

ANALYSIS ON URBAN LAND USE CONTROL SYSTEMS IN TSUNAMI AFFECTED AREAS BY THE 2011 GREAT EAST JAPAN EARTHQUAKE

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Abstract: Author analyzes the effect of “Area Division” including Urbanization Promotion Area of City Planning Law, “Disaster Risk Area” of Building Standard Law and other urban land use control systems during and after the Great East Japan Earthquake. Some cases of these systems in tsunami affected areas of Tohoku region are evaluated and the limitation to apply these systems to tsunami prone cities such as Kesennuma city in Miyagi prefecture, Kamaishi city in Iwate prefecture. Several issues of land use control are analyzed based on the views of municipalities.

Miyagi prefecture and Iwate prefecture were taking different recovery policy and program soon after the Great East Japan Earthquake. Although many municipalities have similar geographical and socio-economic conditions and were affected similar damage by tsunami, they are now facing different challenges. Miyagi prefecture restricts permanent reconstruction while Iwate prefecture admits individual reconstruction activities. The difference was caused by the future prospect, trend in population and economy and reconstruction plan of each affected area. The paper analyzes the current conditions and challenges of reconstruction from view point of land use control and disaster management.

1. INTRODUCTION

Tsunami disasters by the Great East Japan Earthquake that occurred on March 11, 2011 posed a question about the past urban land use control systems. In order to avoid such huge disasters in future this paper tries to verify the current systems.

Before establishment of the “Law on Creating Regions for Tsunami Disaster Management (Tsunami Law)”, the word of “tsunami” was not included in the Japanese City Planning Law (CPL) itself. The word was used only once in the Ordinance of CPL, however the interpretation of “areas with risk of flood, water logging, tsunami and high tide etc.” depends on decision by local governments. It means that the urban planning system in Japan has dealt with tsunami very superficially before the 2011 Great East Japan Earthquake.

On the other hand, the Building Standard Law (BSL) deals with tsunami in its Article 39 as “(Disaster Risk Area: DRA) A local government may designate areas with a frequent danger of tsunami, high tide, flood, etc. as DRAs by ordinances.² With respect to DRAs, prohibition of building construction for use as houses and other restrictions relating to the construction of buildings, which are necessary for disaster prevention, shall be prescribed by local ordinances as mentioned in the preceding paragraph.”, however the decision of frequent danger also depends on local authority similar to the CPL. Though application of the DRA against tsunami can be found in several municipalities since many decades ago and this BSL system is used more than the CPL, applied cases were very limited.

Under such circumstances, there are issues for many local governments how to establish land use control systems from a long term view point for the reconstruction of the tsunami affected areas by the Great East Japan Earthquake. Most of the reconstruction projects that will be implemented through land readjustment projects (LRP), group relocation projects (GRP) for disaster mitigation, recovery base project against tsunami (RBP), and public operated houses (POH) etc. may be finished during five or ten years from now on. However, land use control must be more permanent and sustainable from view point of equality and science.

There are some land use control systems that can be applicable to tsunami disaster management such as Area Division especially Urbanization Control Area (UCA) by the CPL, DRA by the BSL, and Special Precaution Area (SPA) against tsunami by the Tsunami Law that was established in 2011. In addition, there also exist some temporary land use control systems as shown in the Table 1.

Table 1: Land use control systems against tsunami

Type of Control System	Term	Area	Authority	Art.,law
Area Division (UCA etc.)	P	Urban	Prefecture	7, CPL
Disaster Risk Area (DRA)	P	All	Local govt.	39, BSL
Special Precaution Area	P	Design.	Prefecture	Tsunami
Affected area (2-month)	T	Planned	Admi. Agency	84, BSL
Affected area (2-year max)	T	Planned	Municipality	Special
Urban planning project area	T	Planned	Municipality	53, CPL

Note: “Term” P- permanent, T- temporary, “Area” Urban- urban planning area, All- no limitation, Design.- designated area as SPA by Tsunami Law, Planned- project planned

2. AREA DIVISION

2.1 Area Division by CPL and Disaster Risk

Firstly, the Article 8 of the Ordinance of CPL is verified since it is the unique article that the word of tsunami is used in the whole legal urban planning system in Japan before the Great East Japan Earthquake.

The New CPL that was established in 1968 and enforced in 1969 provides “Area Division as a division into Urbanization Promotion Area (UPA) and Urbanization Control Area (UCA)” in the Article 7 of the Law. The Article 8 of the Ordinance of CPL provides technical criteria to determine UPA to include areas where should be urbanized within ten years principally except three types of area as well as already urbanized area. One of the three types is “areas with risk of flood, water logging, tsunami and high tide etc.”, and tsunami is clearly stated.

The first Report of the Central Urban Planning Council titled “Report on principles to set up UPA and UCA and to develop UPA” was issued on November 28, 1968 and noted “areas with risk of flood, water logging, tsunami and high tide etc principally should not be included in UPA”. In addition, Ministry of Construction (MOC, current Ministry of Land, Infrastructure, Transport and Tourism (MLIT)) has issued a notification titled “Principles to coordinate between Area Division of UPA and UCA by CPL and flood control works” on January 8, 1970 has set forth “those areas that corresponds to river inundation area against rainfall intensity approximately 50 mm per an hour and water logging is assumed more than 0.5 m, are regarded as areas with risk of flood, water logging, tsunami and high tide etc by the Article 8 of CPL Ordinance, and those areas principally should not be included”. However this notification aimed at floods of river such as overflow and water logging, and not tsunami.

2.2 Area Division and the Great East Japan Eq.

Figure 1 shows the affected area by tsunami inundation at the Great East Japan Earthquake and UPA in the Sendai –Shiogama urban planning area, while Figure 2 shows those in the Ishinomaki wide urban planning area respectively. (Figure 3 indicates whole tsunami affected areas in Miyagi and Iwate prefectures including areas of Fig. 1 and Fig. 2.)

Sendai Plain has formed agricultural land. The city area has been designated as UPA in 1970 in Sendai-Shiogama and Ishinomaki area. Because Sendai city has not designated UPA except surrounding areas of Sendai Port and because the old city area of Sendai is mainly located inland area, there were not so much damages even in the coastal areas of Sendai city except some existed villages and few new developments such as Arahama-shin in Wakabayashi ward of Sendai city. Affected areas are located in UPA of Natori city (Yuriage) and Iwanuma city around Sendai city. New development of Arahama-shin and old village of Arahama where devastated damage by tsunami are observed, are both located in UCA of Sendai city.

Although this system is connected with UCA of Area Division that provides the strongest control mechanism for land use control, this provision has not been applied so

clearly to tsunami. The following data shows the reality and author analyzed the reasons why the Article 8 of CPL was not used so clearly in the next sub section.



Fig. 1 UPA and tsunami in Sendai Urban Planning area



Fig. 2 UPA and tsunami in Ishinomaki Urban Planning area

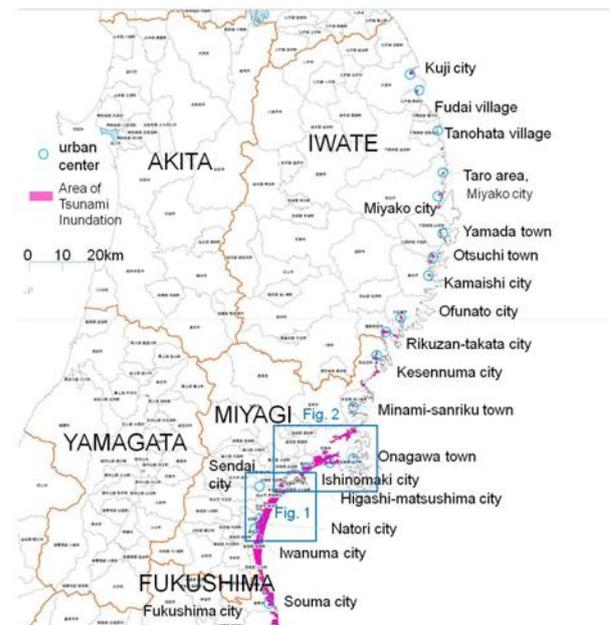


Fig. 3 Tsunami affected areas by the Great East Japan Eq.

2.3 Reasons why Article 8 was not well utilized

The reasons why CPL did not function well against tsunami in spite of Article 8 of its Ordinance are listed according to the type of reasons as follows:

(1) Social Reasons

- When the UPA was firstly designated, the areas where

consensus could be easily obtained were selected. Already urbanized city areas had the first priority.

- UPA was basically set in the regions that rapid increase of population occurred like surrounding cities of Sendai.

- Many new public facilities and care houses for the elderly were constructed in the UPC areas with tsunami risks, because of consolidation of municipalities, progress of aged society and long-term trend in decrease of population.

(2) Physical Reasons

- People thought that it will be easy to evacuate from tsunami, since the most advanced information technology and early warning systems are established.

- People who lived in the coastal area thought that seawalls, river gates and tsunami evacuation buildings would protect residents from tsunami disasters.

(3) Economic Reasons

- UPA tends to be designated in and around already urbanized area, because of efficient use and maintenance of infrastructure, such as roads, sewerage and water supply.

- To move to safer area, in particular change of urban setting is almost impossible in normal time even though all people recognized their high risk as well as partly because of financial reason of municipality and prefectural government.

- The movement to protect agricultural land becomes weaken as demand of agricultural land will not increase and because of higher exchange ratio (strong yen) and excessive domestic rice production etc.

- Even if the risk is judged, agreement with local residents would not invest against tsunami because the probability of occurrence is quite low compared with floods

(4) Institutional Reasons

- This provision is applied for new areas to include in UPA within 10 years. It regulates only newly urbanizing areas.

- There were no concrete criteria with numbers as shown in the old notification and it is hard for local governments to judge the risk of tsunami on their own responsibility.

- There is no detail explanation on how to set up the CPA against tsunami in the MLIT guideline of urban planning.

- Some urban planning may not be realized when other urban function is not conscious except disaster management, and so on.

3. DISASTER RISK AREA

3.1 Disaster Risk Area by BSL

Disaster Risk Area (DRA) system was introduced when the BSL was established in 1950. The Article 39 of BSL provides “local government can designate highly hazardous areas against tsunami, high tide and floods etc. as DRA by its bylaw”. There is no detailed ordinance or regulations in BSL, however notification of administrative vice minister of MOC on October 27, 1959 (after Ise Bay Typhoon occurred on September 26, 1959) entitled “disaster prevention for buildings against storm and flood damages” recommended to positively designate DRA based on the Article 39 of BSL, especially in the low land areas, to strengthen the structure of buildings in the area and to develop evacuation facilities.

In addition the notification noted “buildings in DRA must be constructed as strong buildings such as reinforced concrete structure unless there exist effective embankment etc.” and “residential use buildings should be prohibited to construct in the heavily hazardous area”. However definition of “heavily hazardous area” was not mentioned as well the target of this notification did not include tsunami so clearly but mainly for storm and flood disasters.

3.2 Disaster Risk Area and Tsunami

Detailed explanation of “strong buildings” and “heavily hazardous area” is firstly found in the Notification No.1318 of MLIT in 2011 on “Definition of safe structural systems against tsunami to presume tsunami inundation” based on Tsunami Law. In addition, technical guidelines on land use against tsunami disaster are issued continuously such as a technical advice to the additional knowledge issued by the Director General of Housing Bureau on November 17, 2011, a technical advice on enforcement of Tsunami Law by the Cabinet Office on March 9, 2012, and a technical advice on enforcement of the Section 9 of Tsunami Law on July 31, 2012, recently.

As the reference, in the guidance textbook on BSL issued by the Architectural Institute of Japan (AIJ) in 1950, DRA was referred as “Target of DRA is areas prone to tsunami as Sanriku region, and/or river side areas prone to flood disasters. However as an actual condition, designation of DRA is quite hard issue and the issue is a regional issue of the area, therefore the system provides designation of the area and contents of control for building restriction are all trusted to the local ordinance”. The risk of Sanriku region against tsunami was recognized.

Table 2: Designation of DRA (as of Mar. 2009, by MLIT)

Area Type	Number (places)	Area (ha)	Number of Buildings in the Area			Total (unit)
			Houses (unit)	Incl. unfit houses (unit)	Non residential	
Steep slope	18,785	36,898	339,785	122,343	37,371	377,156
Landslide	64	252	283	217	229	512
Flood	111	2,781	1,696	676	1,179	2,875
Tsunami	2	143	0	0	38	38
Tsunami/flood	5	6,504	74,002	0	39,020	113,022
Snow/slide	3	21	3	3	6	9
Avalanche	8	149	14	4	28	42
Avalanche etc.	2	548	531	0	0	531
Lava flow	2	41	0	0	0	0
Subsidence	1	0.4	1	0	1	2
Land deform	5	13	0	0	0	0
Erosion	1	0.5	3	0	9	12
Fall of rocks	5	15	129	0	48	177
Mud flow etc.	4	13	0	0	0	0
Others	0	0	0	0	0	0
Total	18,996	47,383	416,447	123,243	77,929	494,376

3.3 Reasons why DRA was not so used against tsunami

The following (1) to (7) analyzes the reasons why DRA was not so utilized in the hazardous areas against tsunami.

(1) As shown in the guidance textbook on BSL by AIJ, designation of DRA was quite hard issue. Before BSL was established, principally all construction activities were free and no restriction. Even though the restriction by BSL is set up as “minimum standards”, it was told that the then owners, architects, and contractors could not easily accept the BSL. From the legal view point, when a certain restriction violates some property rights, compensation measures to the owner

must be provided. However because the restrictions based on BSL provide minimum standards in order to protect lives, health and properties of the people, no compensation system is prepared and authorized.

(2) In 1950 when BSL was established, there seemed almost no scientific knowledge on tsunami hazards. Since BSL prescribes technical standards, it was impossible to regulate standards without any scientific bases. In contrast to tsunami standard, seismic standard in BSL has been created from the first as well as fire codes, because of experiences of Nobi earthquake in 1891 and the Great Kanto Earthquake.

(3) DRA aims to prevent disasters utilizing locally applicable control codes through designation of the area. There exist approximately 19,000 DRA in Japan as shown in the Table 2 (2009 MLIT). However most of them were designated against landslides to restrict housing construction in the steep slope areas. DRA against tsunami risk was not established except few cases as the frequency of occurrence is quite rare and residents do not agree to prohibit from building their houses. There is no national financial support.

(4) As shown in the Table 3, DRA provides permanent restriction while other building control system in the disaster affected area like the building control based on the Article 84 of BSL, sets normally two months' limitation or in the case of the Great East Japan Earthquake maximum eight months' control. DRA controls won't be necessary for the area without any development pressure.

(5) DRA was sometimes used in the recovery projects after damaged disasters. In the case of Aonae area of Okushiri town after a big tsunami of the off coast of South-West of Hokkaido earthquake in 1993, DRA was introduced to the high risk area in the old residential zone after the new hilly safe area was developed utilizing "Group Removal project against Disasters (GRP)" with subsidies from national government (by MOC, current MLIT). This was the unique case after tsunami under DRA.

(6) As shown in the Table 3, Iwate prefecture requested all affected municipalities to set DRA to the heavily tsunami affected area in April 2011. However Kamaishi city decided not to use DRA in July 2011 and other municipalities are also reluctant to apply DRA but they changed the policy in 2012. On the contrary, Miyagi prefecture set building control in large areas using the Article 84 of BSL as well as DRA to apply CRPs. Sendai city and Yamamoto town utilized DRA to control building construction in tsunami hazardous areas.

(7) As shown in the Table 4, the basic direction toward reconstruction of Miyagi prefecture and Iwate prefecture seems to select different way as the case of building restriction in early stage. It seems that Miyagi prefecture aims to improve urban structure using this opportunity especially in the coastal zones, while Iwate prefecture seems to be struggling to maintain population in the tsunami affected areas and then restriction of building construction in Iwate pref. is not so strict compared to Miyagi prefecture because the population decrease trend is expected severer in the remote regions from big cities. However, it may be caused simply because of the difference of urban planning settings of both prefectures, i.e. Miyagi prefecture sets UPA

and UPC and most of coastal areas are prohibited to construct buildings. In Iwate prefecture, construction of buildings is not so strictly controlled in the coastal cities and towns.

Table 3: Building control based on BSL after disaster

Building Standard Law	Article 39 (Disaster Risk Area: DRA)	Article 84 (Control in Affected Area)
Designation of area	Based on bylaw of local governments	By Specialized Admin. Agency
Duration of control	Permanent measures	Max. two months
Construction control	Prohibit housing, limit other building (no national intervention)	Prohibit / limit building construction in the project planned area
Application to Great East Japan Earthquake	Iwate: Urge municipality to set bylaw Miyagi: Pref. started to plan to apply	Iwate pref.: No application Miyagi: Applied to 5 municipalities
Response of municipalities	Iwate: Mayors are prudent (negative) Miyagi: Part of Minami-sanriku town	Miyagi: Enterprises were embarrassed then try to permit some construction
Applied cases	Hokkaido, Okushiri town, Aonae area	Great Hanshin-Awaji Eq. (Kobe etc.)

Table 4: Comparison of Miyagi and Iwate prefectures

	Miyagi Prefecture	Iwate Prefecture
Total population	2,360,218 persons	1,385,041 persons
Estimated pop.	1,894,000 persons	962,000 persons
Ratio(2040/2005)	- 19.8% (affected area - 46.8%)	- 30.5% (affected area - 48.8%)
Aged ratio (05-40)	20.0% (2005) → 34.3% (2040)	24.6% (2005) → 38.0% (2040)
Basic Concept for Reconstruction (part of land use & development)	Miyagi Prefecture Recovery Plan: Recovery focusing on tsunami disaster management of coastal areas applying removal to high land, separation of work and home, multiple protection against tsunami from the lessons	Iwate Prefecture Recovery Basic Plan: Based on agreements with residents, improvement of residential area for safety and development connected with land use plan considering tsunami disaster management
Current situation (building control)	Pref. set building control based on City Planning Law etc. after BSL Article 84. BSL Article 39 (DRA) is also used in many areas in Sendai, Kesenuma, Minami-Sanriku etc. in order to apply GRPs.	Pref. recommended municipalities to use BSL Article 39. Some GRPs areas are under planning to apply DRA in Kamaishi and Miyako cities, Yamada town and Noda village as of Sept. 2012.

Table 5: Major project systems for reconstruction

Basic Projects	Group Relocation proj. against Disasters (GRP)	Recovery Base project against Tsunami (new system after 2011) (RBP)	Project on Land Readjustment for Urban Recovery (LRP)	Project on Urban Redevelopment (URP)	Public Operated Houses project against Disaster (POH)
Subsidies	Cost for public works incl. land development except sell land	Total mounding cost, Development of evacuation building and Public works etc.	Cost for public works incl. land, totally mounding (40 persons/ha)	Cost for design, common facility and public space etc.	Land purchase, design and construction cost, low rent subsidy
Area	No relation to Urban Planning	Principally within Urban Planning Area	Within Urban Planning Area	Within Urban Planning Area	No relation to Urban Planning
Scale	More than five (usual 10) houses	Principally 2 projects per urban, and approx. 20 ha per project	No condition	No condition	No condition
Condition	Designation of Disaster Risk Area is requisite	Define area for land purchase. Step by step extension will be possible	Consolidated area to develop road system. Division of project area	Consolidated area to build co-owned houses and/or building	Demand to public houses for low income household after disaster
Urban Planning	No relation	Area is designated	Area and project is designated by UP	Area and project is designated by UP	No relation
Process	Agreement of MLIT minister on removal plan	Planning decision as urban facility, project approval of prefecture (or MLIT)	Urban planning procedures are needed from planning decision to liquidation)	Urban planning procedures are needed from planning decision to liquidation)	Municipality and prefectural govt. construct and operate the houses
Aid ratio	All costs will be covered (special case by national grant + special tax).				

4. DAMAGE AND URBAN PLANNING

4.1 Analysis on Damages by Tsunami

The data on damages of the Great East Japan Earthquake from the view point of building control and urban planning are analysed, and observations can be pointed out as follows:

(1) Fig.4 indicates the characteristics of urban planning with UPA by Area Division. The damaged houses include

collapsed, half collapsed and partially damaged one. That means in UPA such as in the Sendai plain, housing damage inundated areas turned out large number, while human damage was not so severe if compared with Sanriku rias coast areas where there is no UPA except Onagawa town.

(2) Fig.5 shows two exceptionally large damaged cities in terms of physical damage. Both Sendai city and Ishinomaki city are classified as the area of “Urban Planning with Area Division”. That means the pressure of development and increase of population is expected in these cities. Therefore it is required to effectively invest resources into the UPA.

(3) Fig. 6 shows casualties per collapsed houses with classification by urban planning type. As same as the Fig. 5, all municipalities in Fig. 6 established urban planning. That means heavily damaged areas to houses and human were basically controlled under urban planning system that can apply rather strict building control.

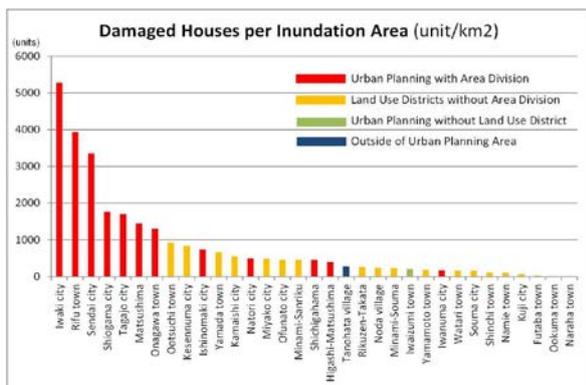


Fig.4: Totally collapsed houses by municipality

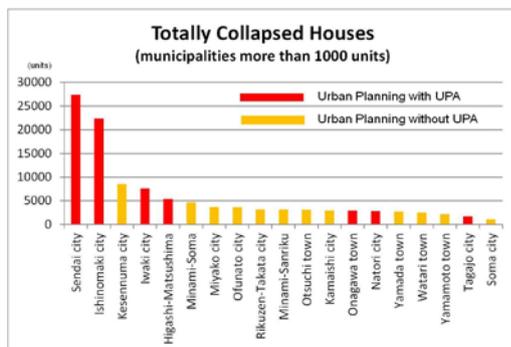


Fig.5: Damaged houses per inundation area

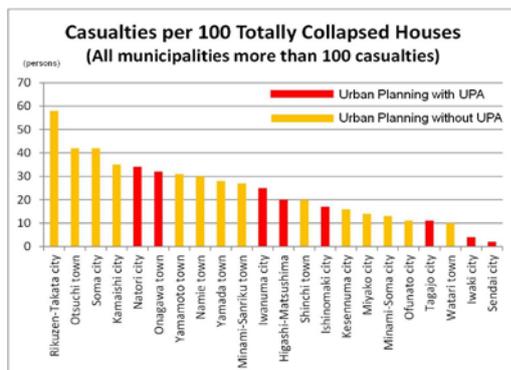


Fig.6: Casualties per 100 totally collapsed houses

(4) Fig.7 shows severity of damage of each municipality by classifying the characteristics of regions. The proposed indicator is calculated as “number of human damage per totally collapsed houses” by municipality. Coburn, Spence and Pomonis defined similar ratio as “Lethality Ratio” in 1992. The following data is formulated after extracting less damaged municipalities that have large fluctuation because of their smaller denominator.

(5) The ratio varies almost double figures (from 60 to 2-1) under this indicator. Rikuzen-Takata city recorded around 60 persons’ human damage per 100 totally collapsed houses, while Sendai city’s indicator shows around 1 or 2 persons. Fig.8 tries to classify the damages however not so clear difference was observed from above mentioned data according to the characteristics of the region type.

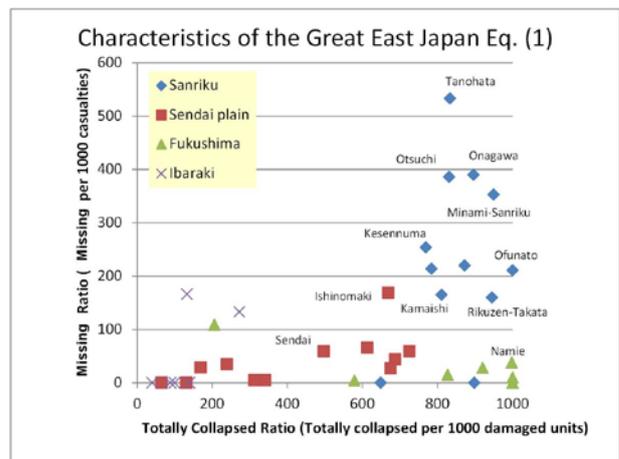


Fig. 7: Missing ratio and totally collapsed ratio

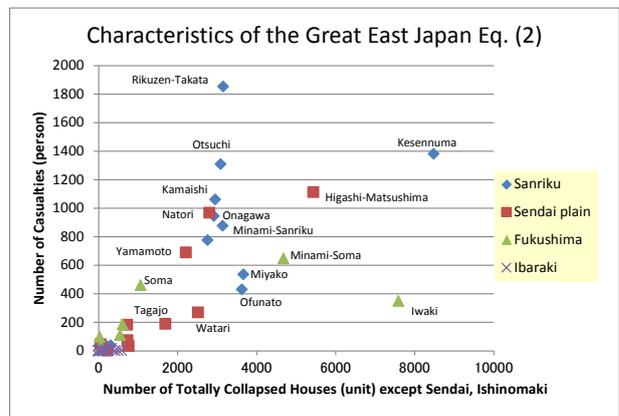


Fig. 8: Totally collapsed houses and casualties

Then, the reasons why such great difference was observed among affected cities and towns, especially as shown in the Fig. 6 (under the same physical house damage but the human damage varies a lot) will be as follows. In the case of tsunami, relation of physical damages and human damages may be significantly affected by evacuation behavior. The factors may be;

1. Evacuation from house or not
2. Time for evacuation to the refuge
3. Measure for evacuation (on foot or by car)
4. Evacuation route (and traffic congestion)

5. Safety of refuge (or evacuation shelter etc.)

In addition, except for evacuation behavior, the following factors may affect the difference of damage;

6. Judgment of “totally collapsed” differs from municipality (e.g. if tsunami reached ceiling, municipality regarded as totally collapsed.)
7. The residents who experienced few damage at the Chile Tsunami in 1960, became rather unprepared or careless against tsunami.
8. The area has no tsunami evacuation building such as 4-story close to the residential area.

4.2 Urban Planning in Pacific coastal region in Tohoku

In total 37 municipalities in the Pacific coast region in Iwate, Miyagi and Fukushima prefectures, 3 municipalities have no urban planning area. In addition 4 municipalities in these 3 prefectures have urban planning without land use districts. That means other 30 municipalities of this region have urban planning areas with land use district.

With regard to the Area Division, no municipality in this region in Iwate prefecture has urban planning area with Area Division (UPA and UCA). In Fukushima coastal region, Iwaki city only sets up Area Division. To the contrary, 11 municipalities within total 15 municipalities in the coastal region of Miyagi prefecture divided UPA and UCA by Area Division. Because there is no increase of population in Sanriku (rias coast) region, no UPA is designated in coastal areas of Iwate prefecture as well as Kesennuma city and Minami-sanriku town in Sanriku area of Miyagi prefecture.

From the analysis of the damage, it was unfortunate that objectives of the Article 8 of CPL Ordinance could not function in many tsunami affected cities (mainly in Miyagi prefecture) at the Great East Japan Earthquake. However, from the figures 1 and 2, UCA by Area Division decreased human damage in Sendai city than Ishinomaki city although this was not obvious until after the event.

4.3 Issues of Land Use Control in Reconstruction area

(1) As shown in the data and figures, damage by tsunami varied in each municipality (e.g. in Onagawa town and Ishinomaki city have huge damages even in the UPA), we need continuously investigate the reasons and factors from various points such as evacuation, traffic, land use, building structure, depth of tsunami inundation, response of administration by municipality, awareness information etc.

(2) Since there is no Area Division in coastal areas of Iwate prefecture and Fukushima prefecture except Iwaki city and land use control system is not so strict, DRA with Group Relocation Project (GRP) against Disasters, Tsunami Law and other land use control system are indispensable to safe buildings and urban areas.

(3) One of the most significant issues in the tsunami affected areas is land level raising works in urban area. Because of around 1 m land subsidence by the Great East Japan Earthquake, coastal zone are suffered from inundation every day. Municipalities are starting to raise the ground level of roads and other public facilities. However private land owners basically have to raise the land by themselves,

unless the land is included in reconstruction project areas. The compensation for private properties caused by land subsidence may be one of the new discussion points as a part of public assistance as well as the level of support to the reconstruction of private houses and business facilities.

(4) Other important issue is manpower assistance. Many staffs of the affected municipalities such as Kamaishi and Kesennuma city pointed out lack of staff for urban reconstruction projects because many projects started after the first recovery stage such as debris clearance and disposal, temporary housing and so on. Many municipalities outside of affected areas have sent technical or project support staffs to the affected area. For instance, Kitakyushu city sent a team of project staffs to Kamaishi city where the same steel company is located.



Fig. 9: Land subsidence and water logging (Kesennuma)



Fig. 10: Reconstruction project area (Unosumai, Kamaishi)

5. CONCLUSIONS

Urban planning and building control systems that are prescribed in the CPL and the BSL are expected to play significant roles to prevent tsunami and earthquake disasters.

Japanese urban planning system was established in 1919 and since then Japan had opportunities to realize the urban plans after the 1923 Great Kanto Earthquake and reconstruction process from the damages by the WWII after 1945. In addition recovery from Ise Bay typhoon in 1959

and the 1995 Great Hanshin-Awaji Earthquake exposed past issues of urban planning and new legal and support systems were formed in order to achieve safer urban settings. And now after the Great East Japan Earthquake, we are requested again to reconsider the future of urban planning systems including land use control.

Land use control in the urban area especially in the disaster risk area has to be integrated with socio-economic, institutional, technical and other tools to achieve safety of buildings and built-environment. To mitigate earthquake and tsunami risk, land use control plays a quite important role. Awareness creation is also instrumental for building culture of safety and creates demands for intervention in disaster mitigation.

The demands ultimately help in creating conducive environment to policy intervention, in realizing institutional mechanism of code enforcement and land use control for the municipal authorities and in creating demand for competent professionals in the field of urban planning and disaster risk management.

As a summary of conclusion, author would like to note the following future prospect on land use control systems;

(1) Though the final goal of tsunami disaster management will be relocation and land raising of urban area, evacuation training, designation and development of safe refuges and evacuation routes against tsunami are the first measures.

(2) Land use control against disasters will be more effective when it is combined with urban planning project and disaster management project. Such combined cases will be expected to widely advance through GRP and RBP by the Tsunami Law as well as new development of LRP and projects for urban redevelopment etc.

(3) Reconstruction of the affected areas by the Great East Japan Earthquake faces long-term social issues such as aged society, decreasing population and the sustainability. New concept of compact city, smart city and eco city may help to solve them in the near future.

(4) Disaster Management Plan prepared by prefectures and municipalities are needed to closely relate to urban planning including land use control system of each area in the near future, as there is few connection now.

(5) Finally, hope and intention of residents and staffs of local governments was the key of recovery. Strong intention of local people to make safer and more sustainable region and city for the next generations is really expected.

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