

Land Management Issue Related to Recovery From East Japan Great Earthquake

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SUMMARY

To promote quick recovery from damage by East Japan Great Earthquake on March 11, 2011, Japanese government continuously invest budget and implement necessary measures. East Japan is an area where cadastral survey has been intensively conducted compared to other area in Japan. Land administration related effort and role of Cadastral record in recovery in the area are summarized from documents and presentations by government, especially Ministry of Land Infrastructure Transportation and Tourism (MLIT), Reconstruction Agency and by JACIC. Reconstruction is advancing steadily in general. However, reconstruction of residences still is in early stage. It will be accelerated when initial discussion and adjustment phase will be completed. In preparation, an example suggests cadastral records help contacting stake holders on land concerned and speed up preparation. To prepare other earthquakes concerned about, it is urgent issue to promote cadastral survey in areas progress is not enough.

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1. INTRODUCTION

On March 11, 2011, Pacific coast of north eastern part of Japan was hit by M9 earthquake. The earthquake was followed by large Tsunami. The tragedy was widely reported by mass media. Many scientific papers on the event were published. Crustal deformation and source model was published, for example, by Ozawa et al. (2011). Kaidzu (2011) summarized damage and initial counter measure plan by government, prefectures and municipalities.

Three years have passed since the earthquake. To promote speedy recovery from the damage, Japanese government continuously investing budget in the area and also prepared administrative measure so that local government or people can stand up and manage to open their ways.

In this paper, we focus on land management issue and overview effect of cadastral record through reports by Japanese government mainly Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Reconstruction Agency and CORINS data of Japan Construction Information Center Foundation (JACIC). Reconstruction in residences are still in early stage. It will be accelerated when initial discussion and adjustment phase will be completed. In preparation, an example suggests cadastral records help contacting stake holders on land concerned and speed up preparation. To prepare other earthquakes concerned about, it is urgent to promote cadastral survey in areas progress is not enough.

2. PRESENT STATUS OF RECOVERY

According to a report by Reconstruction Agency, on January 2014 (Reconstruction Agency (2014)), percentage progress of recovery as of end of Nov., 2013 is as follows.

Removal of rubble: 91% completed.

Reconstruction of highways: 80% started and 37% completed.

Railways recovered operation: 89% in route length.

Restoration of dike along rivers: 99% completed.

Restoration of water works: 89% completed.

Restoration of sewage system: 97% completed.

Land readjustment: 65% started and 0% completed.

Removal of residence to elevated area: 64% started and 5% completed.

Construction of public residence: 61% started and 2% completed.

Restart farming in Tsunami-devastated area: 63%

It shows reconstruction of highways, railways or other social infrastructures which can be restored on the same site show rapid recovery. On the other hand, land readjustment or removal of residence to elevated land is rather slowly advancing. Adjustment of interests and rights is not an easy work. Especially in this case, some of land owners are lost. It certainly cause increase of persons involved through succession. Some of those are taking refuge and difficult to communicate. Because human casualties are large, when transaction of land is involved, it becomes an issue besides adjustment of interests and rights.

2.1 East Japan Great Earthquake Reconstruction Special Area Act

According to “East Japan Great Earthquake Reconstruction Special Area Act”, local government in those area where certain amount of damage occurred due to East Japan Great Earthquake can request special area treatment in area under reconstruction plan be a special area. If Prime Minister agree, they can follow special provision for agreed items for agreed purpose. Followings are some examples of such provision which is related to land management.

- Tax reduction and increased depreciation for good quality lease houses for victims.
- One-stop Processing of administrative procedure for Restructuring of Land Use.
- Ease a restriction of land use for
 - Integrated construction of residential and agricultural area
 - Land adjustment
 - Group removal of residence to elevated land
 - Liquefaction counter measure
 - Landslides countermeasure
 - ...and so on
- Ease procedure for changing route of rail way or bus and newly establishing bus routes
- Extension of existing period of emergent temporal buildings
- Ease restriction of limit to private use of parks or similar public properties for temporal buildings for reconstruction purpose
- And so on

Special provisions are not only ease restriction but include stronger restriction. When some activity in the special area has possibility to hinder reconstruction, local government can ask report and if necessary can issue recommendation so that the activity will not hinder reconstruction process.

2.1.1 Special Provision related to land

Tsunami associated with East Japan Great Earthquake left wide land where boundaries are not clear and land owners lost or missing and land owners difficult to access. For any public works including acquisition or transaction of land, cadastral information is necessary. To promote fast and proper recovery or survey of boundary, special provisions are prepared in special area as follows.

- Cadastral survey was done by prefectural governments or municipalities so far. In special provision, it is allowed that national government act for local government.
- Parcel boundary demarcation was done only by land owners so far. In special provision, it is allowed project implementing body such as national or prefectural government or municipalities can carry out parcel demarcation when land owners are not found or difficult to access.
- In survey for public project, land owners' permission was necessary to enter private land so far. In special provision, it is allowed to enter private land for survey or exploratory drilling when land owners are not found or difficult to access.

2.2 Time and cost required for land acquisition for public works

Restoring damaged structure is costly. If structure is restored in the original position, land

acquisition problem is not a very difficult problem. In case of group removal of residence to elevated land or land readjustment, Transaction of land is a main issue and all the stake holders on land in the concerned area are involved. Even in usual days, it is not easy task. After the huge Tsunami, many of them are lost or missing and through inheritance process, number of stake holder increase and adjusting their interest will be time consuming and tough job. That is so, still we must start from finding persons concern. Cadastre is the starting point of public works related to land.

It is quite difficult to account how much the existence of cadastral data can reduce time and cost of land acquisition for public works. There is estimation by Natori city, Miyagi prefecture. According to a brochure of cadastral survey published by MLIT (MLIT (2013)), group removal of residence in Shimomasuda, Natori, Miyagi Pref. to elevated land cost 12 million Yen and survey took 7 months. Natori City estimates the cost will be 22 million yen and duration will be 1 to 1.5 year if cadastral data be not available. In Shimomasuda area, construction work is going as expected. MLIT refers to this example to show how cadastral record help public works.

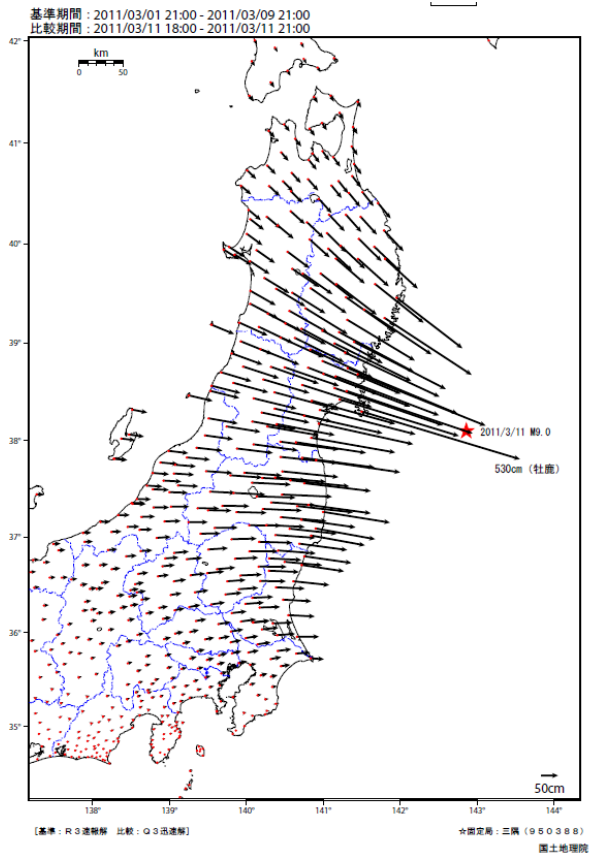
Although the progress of cadastral survey is high in East Japan compared to Japanese average progress, Recovery of residence is only slowly advancing. One reason is that damaged area is located in narrow flat land in between mountainous area and sea shore. Habitable land is already in use. There are many stumbling blocks related to adjustment of right and interest. Even so, in case of Shimomasuda, existence of cadastral record helped early group removal of residence to elevated area. In most of damaged area, as cadastral data are available, at least we know to whom we should discuss.

3. RECOVERY OF CADASTRAL RECORD

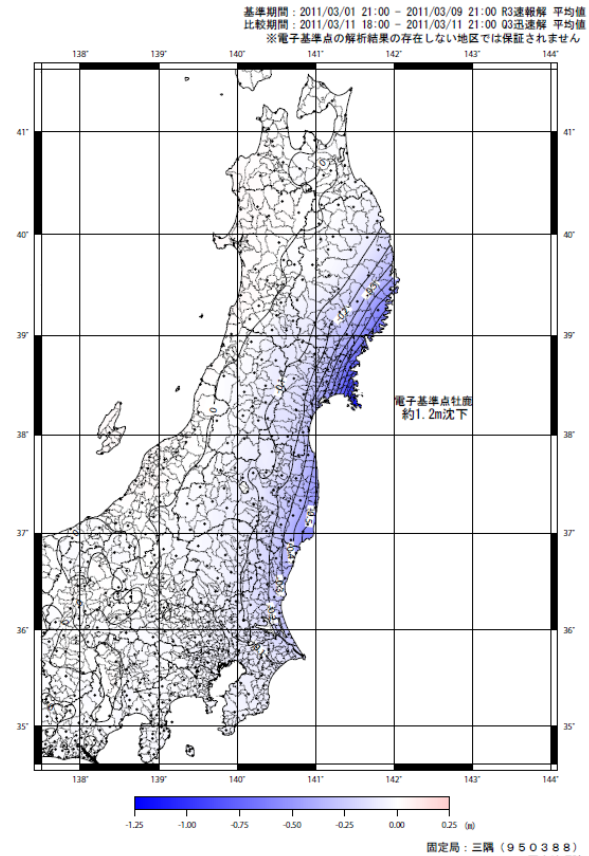
According to permanent GNSS monitoring network “GEONET” of Geospatial Information Authority, MLIT (GSI), crustal deformation due to the earthquake spread widely both in space and time (Figures 1 and 2) (Geospatial Information Authority(2011)). Figure 2 shows temporal change of a cord distance between Kashiwazaki (located on Japan Sea coast, central Japan) and Onagawa (located on Pacific coast Miyagi Pref.). Distance between those stations is about 277km. The graph includes discontinuities due to crustal deformation associated with the main- shock and aftershocks. It also shows bend due to post seismic aftereffect. Aftereffect continues till present although the amplitude gradually decreases in time.

To cope with this large crustal deformation, GSI renewed official coordinates of control stations in eastern part of Japan. While resurvey and recalculation was done, GEONET coordinates were provided so that necessary survey for reconstruction work can proceed.

Coordinates of GEONET stations are continuously monitored by GSI and we can recover coordinates of surveyed position at given epoch easily afterward.



a. Co-seismic horizontal displacement.
Maximum displacement is 5.3m



b. Co-seismic vertical displacement.
Maximum subsidence is 1.2m

Figure 1. Coseismic displacement of GEONET stations (after GSI)

3.1 Recovery of coordinates of parcel boundary vertices

Surface displacement can be divided into two categories. One is due to deformation of crust and the other is due to surface phenomena such as liquefaction, land slide, crack in soil and so on. Displacement due to crustal deformation is basically continuous and wavelength of displacement is long. We can refer to displacements of GEONET stations and apply mathematical interpolation to recover coordinates of vertices of parcel boundary. To apply such procedure, it is needed to have

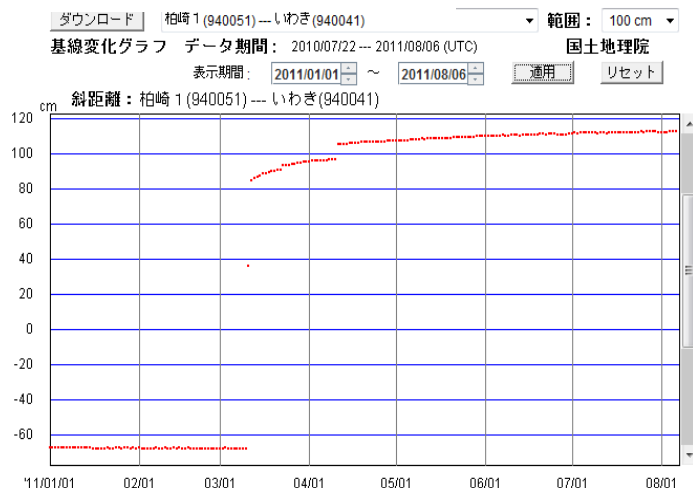


Figure 2. Temporal change of cord distance between Kashiwazaki and Onagawa stations of GEONET during 2011/01/01 and 2011/08/06.

Produced with Web Service in GSI Web site

accurate cadastral maps. When cadastral survey has completed, even if records and maps are washed away, we could recover data from Immovable Property Registration Data Base of Ministry of Justice. That is because a copy of cadastral survey result, by law, should be sent to registry office and reflected to registration.

Surface phenomena, on the contrary, are more complicated and its wavelength is short. When such displacements are observed, the area should be re surveyed.

4. STATUS OF CADASTRAL SURVEY IN THE DAMAGED AREA

In Japan, land is registered and it is shown on maps according to article 14, Immovable Property Registration Law. Some of those maps are produced in 1873-1880 and are not accurate in modern standard. In 1951, Japanese government started cadastral survey. Cadastral maps are based on official coordinate system. The survey is conducted by municipalities with governmental and prefectural subsidy according to Land Survey Law. Copies of Cadastral maps and records are sent to registry offices and replaced with old contents and maps of representation division. Even after more than 60 years, progress is still 50% as a total. In Tohoku area (North Eastern Japan), fortunately cadastral survey is well advanced. Damage due to strong quake, Tsunami and liquefaction in residential area are reported in Aomori, Iwate, Miyagi, Fukushima, Ibaraki, Chiba prefectures.

According to statistics by Cadastral Survey Promotion Division, MLIT (2013), progress in terms of area surveyed is as follows.

Aomori.....93%

Iwate.....91%

Miyagi.....88%

Fukushima...61%

Ibaraki.....66%

Chiba.....14%

Beside Chiba prefecture, other prefectures are well surveyed. Especially, in Tsunami inundated area, progress is ca.90%.

Cadastral record is only an entrance to proceed along land related reconstruction process. This high percentage progress of cadastral survey in this area definitely helps accelerating reconstruction process.

5. INFORMATION IN DATASETS OTHER THAN STATISTICS BY RECONSTRUCTION AGENCY

There are some more datasets which includes information on reconstruction in Eastern Japan. Here, we will glance at “Trend in Land Management in 2012 and Basic Measure on Land in 2013” (MLIT(2013)) known as “White paper on Land” based on Basic Act for Land (Act No. 84 of December 22, 1989) and “CORINS and TECRIS” data by JACIC.

5.1 Transaction of Land in Market

According to Basic Act for Land, MLIT reports situation and measure on land to Diet. In the report known as White paper on Land, in 2013 report (MLIT (2013)) we can find recent trend in transaction of land in Iwate, Miyagi and Fukushima prefectures. Figure 3 shows year to year comparison of number of transaction based on registry record by Ministry of Justice.

In Iwate and Miyagi, after half year of decrease, transaction became active and after 2012, rapid increase of number of transaction is seen. In Fukushima, nearly one year of delay in trend is seen. This will be due to accident in nuclear power plant.

In the same white paper, it is reported that in above referred three prefectures, year to year comparison of number of housing start indicates high increase in year 2012. These report shows, if we include private activities in market, reconstruction of residences or offices have started and advancing.

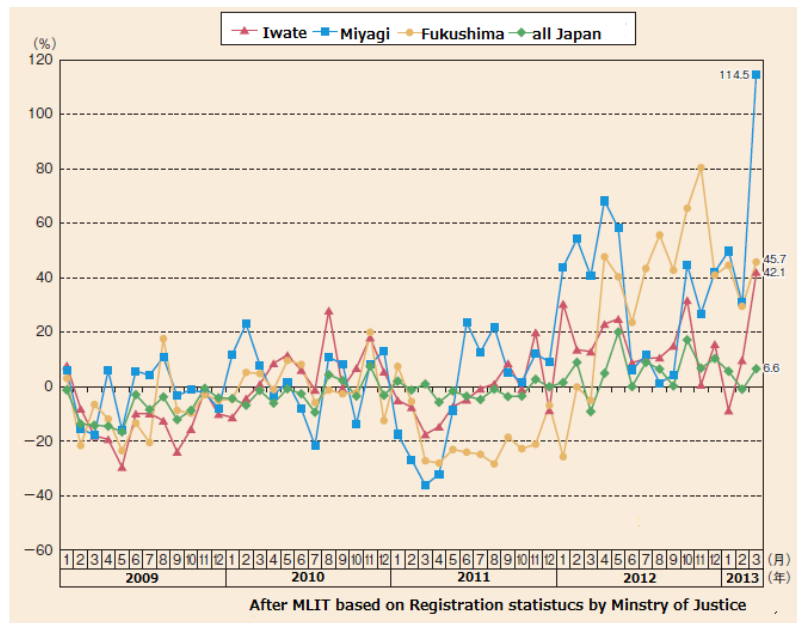


Figure 3. Year to year comparison of number of transaction of land. Figure is after White paper of Land (MLIT (2013)) based on statistics of registry record by Ministry of Justice

5.2 Progress of Public Works in Terms of Contract Based on CORINS data

CORINS is a database maintained by JACIC, Japan To help public organizations such as government agencies, prefectural government, municipalities and so on to find Experienced reliable contractors for public works. The data can be used as an indicator of temporal change of construction works in terms of both numbers of contract and amount of contract.

5.2.1 CORINS and TECRIS

The back ground of development of the system is as follows.

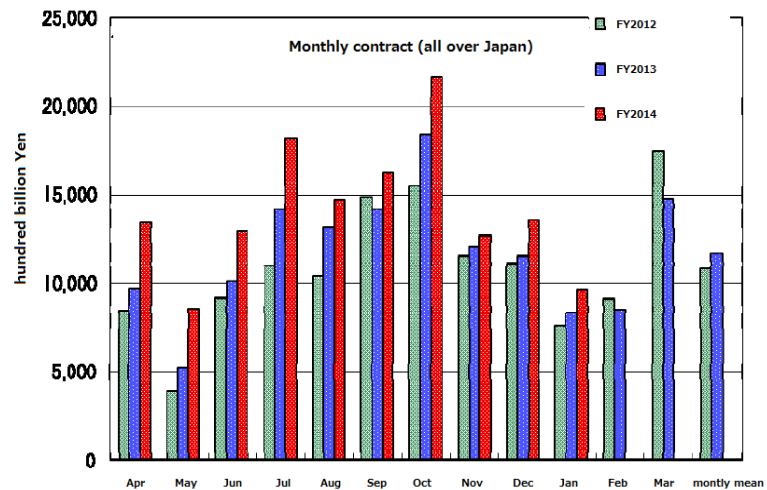


Figure4. Amount of total contract of construction work all over Japan registered with CORINS

Reflecting social needs such as prevention of the fraudulent activity at bidding and contracting procedure in ordering public works and responding to internationalization of a construction market, The Central Council on Construction Contracting Business worked out the proposal named "Reform of the Bidding and Contracting Procedures for Public Works" on December 21, 1993. As part of the reform, the proposal states that it is necessary to develop the record database which will enable them to make fair and transparent selection of firms when public sectors contract out construction and their related works. As JACIC has

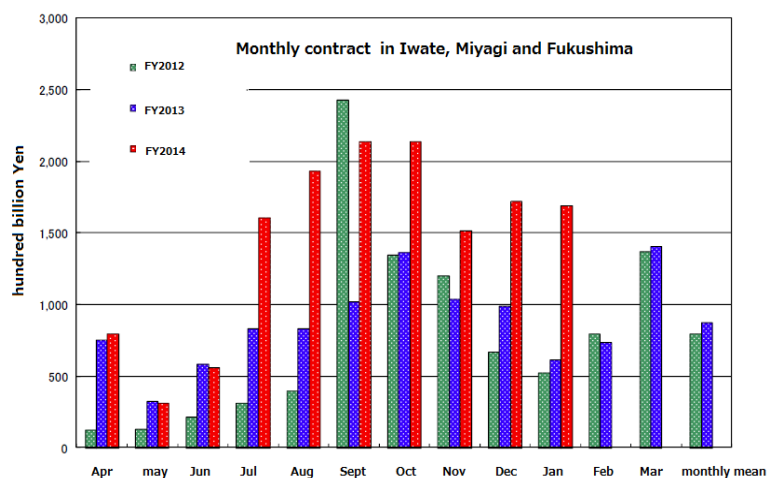


Figure 5. Amount of total contract of construction work in Iwate, Miyagi and Fukushima registered with CORINS

expertise in construction information widely, we have created construction records and technical consulting records database (CORINS, TECRIS), and provide such information with each client organization (JACIC (2013)).

Using this data base service, client organizations can easily know experience of the company, existence of qualified and experienced engineer in the company and so on so that they can select reliable contractors. For public owners outside of Japan, JACIC issues certificate of registration. Presently, 250,000 records are registered with CORINS per year and 100,000 records are registered with TECRIS per year.

5.2.2 CORINS data as an indicator of progress of reconstruction

CORINS is one of the largest data base of contract, starting and completion of public works in Japan. The trend of registration of data is a reliable indicator of construction activities in Japan. To see the trend of investment on public works, JACIC provides statistics based on these data through Web site (JACIC (2014)). Figure 4 shows amount of total contract all over Japan in recent 3 years. Investment on public works is increasing after the earthquake.

Figure 5 shows amount of total contract in Iwate, Miyagi and Fukushima prefectures registered with CORINS. It is significant that amount invested in this region increased remarkably.

Using CORINS and TECRIS data, Suzuki (Suzuki (2012), Suzuki(2013)) studied progress of reconstruction in area damaged by East Japan Great Earthquake. He also studied distribution of increase rate of investment on construction and found that increase rate is higher in municipalities along including seashore in these three prefectures.

Construction works starts in planning, then survey performed. Then design and settlement of right and interest including land acquisition follow. Only when those steps are successfully completed (at least in some part of planned area) construction work can be started. Of course it will not be such straight forward but this rapid progress in so wide area suggests finding stake

holders through survey and negotiation among them proceeded steadily in many cases.

6. CONCLUDING REMARKS

More than three years have passed since 3.11, 2011 East Japan Great Earthquake and associated Tsunami disaster. Restoration of public infrastructure is steadily proceeding. On the contrary, Residential recovery is still in early stage. These three years were preparation phase. We are expecting reconstruction of residences will be accelerated.

Statistics referred here shows by virtue of investment and special provisions, reconstruction and recovery is steadily advancing. We should carry on reconstruction activities steadily and at the same time, in preparation to other large earthquakes such as one along Nankai trough that is concerned about, we should promote not only enhancement of Dike, Shelter and so on but also cadastral survey in Central and Western Japan where progress is in general behind eastern Japan.

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BIOGRAPHICAL NOTES

- Graduate Physics course in Faculty of Science, Nagoya Univ.,Japan in 1975.
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- Since 2005 till present, working at Japan Construction Information Center foundation in fields of GIS and System Engineering.
- Chair, Commission 7, Japan Federation of Surveyors.

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