

3. Overview of Damage

The 2011 Tohoku earthquake was followed by tsunami and several aftershocks with largest seismic intensities greater than 5 in JMA scale and caused extensive damage in broad areas including the Pacific coast of Tohoku and Kanto region. With a sequence of aftershocks including the Off Miyagi Pref. Earthquake of April 7, the Earthquake in Hamadori, Fukushima Pref. of April 11 and 12, and the earthquake in northeastern part of Chiba prefecture of May 22, a large number of casualties and damage to buildings were reported in more than 20 prefectures. This chapter mainly presents the overview of damage to buildings based on the press releases by national agencies. Note that the data presented here is based on press releases on July 11, 2011 and earlier, and subject to change.

3.1 Distribution of JMA Seismic Intensity

Table 3.1-1 summarizes municipalities where JMA seismic intensities 6 and 7 were recorded in the 2011 Tohoku earthquake. Fig. 3.1-1 illustrates distribution of JMA seismic intensity in the seismic affected prefectures.

Table 3.1-1 Largest JMA Seismic Intensity of municipalities in the 2011 Tohoku earthquake ³⁻¹⁾

JMA Seismic Intensity	Prefecture	Municipalities
7	Miyagi	Kurihara city
6 Upper	Miyagi	Sendai city Miyagino ward, Ishinomaki city, Shiogama city, Natori city, Tome city, Higashimatsushima city, Osaki city, Zao town, Kawasaki town, Yamamoto town, Ohira village, Wakuya town, Misato town
	Fukushima	Shirakawa city, Sukagawa city, Kunimi town, Kagamiishi town, Tenei village, Naraha town, Tomioka town, Okuma town, Futaba town, Namie town, Shinchi town
	Ibaraki	Hitachi city, Takahagi city, Kasama city, Hitachiomiya city, Naka city, Chikusei city, Hokota city, Omitama city
	Tochigi	Utsunomiya city, Moka city, Ohtawara city, Ichikai town, Takanezawa town
6 Lower	Iwate	Ofunato city, Hanamaki city, Ichinoseki city, Kamaishi city, Oshu city, Takizawa village, Yahaba town, Fujisawa town
	Miyagi	Sendai city Aoba ward, Sendai city Wakabayashi ward, Sendai city Izumi ward, Kesenuma city, Shiroishi city, Kakuda city, Iwanuma city, Ogawara town, Watari town, Matsushima town, Rifu town, Taiwa town, Osato town, Tomiya town, Minamisanriku town
	Fukushima	Fukushima city, Koriyama city, Iwaki city, Soma city, Nihonmatsu city, Tamura city, Minamisoma city, Date city, Motomiya city, Kori town, Kawamata town, Inawashiro town, Nishigo village, Nakajima village, Yabuki town, Tanagura town, Tamakawa village, Asakawa town, Ono town, Hirono town, Kawauchi village, Iitate village
	Ibaraki	Mito city, Tsuchiura city, Ishioka city, Joso city, Hitachiota city, Kitaibaraki city, Toride city, Tsukuba city, Hitachinaka city, Kashima city, Itako city, Bando city, Inashiki city, Kasumigaura city, Sakuragawa city, Namegata city, Tsukubamirai city, Ibaraki town, Shirosato town, Tokai village, Miho village
	Tochigi	Nasushiobara city, Nasukarasuyama city, Haga town, Nasu town, Nakagawa town
	Gunma	Kiryu city
	Saitama	Miyashiro town
Chiba	Narita city, Inzai city	

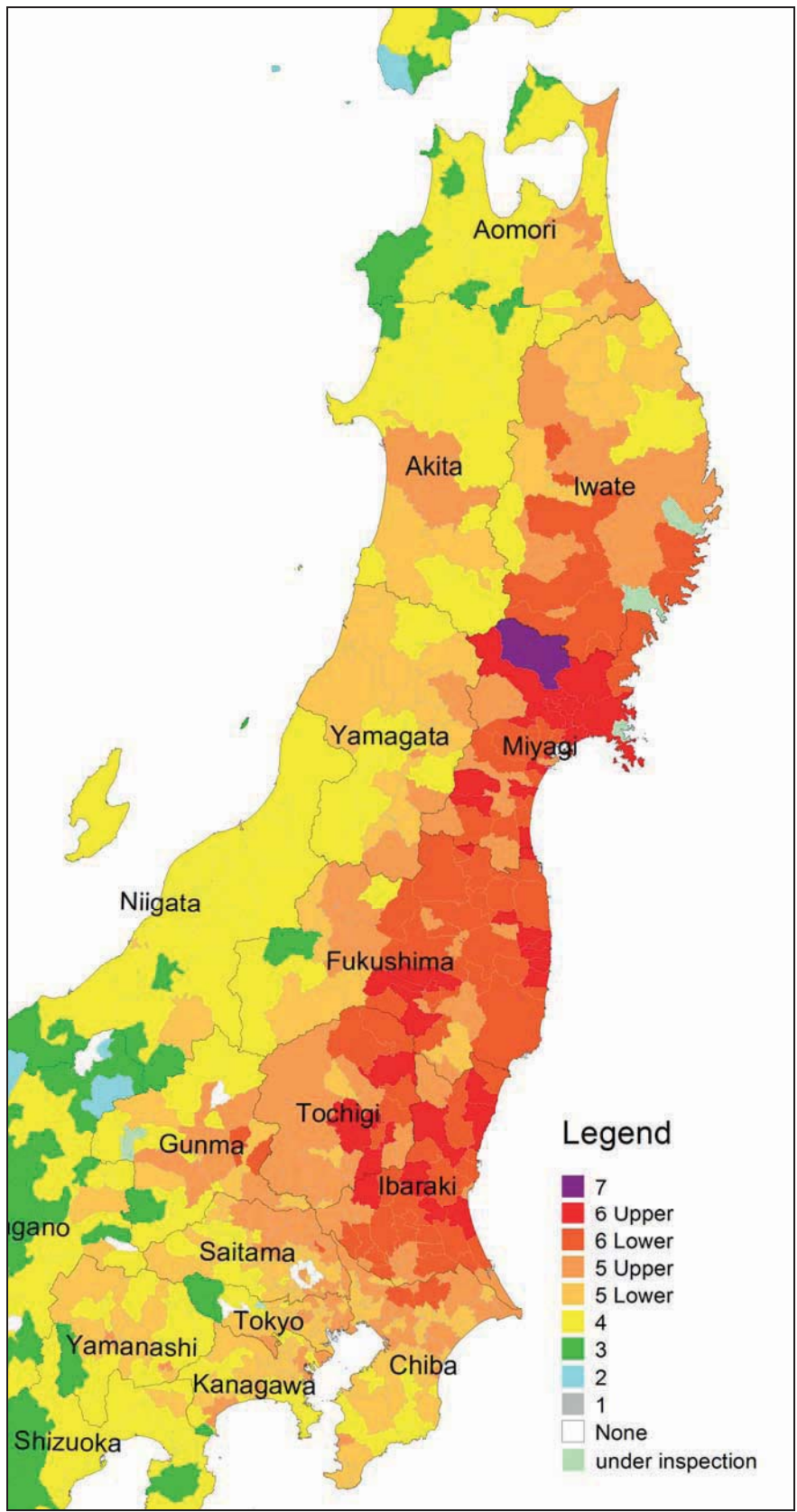


Fig. 3.1-1 Distribution of JMA seismic intensity in the 2011 Tohoku earthquake³⁻¹⁾

3.2 Casualties and Damage to Buildings and Utilities

3.2.1 Casualties

Table 3.2-1 shows the numbers of deaths, injuries and people missing due to a series of earthquakes as of July 11, 2011³⁻²⁾. It also shows the number of evacuees in shelters, hotels, and houses of their relatives and friends. The number of evacuees has significantly decreased since mid-March when it exceeded 450,000. However, it still amounted to 68,816 as of June 30³⁻³⁾.

Table 3.2-1 Casualties and Evacuees³⁻²⁾⁻³⁾

Prefecture	Casualties ^{*1}			Evacuees ^{*1*2} [person]
	Deaths [person]	Missing [person]	Injuries [person]	
Hokkaido	1		3	959
Aomori	3	1	61	848
Iwate	4,584	2,247	186	9,339
Miyagi	9,300	2,807	3,777	15,871
Akita			12	1,240
Yamagata	2		29	2,300
Fukushima	1,600	286	236	19,484
Ibaraki	24	1	694	844
Tochigi	4		131	1,404
Gunma	1		38	1,073
Saitama			42	1,075
Chiba	20	2	248	3,432
Tokyo	7		90	2,216
Kanagawa	4		129	83
Niigata			3	3,967
Yamanashi			2	289
Nagano			1	349
Shizuoka			4	684
Others			2	3,359
Total	15,550	5,344	5,688	68,816

Notes: *1 Casualties and Evacuees include those caused by the Off Miyagi Pref. Earthquake of April 7, the Earthquake in Hamadori, Fukushima Pref. of April 11 and 12, and the Earthquake in northeastern part of Chiba Pref. of May 22.

Notes: *2 Evacuees also include those who relocated due to the 2011 Accident at Fukushima Nuclear Power Stations.

3.2.2 Damage to buildings

Table 3.2-2 shows the number of residential and non-residential buildings damaged by the disaster³⁻²⁾ and the number of earthquake-related fires³⁻⁴⁾.

Table 3.2-2 Number of Buildings Damaged³⁻²⁾ and 3-4)

Prefecture	Residential Buildings					Non-Residential Buildings Damaged ^{*1}	Number of Fires ^{*1}
	Total Collapse ^{*1*2} [housing unit]	Half Collapse ^{*1} [housing unit]	Total burn down ^{*1} [housing unit]	Partial burn down ^{*1} [housing unit]	Partially Damaged ^{*1} [housing unit]	[building]	[case]
Hokkaido					5	470	
Aomori	307	854			96	1,193	5
Iwate	21,004	3,313		15	2,668	1,538	26
Miyagi	66,929	54,006		114	87,607	17,900	163
Akita					3	3	1
Yamagata	37	80					
Fukushima	16,198	32,458	77	3	100,881	1,015	11
Ibaraki	2,265	15,890		37	138,497	9,056	37
Tochigi	257	2,079			57,627	295	
Gunma		6			16,150	195	2
Saitama		5	1	1	1,800	33	13
Chiba	782	8,310		12	28,440	708	13
Tokyo		11	3		257	20	33
Kanagawa		7			279	1	6
Others					17	16	1
Total	107,779	117,019		263	434,327	32,445	311

Notes: *1 Damage and fires include those caused by the Off Miyagi Pref. Earthquake of April 7, 2011, the Earthquake in Hamadori, Fukushima Pref. of April 11 and 12, and the Earthquake in northeastern part of Chiba Pref. of May 22. Due to the inability to collect information in some areas affected by the tsunami and the 2011 Accident at Fukushima Nuclear Power Stations, the numbers presented in this table may not show the full extent of the damage.

*2 Total Collapse includes housing units washed away by the tsunami.

3.2.3 Damage to utilities

Table 3.2-3 shows the maximum damage to electricity supply, city gas supply, water supply and communication.

Table 3.2-3 Maximum Damage to Utilities

	Number of Damaged Units	Date	Source
Electricity supply (Power Failure)	8,450,000	March 11	Press release by Tohoku Electric Power Company and Tokyo Electric Power Company
City gas supply (Suspension)	458,495	March 23 ^{*1}	Press release by the Japan Gas Association
Water supply (Suspension)	1,700,000	March 15	Press release by Ministry of Health, Labour and Welfare
Communication (Fixed phone Suspension)	879,500	March 12	Press release by Nippon Telegraph and Telephone (NTT) East Corporation

Note: *1 The number of damaged units of Gas supply (Suspension) as of March 23 reflects some correction later on.

3.3 Regions Affected by Tsunami

3.3.1 Tsunami affected area

The Geospatial Information Authority of Japan (GSI) estimated tsunami affected area and the total area in 6 prefectures (Aomori, Iwate, Miyagi, Fukushima, Ibaraki, and Chiba) is about 561km². Table3.3-1 shows tsunami affected area classified by municipalities³⁻⁵⁾.

Table 3.3-1 Tsunami affected area(classified by municipalities)³⁻⁵⁾

Prefecture/ Municipality	Tsunami affected area(km ²)*1	Municipality area (km ²)	Prefecture/ Municipality	Tsunami affected area(km ²)*1	Municipality area (km ²)
Aomori Prefecture	24	844	Fukushima Prefecture	112	2,456
Hachinohe city	9	305	Iwaki city	15	1,231
Misawa city	6	120	Soma city	29	198
Rokkasho village	5	253	Minamisoma city	39	399
Oirase town	3	72	Hirono town	2	58
Hashikami town	0.5	94	Naraha town	3	103
Iwate Prefecture	58	4,946	Tomioka town	1	68
Miyako city	10	1,260	Okuma town	2	79
Ofunato city	8	323	Futaba town	3	51
Kuji city	4	623	Namie town	6	223
Rikuzentakata city	13	232	Shinchi town	11	46
Kamaishi city	7	441	Ibaraki Prefecture	23	1,444
Otsuchi town	4	201	Mito city	1	217
Yamada town	5	263	Hitachi city	4	226
Iwaizumi town	1	993	Takahagi city	1	194
Tanohata village	1	156	Kitaibaraki city	3	187
Fudai village	1	70	Hitachinaka city	3	99
Noda village	2	81	Kashima city	3	106
Hirono town	1	303	Kamisu city	3	147
Miyagi Prefecture	327	2,003	Hokota city	2	208
Sendai city; Miyagino ward	20	58	Oarai town	2	23
Sendai city; Wakabayashi ward	29	48	Tokai village	3	37
Sendai city; Taihaku ward	3	228	Chiba Prefecture	17	689
Ishinomaki city	73	556	Choshi city	1	84
Shiogama city	6	18	Asahi city	3	130
Kesenuma city	18	333	Sosa city	1	102
Natori city	27	100	Sammu city	6	146
Tagajo city	6	20	Oamishirasato town	0.5	58
Iwanuma city	29	61	Kujukuri town	2	24
Higashimatsushima city	37	102	Yokoshibahikari town	1	67
Watari town	35	73	Ichinomiya town	1	23
Yamamoto town	24	64	Chosei village	1	28
Matsushima town	2	54	Shirako town	1	27
Shichigahama town	5	13			
Rifu town	0.5	45			
Onagawa town	3	66			
Minamisanriku town	10	164			
			Total	561	12,382

Note: *1 When the tsunami affected area is less than 0.5km², it makes 0.5. When it is 0.5km² and more, it has rounded at the 1km² unit.

3.3.2 Population affected by tsunami

NILIM and BRI estimated tsunami affected population and households. The way of estimation is as follows: firstly calculate the ratio of tsunami affected area on each basic unit blocks of national census, and then multiply that ratio by the number of population and households on each basic unit blocks, finally sum up those numbers on each prefecture. In that estimation, following two data were used: i) Tsunami boundary data made by GSI and ii) Preliminary counts of 2010 population census made by Ministry of Internal Affairs and Communications of Japan . The result is shown in Table 3.3-2.

Table 3.3-2 Estimated tsunami affected population and households

Prefecture/ Municipalities	Estimated tsunami affected population and households (a)		Population and households of tsunami affected municipalities (b) ^{*2}		Percentage of tsunami affected(%) (a)/(b)×100	
	Population ^{*1}	Households ^{*1}	Population	Households	Population ^{*1}	Households ^{*1}
Aomori	4,794	1,625	335,968	129,666	1.4	1.3
Hachinohe city	1,995	706	237,473	91,925	0.8	0.8
Misawa city	542	166	41,260	16,246	1.3	1.0
Rokkasho village	837	301	11,092	4,751	7.5	6.3
Oirase town	1,023	320	24,188	8,329	4.2	3.8
Higashidori village	43	15	7,253	2,710	0.6	0.6
Hashikami town	355	117	14,702	5,705	2.4	2.1
Iwate	54,025	21,274	274,114	101,900	19.7	20.9
Miyako city	11,581	4,799	59,442	22,504	19.5	21.3
Ofunato city	8,325	3,324	40,738	14,814	20.4	22.4
Kuji city	2,488	960	36,875	14,015	6.7	6.8
Rikuzentakata city	8,379	3,014	23,302	7,794	36.0	38.7
Kamaishi city	5,896	2,520	39,578	16,095	14.9	15.7
Otsuchi town	8,214	3,244	15,277	5,674	53.8	57.2
Yamada town	6,834	2,594	18,625	6,605	36.7	39.3
Iwaizumi town	262	100	10,804	4,355	2.4	2.3
Tanohata village	219	77	3,843	1,309	5.7	5.9
Fudai village	46	17	3,088	1,042	1.5	1.7
Noda village	1,353	477	4,632	1,576	29.2	30.3
Hirono town	427	148	17,910	6,117	2.4	2.4
Miyagi	242,573	87,056	1,205,851	466,356	20.1	18.7
Sendai city; Miyagino ward	14,932	5,537	190,485	85,790	7.8	6.5
Sendai city; Wakabayashi ward	7,313	2,092	132,191	58,891	5.5	3.6
Sendai city; Taihaku ward	1,246	427	220,715	91,585	0.6	0.5
Ishinomaki city	90,854	34,750	160,704	57,812	56.5	60.1
Shiogama city	11,898	4,490	56,490	20,314	21.1	22.1
Kesennuma city	19,985	7,376	73,494	25,464	27.2	29.0
Natori city	11,186	3,654	73,140	25,150	15.3	14.5
Tagajo city	15,172	6,038	62,979	24,047	24.1	25.1
Iwanuma city	7,275	2,049	44,198	15,530	16.5	13.2
Higashimatsushima city	28,638	9,615	42,908	13,995	66.7	68.7
Watari town	11,201	3,315	34,846	10,899	32.1	30.4
Yamamoto town	7,818	2,513	16,711	5,233	46.8	48.0
Matsushima town	1,812	668	15,089	5,149	12.0	13.0
Shichigahama town	4,491	1,363	20,419	6,415	22.0	21.2
Rifu town	61	22	34,000	10,819	0.2	0.2
Onagawa town	3,323	1,341	10,051	3,968	33.1	33.8
Minamisanriku town	5,369	1,805	17,431	5,295	30.8	34.1
Fukushima	32,996	10,369	527,573	191,906	6.3	5.4
Iwaki city	14,413	5,118	342,198	128,516	4.2	4.0

	Soma city	5,738	1,572	37,796	13,240	15.2	11.9
	Minamisoma city	6,334	1,681	70,895	23,643	8.9	7.1
	Hirono town	407	132	5,418	1,810	7.5	7.3
	Naraha town	498	143	7,701	2,576	6.5	5.6
	Tomioka town	467	187	15,996	6,141	2.9	3.0
	Okuma town	155	49	11,511	3,955	1.3	1.2
	Futaba town	416	123	6,932	2,393	6.0	5.1
	Namie town	2,131	610	20,908	7,171	10.2	8.5
	Shinchi town	2,437	753	8,218	2,461	29.7	30.6
Ibaraki		13,181	4,783	963,774	377,878	1.4	1.3
	Mito city	256	87	268,818	111,992	0.1	0.1
	Hitachi city	2,901	1,074	193,129	77,932	1.5	1.4
	Takahagi city	403	160	31,014	11,656	1.3	1.4
	Kitaibaraki city	3,370	1,257	47,026	16,965	7.2	7.4
	Hitachinaka city	2,329	869	157,012	60,276	1.5	1.4
	Kashima city	824	242	66,030	25,222	1.2	1.0
	Kamisu city	573	179	94,823	35,760	0.6	0.5
	Hokota city	414	130	50,161	16,946	0.8	0.8
	Oarai town	1,724	651	18,331	7,020	9.4	9.3
	Tokai village	386	134	37,430	14,109	1.0	1.0
Chiba		9,958	3,509	366,965	128,986	2.7	2.7
	Choshi city	277	128	70,225	26,948	0.4	0.5
	Asahi city	3,686	1,288	69,074	23,121	5.3	5.6
	Sosa city	658	210	39,826	12,869	1.7	1.6
	Sammu city	2,515	830	56,086	19,297	4.5	4.3
	Oamishirasato town	150	57	50,122	18,117	0.3	0.3
	Kujukuri town	1,475	556	18,009	6,617	8.2	8.4
	Yokoshibahikari town	363	124	24,679	8,278	1.5	1.5
	Ichinomiya town	306	123	12,042	4,452	2.5	2.8
	Chosei village	20	7	14,751	5,030	0.1	0.1
	Shirako town	509	185	12,151	4,257	4.2	4.3
	Total	357,526	128,616	3,674,245	1,396,692	9.7	9.2

Notes: *1 This result does not mean real damage situation, number of victim, and number of refugees.

*2 Population and households of tsunami unaffected municipalities are not included.

3.4 Inspection of Damaged Buildings and Residential Lands

3.4.1 Post-earthquake quick inspection of damaged buildings

The post-earthquake quick inspection of damaged buildings aims to quickly identify the damage level of a building according to the observed damage status and to categorize each damage level into one of three different groups related to potential hazards which would be caused by aftershocks and so on³⁻⁶. As of June 2, 2011, 95,227 judgments were conducted in 10 prefectures (149 municipalities) and 11,587 of them were judged UNSAFE (RED). The inspection required a total of 8,515 man-days. Table 3.4-1 shows the interim result of the inspection³⁻⁷.

Table 3.4-1 Result of Post-earthquake Quick Inspection of Damaged Buildings³⁻⁷⁾

Prefecture	UNSAFE (RED)	LIMITED ENTRY (YELLOW)	INSPECTED (GREEN)	Total
Iwate	168	445	459	1,072
Miyagi	5,088	7,511	37,968	50,567
Fukushima	3,314	6,718	5,775	15,807
Ibaraki	1,561	4,684	9,618	15,863
Tochigi	676	1,845	2,658	5,179
Gunma	30	61	19	110
Saitama	0	42	83	125
Chiba	677	1,625	3,213	5,515
Tokyo	59	137	252	448
Kanagawa	14	81	446	541
Total	11,587	23,149	60,491	95,227

Note: It should be noted that: 1) inspection was hardly executed in the tsunami affected areas, 2) the comprehensive inspection was not carried out because there were a lot of damaged buildings in extensive areas, and 3) the result also includes the number of damage to non-structural elements.

3.4.2 Post-earthquake quick inspection of damaged residential lands

Similar to the case of damaged buildings, post-earthquake quick inspection was conducted for damaged residential lands. The post-earthquake quick inspection of damaged residential lands aims to quickly identify the damage level of a residential land according to the observed damage status and to categorize each damage level into one of three different groups related to potential hazards which would be caused by aftershocks and so on. Until July 10, 2011, 6,313 judgments were conducted in 9 prefectures (52 municipalities) and 1,449 of them were judged UNSAFE (RED). Table 3.4-2 shows the interim result of the inspection³⁻⁸⁾.

Table 3.4-2 Result of Post-earthquake Quick Inspection of Damaged Residential Lands³⁻⁸⁾

Prefecture	UNSAFE (RED)	LIMITED ENTRY (YELLOW)	INSPECTED (GREEN)	Total
Iwate	114	103	162	379
Miyagi	886	1,470	1,640	3,996
Fukushima	269	258	484	1,011
Ibaraki	30	64	41	135
Tochigi	101	244	133	478
Gunma	24	9	7	40
Saitama	0	27	104	131
Chiba	10	18	9	37
Niigata	15	12	79	106
Total	1,449	2,205	2,659	6,313

3.5 Temporary Housing

In order to provide disaster victims with decent and stable living environments, local governments have been constructing temporary houses in the affected regions and providing the evacuees with information on available rental housing units across Japan.

3.5.1 Construction of temporary housing

According to the Disaster Relief Act, prefectural governments are in charge of

providing temporary housing for individuals and families who have been displaced by a disaster and the central government provide financial assistance to these prefectural governments. Table 3.5-1 shows the progress of temporary housing construction³⁻⁹⁾.

Table 3.5-1 The Progress of Temporary Housing Construction³⁻⁹⁾

Prefecture	Total Number of Housing Units Estimated to be Necessary	In the Planning Stage		Under Construction		Completed
		Number of Sites	Number of housing units	Number of Sites	Number of housing units	Number of Sites
Iwate	13,833	—	—	312	13,833	11,527
Miyagi	22,435	15	1,844	358	19,918	15,985
Fukushima	14,000	—	—	152	13,487	10,135
Ibaraki	10	—	—	2	10	10
Tochigi	20	—	—	1	20	20
Chiba	230	—	—	3	230	230
Nagano	55	—	—	2	55	55
Total	50,583	15	1,844	830	47,553	37,962

3.5.2 Information Provision Related to Available Rental Housing Units

Local and central governments have provided information on available public and private rental housing. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) set up the Center for Information on Public Houses for the Affected on March 22. Through the center and in cooperation with relevant ministries and private rental housing and real estate associations, MLIT has provided the displaced individuals and families with information on available public and private rental housing across Japan, including national public officers' housing, employment promotion housing, the Urban Renaissance (UR) Agency's housing and private rental housing.

Table 3.5-2 shows the approximate number of available housing units and those that were already allocated to displaced people in early July³⁻¹⁰⁾. It is notable that the Japanese government decided to reimburse the prefectures' costs of renting private housing for those who had been displaced by the disaster. As a result, more than 40,000 private rental housing units were allocated to the displaced. Including newly constructed ones, approximately 85,000 housing units were already allocated or at least ready for the allocation.

Table 3.5-2 Housing Units Available for the Displaced³⁻¹⁰⁾

	Total	Tohoku-region	Already Allocated
Public Housing ^{*1}	23,000	1,800	6,200
UR's Rental Housing	5,100	130	810
Private Rental Housing	—	—	42,300
Total	—	—	49,310

Note: *1 Public housing includes national public officers' housing, UR Agency's housing and employment promotion housing.

3.6 Building Restrictions

3.6.1 Building Restrictions based on the Building Standard Law of Japan

In order to prevent uncoordinated construction of buildings in the affected areas,

Miyagi Prefecture and Ishinomaki city designated the building restricted areas on April 8 and restricted building construction works within these areas, pursuant to Article 84 of the Building Standard Law of Japan. Based on this law, Ishinomaki city has the authority over building regulations under an agreement with Miyagi prefecture. On April 12, the deadline of building restrictions was extended to May 11. Those designated areas include Ishinomaki city, Kesenuma city, Natori city, Higashi-matsushima city, Onagawa town, and Minami-Sanriku town in Miyagi prefecture.

3.6.2 Enactment of New Law concerning Building Restrictions

"Law on Special Provisions of building restrictions in the urban areas severely damaged by the Great East Japan Earthquake" was established on April 28, which took effect as issued on April 29. This law made it possible to implement building restrictions up to eight months from the date of the disaster in the affected areas. Based on this law, on May 11, Miyagi Prefecture and Ishinomaki city extended the period of building restrictions in these designated areas until September 11.

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