moment debris disposal begins and secure land and also roughly separate debris at the disaster location and promptly transfer them to the landfill location. It is not practical to consider possible land after the occurrence of a disaster, so it would be necessary to discuss and determine possibly available land in advance. Considering these situations, it is undeniable that it is not an easy task to switch from the currently undergoing disposal flow and its effect will be limited as well. It is hard to avoid thinking that it would be difficult for these measures to be taken in the future for debris generated by the Great East Japan Earthquake.

However, these suggestions are worth noting for debris disposal that would be generated by possible Tokai, Tonankai and Nankai Earthquakes in the future. If the government could complete

discussion about the possible land before the occurrence of the disaster and if they could start working on the measures at the early stage, at least it would be possible to prevent the situation where debris are piled up in cities for a long period of time.

4. Necessity of Cross-Organizational Examination of the Measures from the Local Public Management Point of View

4.1 Local Public Management (LPM) and Disaster Management System

This chapter discusses physical and organizational issues by local governments which are responsible for disposal of debris. The authors of this study claim that it is necessary to build a management system based on cross-organizational examination of the measures from the standpoint of streamlining an organization system suitable for unique characteristics of our local governments and decision making process. We call it “Local Public Management (LPM)” and are making efforts to achieve this goal.

As a part of this effort, the authors cooperate with a real-life local government (Konan city, Kochi prefecture) and are currently working on building and researching the disaster management system under problem awareness in which “disaster management system” that consistently covers from the occurrence of the disaster till the end (recovery and revitalization) will be needed. This is intended for all post-disaster operations conducted by local governments, such as evacuation policy, the set-up and operation of temporary evacuation centers, the disposal of debris, construction of temporary housing and moving-in of residents, relocating buildings to higher ground before the occurrence of the disaster, mapping out reconstruction strategy, and implementation of a redevelopment project.

After conducting a study on disposal of debris using Konan city as the model, it became clear that debris disposal is one of the most important aspects among comprehensive measures, including strategy for reconstruction. The following physical and organizational issues which cannot be handled by the department that regulates waste management at normal time (“Environment Office” in Konan city) alone have also emerged.

4.2 Physical Problem

In the Disaster Waste Disposal Plan set by the “Environment Office” in March 2010, which was before the Great East Japan Earthquake”, the area that is necessary for a temporary debris storage site for emergence of approximately 540,000 tons of disaster waste was estimated approximately 29 ha. The area that is available for use is estimated approximately 13 ha, which is short by approximately 16 ha of land. On the other hand, the Office of Housing of Konan city is currently making a strategy for temporary housing and the area available for construction, which was calculated in the process, was approximately 44 ha. However, approximately ten ha of it overlaps with the temporary debris storage site. Approximately 13 out of 44 ha are located in flood prone areas, riverbeds and on steep slopes, which leave approximately 15 ha that are available for use. The number of house-holds that can move in would practically be around 900. The number of estimated evacuee households is still under review by the department, but it will be a little over 1,800 households based on provisional calculation by Otani (2012) and a major shortage of temporary housing is expected. In this way, the land as a resource required for disposal of debris and construction of temporary housing is physically and extremely limited. The shortage of land in many regions will be an extremely serious problem if expected massive earthquakes and Tsunamis hit. Konan city is no exception.

4.2 Organizational Issue

In this situation, negotiation for land use inside and outside of city authorities becomes a major problem. It is not hard to imagine that negotiations that took place inside and outside the affected local governments were extremely intense at the time of the Great East Japan Earthquake. In light of the lesson learned from this situation, it would appear that cross-organizational measures need to be examined in advance to prepare for the massive earthquakes and Tsunami disasters expected in the future.

With the example of Konan city, the land for temporary housing overlaps in the disaster disposal plan set by the “Environment Office” and in the temporary housing construction plan which is slated to be set forth by the “Construction Office”, but there is no system that is functioning to confirm and correct it in the current situation. In the workflow of the “Environment Office”, they are first instructed to draw up a plan by the prefecture’s Environment Office, and then draw up a plan based on the determined examination method, and submit the plan to the prefecture. The “Construction Office” follows the same workflow as well. It can be said that this is not unique to Konan city when considering the fact that this is done by all local governments across the country under prefectural supervision. It is quite unlikely for the prefecture to check both plans submitted by these offices for consistency. This responsibility should be assumed by the local governments themselves even from the standpoint of carrying out the measures that are suitable for the region. There is all the more reason to do so when considering how debris are disposed has temporal and spatial affects on the issues that will rise afterwards, such as construction of temporary housing, formulation of recovery and revitalization plans and redevelopment of the city .

It is not reasonable to criticize the measures taken by the local governments against a situation like this. Internal revenue sources in rural regions are extremely limited. In this situation, they have no choice but to use community support measures provided by central government ministries and agencies, such as subsidies and the issuing of bonds with local allocation taxes. If the budget for community support measures is allocated based on segments of central government ministries/agencies, effective means can be taken against community support measures by conforming local government’s organizational system to that of central government ministries/agencies or the prefecture that comes between them. It is assumed that this is the way how vertically segmented structure became reinforced. Isn’t it reasonable to assume that the example mentioned here was generated by the problem of the overall administrative system, including central government ministries and agencies and prefectures? As for disposal of debris, it would appear that planning for prompt recovery and revitalization will be required by using cross-organizational approach. Specifically, this approach demands that employees who are familiar with the area should cross-organizationally examine the measures that have never been taken before, such as debris disposal and construction of temporary housing without a need for the use of public lands.

4.3 Disaster Risk Management Organization in Local Governments

At the time of massive earthquake or Tsunami disaster the role of the Disaster Risk Management Organization, in addition to the Environment Office that regulates debris disposal and Housing Bureau that regulates construction of temporary housing, will be important. The disaster countermeasures office basically regulates short-term evacuation measures. On the other hand, from the fact that the “planning of disaster prevention measures” is listed

first, it appears that this is the first choice as the head office that cross-organizationally examines recovery and revitalization measures, including disposal of debris, which is a relatively long-term task.

Under the “Building National Resilience Project” held out by the Liberal Democratic Party, the ruling party at present, a hefty budget is allocated to soft and hard measures led by central government ministries and agencies. For example, it is a reality that the disaster countermeasures office in Konan city is busy securing the budget for evacuation measures, such as building the evacuation tower, negotiation with the local officials, and consumption of budget. It can be imagined that almost any coastal local governments is in the same situation more or less. Depending on the characteristics of each local government, the City Planning Bureau or the Planning Bureau can function as the head office. In any case, the creation of an organization to conduct a cross-organizational examination is required in strategic planning for prompt disposal of debris.

5. Concrete Measures for Prompt Debris Disposal and Challenges to Achieve the Goal

We suggest concrete measures based on above facts in this Chapter.

5.1 Landfill on the Coast Line

As explained in Chapter 2, the method focusing on promoting of recycling resources in the current situation makes it extremely difficult to dispose debris quickly. With the on-shore landfill method among the past suggestions mentioned in Chapter 3, it is easy to assume that securing land in advance will be difficult from the fact that relocating buildings to higher ground has not made progress.

From the above reason, this study suggests a concrete strategy based on the landfill on the coast line. The examples of the landfill on the coast line accompanied by the earthquake are listed below.

a)Yamashita Park

Around September 20, 1923, soon after the earthquake hit, a tentative revitalization plan was reported by Yokohama city. Among them was the boardwalk by the shore which is the archetype of Yamashita Park and the debris disposal method was also discussed together with a facility planning. It is said that the sea near the location where Yamashita Park is now is relatively shallow, and it was difficult to use for anchoring the ships or as a harbor, so the city requested the permission from the government to designate this area as a place to dispose ashes and debris generated by the earthquake. The city planning decision was made in January 1925 and construction began in June of that year. It opened as a 91-meter-wide park on average in 1930. Over half of the landfilled park is made of debris.

b)Osaka Bay Phoenix Project

Fundamental policy set forth by the Great Hanshin and Awaji Earthquake Countermeasures Headquarters claims that “debris needs to be promptly disposed so that it will not be an obstacle to revitalization” and “disposal of debris requires caution so that it will not be an obstacle to reconstruction work and recycling resources is also encouraged”. Unlike the Great East Japan Earthquake, it is notable that prompt disposal was listed as a priority matter. As a concrete strategy for prompt disposal, the policy also says it promotes “acceptance of debris as a landfill material for implementation of harbor works.”

This was embodied in the form of debris landfill to create the Osaka Bay Regional offshore Environmental Improvement Center (Phoenix Center). On February 17, 1995, the Central Port and Harbor Council approved a revision of the harbor planning, which claims 450 ha will be landfilled using debris and will be used for redevelopment of the harbor and also used as a land

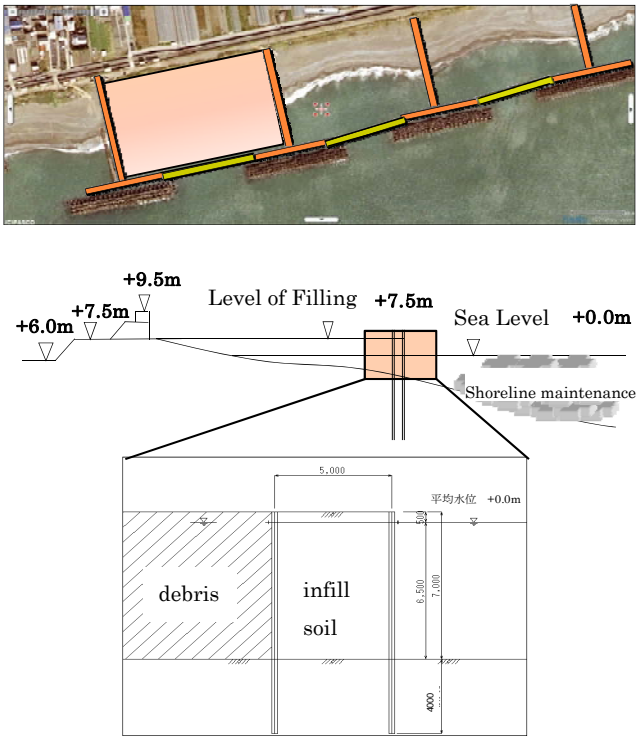

Figure-3 summary of the shore landfill area plan

for city and logistics purposes. Normally, it takes from six months to 2 - 3 years for change procedures of Port and Harbor Planning. They say the fact that change in the port and harbor planning by Kobe city was supposed to take place in March of 1995 and negotiations with relevant organizations were completed in advance made such a prompt pro-cedure possible. Debris generated by destructed roads and railways (4.8 million ton in total) was transferred to Phoenix at an early stage. Destructed matter from the Hanshin Expressway Kobe Line was brought in approximately three weeks after the earthquake, approximately two months for the JR line and within approximately five months for the Hanshin Railway. Approximately 79% of disaster waste was practically used for coastal landfill.

5.2 Shore Landfill Area Plan Using the Double Sheet Pile Bulkhead Method

Hirao (2102) reviewed disposal of debris together with the authors of this study using Nankoku city in Kochi prefecture, as the model which shares the similar type of geography as Natori city in Miyagai prefecture, which suffered a damage from the Great East Japan Earthquake. A summary of the shore landfill area plan is shown in Figure 3. Using the double sheet pile bulkhead method, shore landfill areas will be created inside of the shoreline maintenance blocks that are placed as coastal erosion prevention measures. Debris is to be collected in the following manner.

①Before a disaster hits the area, a double sheet pile structure is created using sheet piles in the orange-highlighted areas in Figure 9. Considering the layout of shoreline maintenance blocks, the size of one section is approximately 145 m in the direction of shoreline and 115 m deep.

②Before a disaster hits, install steel H-beam piles at 5 meter intervals on the yellow-highlighted areas.

③After the disaster, use the pre-installed double sheet pile structure as an approach path and drop PC sheet piles using a crane between pre-installed stakes. It is estimated that it will take approximately ten days to install sheet piles in each section.

④Connect the above with the pre-installed double sheet pile structure and fill inside with solid soil.

⑤In this way, a debris landfill area surrounded by double sheet pile structure is created (pink-highlighted area in Figure 9). Install waterproof sheet inside of the structure.

⑥Fill debris in the landfill area. If input depth at the deepest area was 5 meters (2.5 meters on average) and debris ’ unit weight is 2.0 ton/ m3, approximately 83,000 tons per section can be accumulated.

⑦Collect lumber using a floatation process and metals using magnets and recycle.

⑧Alternately, fill debris and soil and purify the soil in the end.

This process reinforces coastal erosion prevention measures as well as effectuates prompt disposal of debris.

Details of the structure will be determined using the double sheet pile seawalls at existing waste disposal sites as a reference. The resistance to Tsunami

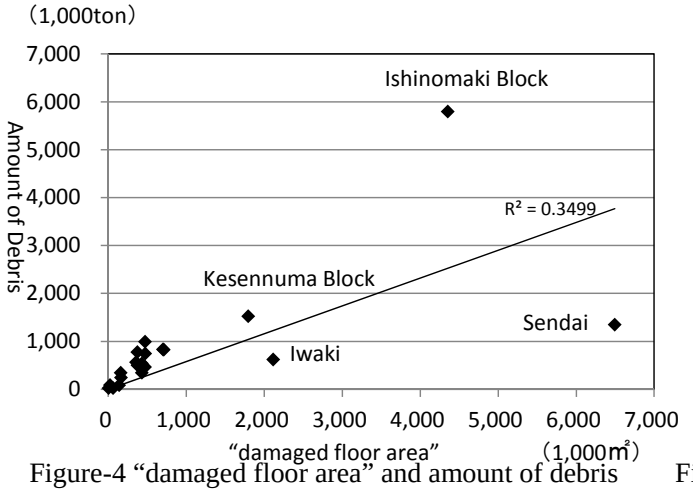

Figure-4 “damaged floor area” and amount of debris

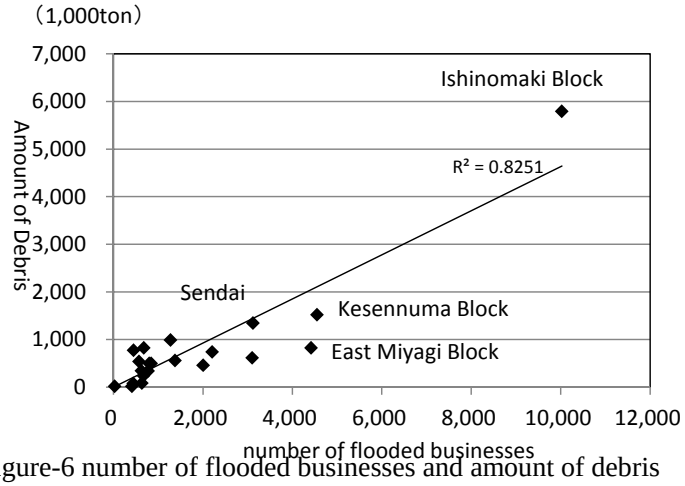

Figure-6 number of flooded businesses and amount of debris

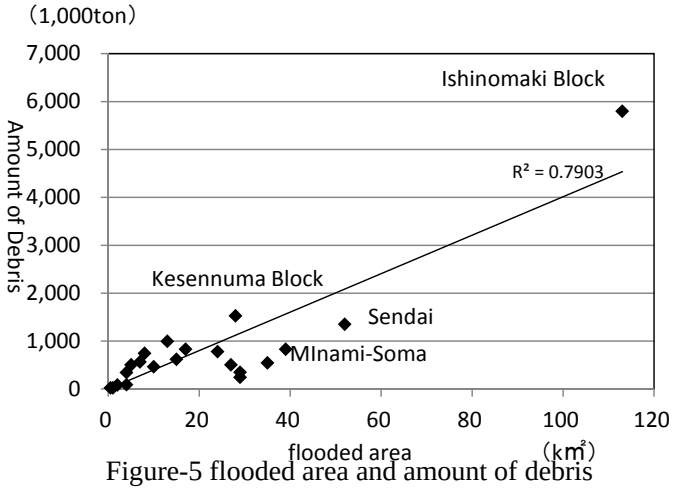

Figure-5 flooded area and amount of debris

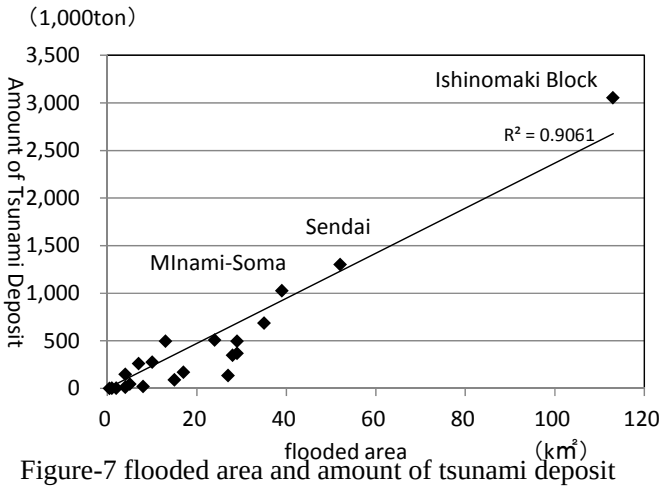

Figure-7 flooded area and amount of tsunami deposit

possessed by the double sheet pile structure, which should be installed before a disaster hits, needs to be investigated based on the massive Tsunami generated by the Great East Japan Earthquake. However, according to the local investigation constructed by the Japan Press-in Association after the earthquake, it was pointed out that temporarily installed sheet piling double-wall cofferdams on the crevasses of the river dike, which is a permanent structure, remained intact. The association suggests that this structure would be strong enough to resist a massive Tsunami by allowing more embedded depth to the double sheet pile structure.

5.3 Debris Disposal Plan using Konan city as the model

Prior to suggesting the landfill area mentioned above, based on the data generated by the Great East Japan Earthquake, Hirao (2012) estimated the amount of debris in Nankoku city and the amount of temporary housing required and sug-gested securing land for temporary housing by utilizing golf courses and also noted the shortage of land for temporary debris storage. Based on these situations, Hirao also suggests creation of a shore landfill area. When this review was conducted (2012), disposal of debris was not yet making a substantial progress and the estimated debris generation data which was disclosed by the Reconstruction Agency was low in accuracy. At the stage where this study is implemented, relatively reliable data for debris generation has been disclosed. Based on this data, we reviewed the debris disposal plan once again using Konan city as the model, which could obtain co-operation from the city authorities in terms of land data provision, etc. Konan city is adjacent to Nankoku city and both cities are similar in basic geographical features.

a)Estimated amount of debris based on data generated by the Great East Japan Earthquake

In the disaster waste disposal plan set forth by Konan city in March 2010, referring to the guideline

provided by the Ministry of Welfare for the damage estimated by Kochi prefecture, the amount of debris generation is estimated from the floor space of the completely or partially destroyed buildings. We call this “damaged floor area” in this study.

The relationship between the “damaged floor area” and generation of disaster waste in three prefectures devastated by the Great East Japan Earthquake is shown in Figure 4. They do not seem to have a high correlation. Flooded area and the number of flooded businesses, which becomes a guideline for industrial agglomeration, have a higher correlation. On the other hand, regarding Tsunami deposits, correlation with flooded area is high as shown in Figure 7. From these result, the generated amount of Tsunami deposits can be estimated to some extent from the flooded area, but it would be difficult to determine the disaster waste generation only from “damaged floor area”. In this study, we considered that disaster waste generation is caused by building damage and damage of agglomerated businesses and also conducted multiple linear regression analysis on “damaged floor area” and the number of flooded businesses to estimate generation of disaster waste. The result is as follows;

Amount of Debris Q_1(ton)

=442.06×number of flooded businesses

+41.95×damaged floor area(1,000m^2)

Amount of Debris Q_2(ton)

=23,677×flooded area(km^2)

If this is applied to the conditions of Konan city, it is estimated that approximately 380,000 tons of disaster waste will be generated and approximately 780,000 tons of Tsunami deposits will be generated.

b) Securing the land for temporary housing

As explained in Chapter 3, in the current plan, available land would be approximately 15 ha and the number of occupancy will be a little over 900 if flood prone areas, riverbeds, steep slopes and overlapping land for temporary debris storage are excluded from the extracted 44 ha for the land for temporary housing. If the shore landfill plan was carried out without temporarily storing debris in the city as we suggest, approximately 1,300 temporary housing units, including the overlap-ping land with debris storage sites are added, can be provided. Since the necessary number of temporary housing is approximately 1,800 as stated in Chapter 3, there is still shortage of land for temporary housing.

As with Nankoku city, Konan city has a golf course with 36 holes. If the f airway area for one hole is estimated at approximately one ha, the building lot for temporary housing will satisfy the needs by utilizing it. Furthermore, according to the survey by the Agricultural Affairs Council in Konan city, there are 19.5 ha of fields and rice paddies that have been abandoned and the use of these lands can be taken into consideration. However, the abandoned fieldss and rice pad-dies are small for lots (five to seven houses per lot) and there is the problem of accessibility as they are often located far from the city area. In any case, it would be necessary to change the use of the land in advance and make land lease contracts for the time of disaster with the land owners. Therefore, it may become necessary to consider securing land for strategic disaster measures by giving a tax break to the land owners.

c)Landfill in the Shore Landfill Area Using the Generated Debris

As in Nankoku city, there are shoreline maintenance blocks placed along the shore in Konan city. The area required for accumulating 780,000 tons of debris is equivalent to nine to ten sections. It will be possible to promptly dispose of debris generated in the city as the shore landfill area can be created in an area where shoreline maintenance blocks are located.

5.4 Issues to Achieve the Goal

a)Preliminary Selection and Securing of the Landfill

Area

When compared to the on-shore landfill method, securing the landfill area appears relatively easy but a great deal of work, including negotiations with the fishing industry, will be generated in the local governments. Since this will affect the post-disaster land use in the region beyond the bounds of debris disposal plan, it will be essential to focus on approaches involving cross-ministries and organizational efforts as well as the residents in the area, not by considering it as a matter to be regulated by the Environment office. It is necessary for the local governments to establish such a review system.

b)Establishment of Disposal Technology by Test Operation

Basically, the existing technology should be utilized but it will also be necessary to establish specific technologies, such as separation of lumber using the flotation process, collection of metals using magnets, soil purification, and prevention of contaminant outflow.

c)Preliminary Establishment of Emergency System

Primarily, the shore landfill method is not constitutively approved by the law and institutions and it is proposed as emergency measures. Landfill in the Osaka Bay Phoenix after the Great Hanshin and Awaji Earthquake was successfully achieved simply because the time the government changed the port and harbor plan occurred close to the occurrence of the disaster. Disposal measures against disaster waste were not carried out in advance.

It is essential to formulate a pre-disaster plan focusing on prompt disposal of debris against massive earthquakes and Tsunamis expected in the future. However, the current system that applies regular laws and institutions in the time of emergency cannot accommodate such a plan.

With the objective of carrying out a plan suitable for the regional situation, it appears that the central government should establish an emergency system in advance on the premise that the local governments can formulate a strategic plan on their own.

6. Summary

The current policy for catastrophe is built on the paradigm of “prevention”. The major problem of the “disaster prevention” concept is that it lacks the measures for post-disaster “recovery” 38). Currently, intensive investment focusing on the evacuation and physical measures is being made under the central government’s Building National Resilience Project. This is also done under “disaster prevention” concept.

Taking a look at the situation of local governments, employees are busy drawing up evacuation measures, securing the budget for physical measures, negotiations with the residents and the budget implementations since the work related to the disaster prevention and construction has increased along with the Building National Resilience Project. ”Disaster prevention” will be reinforced by doing so. On contrary, this will lead to a situation that a vertically-structured administration will be most reinforced in order to work with the vertically allocated budget by the central government. Partially due to discontinuation of grants to local governments, vertically-segmented structure is being reinforced inside the local governments since the occurrence of the Great East Japan Earthquake. We are deeply concerned that the foundation for cross-organizational consideration by the employees who are familiar with the area will be lost and the “recovery power” will be neglected.

Post-disaster disposal of debris is managed by the Ministry of Environment and the local governments that regulate waste disposal in normal times. It would be a matter of course that if debris disposal is managed by these organizations that make it their mission to protect the environment, it be done in the

mindset of resource recycling and maintenance of remaining capacity at the final disposal site. On this point, it cannot be helped but to raise a question about the initial political decision that designated the Ministry of Environment to regulate debris generated by the earthquake.

Disposal of debris is one of most important aspects of “recovery” and requires prompt implementation. We assume it is necessary for achieving prompt “recovery” to prepare shore landfill areas using debris suggested by this study. As repeatedly stated in this study, the disposal of debris problem cannot be solved by the Ministry of Environment alone. It is a complex regional issue that must be addressed cross-organizationally, including agencies such as the housing bureau that regulates temporary housing, the disaster measures bureau and planning/ city planning bureaus. Achieving the idea of shore landfill areas using debris requires cross-organizational efforts as well. We wish to continue our efforts to contribute to enhance the “recovery power” together with promotion of regional “disaster prevention power”.

Acknowledgement: We would like to sincerely thank Mr. Masashi Kiyoto, the Mayor of Konan city, and his staff for their cooperation, such as providing us with data and holding seminars. This study could not have been completed without their help. Once again, we extend our deepest appreciation to them and wish to continue our efforts to expand their disaster countermeasures for the city.

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