EAST- JAPAN GREAT EARTHQUAKE DISASTER 11 MARCH in 2011

NILIM, JAPAN

【CONTENTS】

1.Outline of the GREAT EARTHQUAKE DISASTER

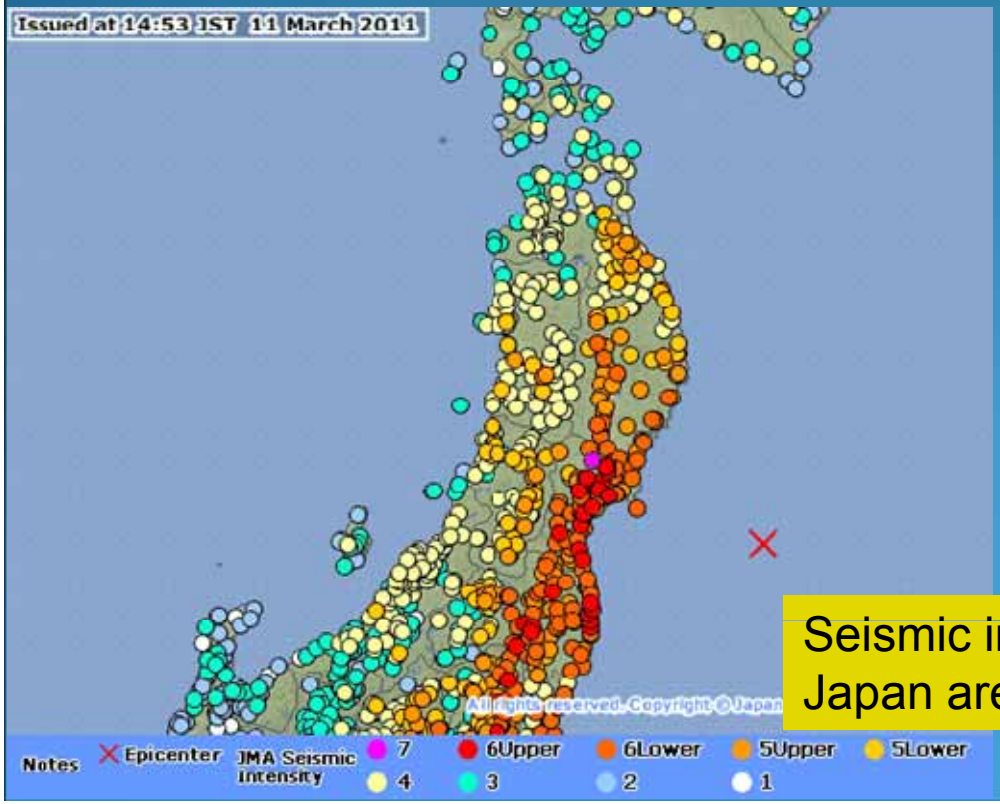
A. OFF-PACIFIC COAST EARTHQUAKE in TOHOKU region in Japan

Occurred at PM 2:46 on 11 March 2011

Epicenter at latitude 38’6 degree north and longitude, 142’52 east

Focal Depth：24km

Magnitude：9.0 (maximum in Japan records)

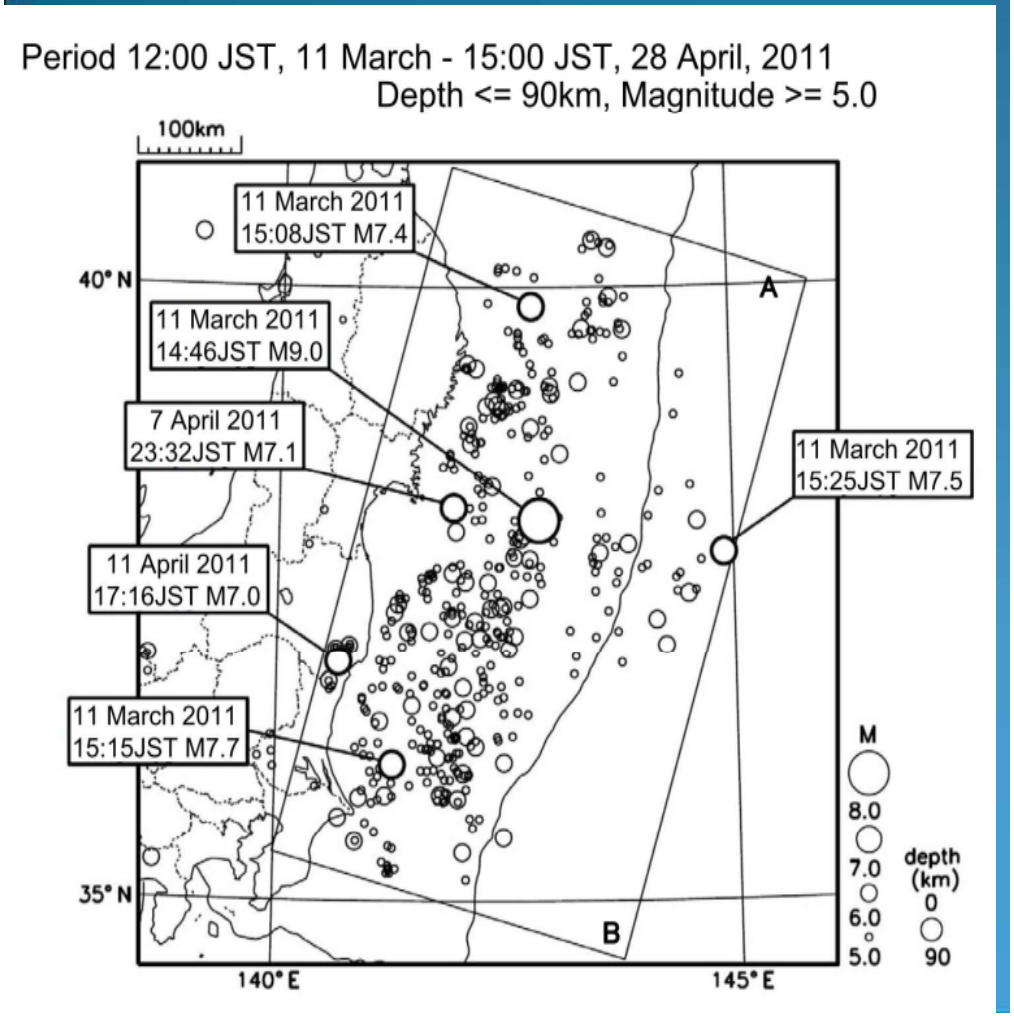


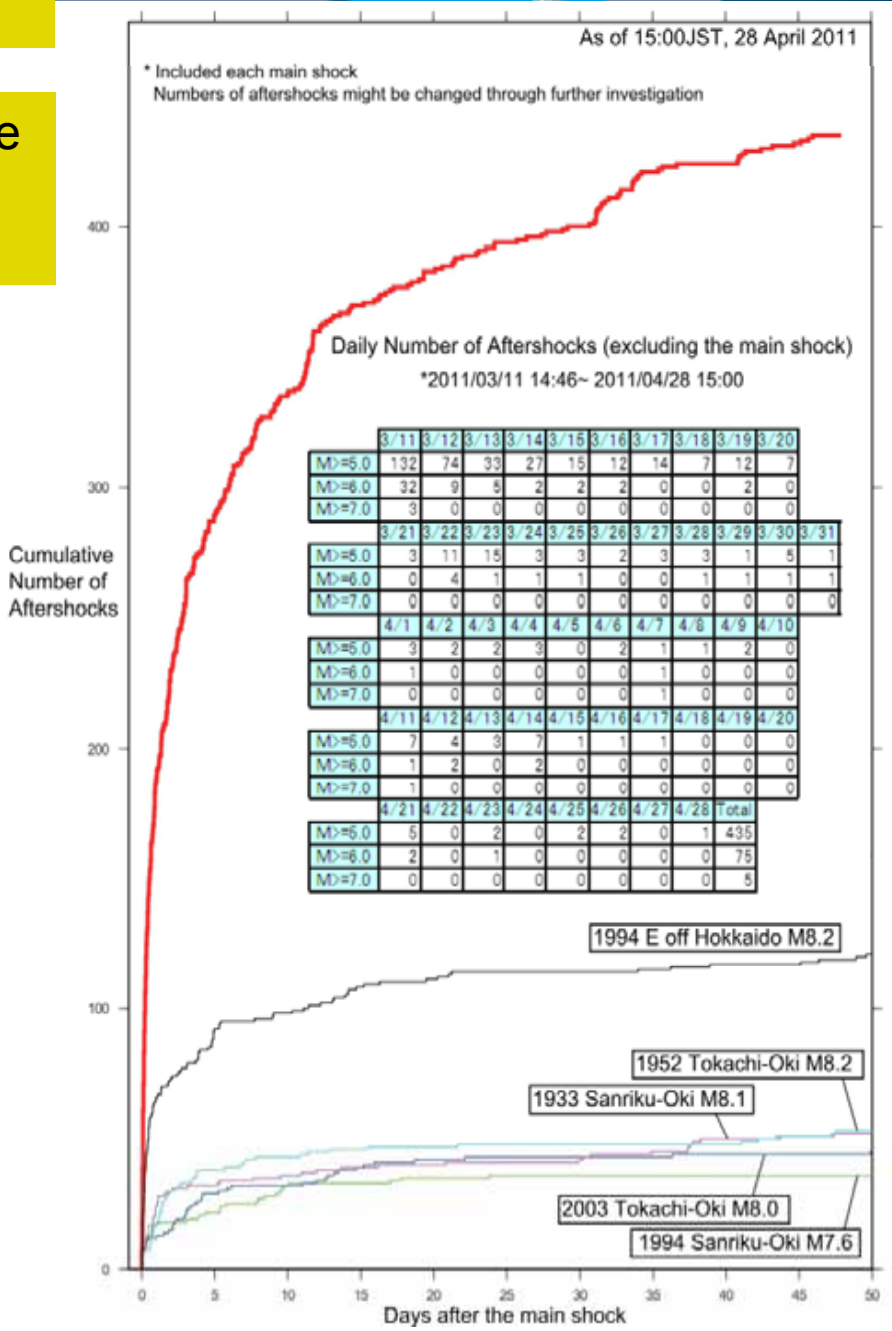
Seismic intensity observed at East Japan area.

(Reference: JMA)

B. Distribution of Main Shock and Aftershocks

The 2011 off Pacific coast of Tohoku Earthquake
Cumulative Number of Aftershocks
(Magnitude>=5.0) (Reference: JMA)





	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20
M>=5.0	132	74	33	27	15	12	14	7	12	7
M>=6.0	32	9	5	2	2	2	0	0	2	0
M>=7.0	3	0	0	0	0	0	0	0	0	0

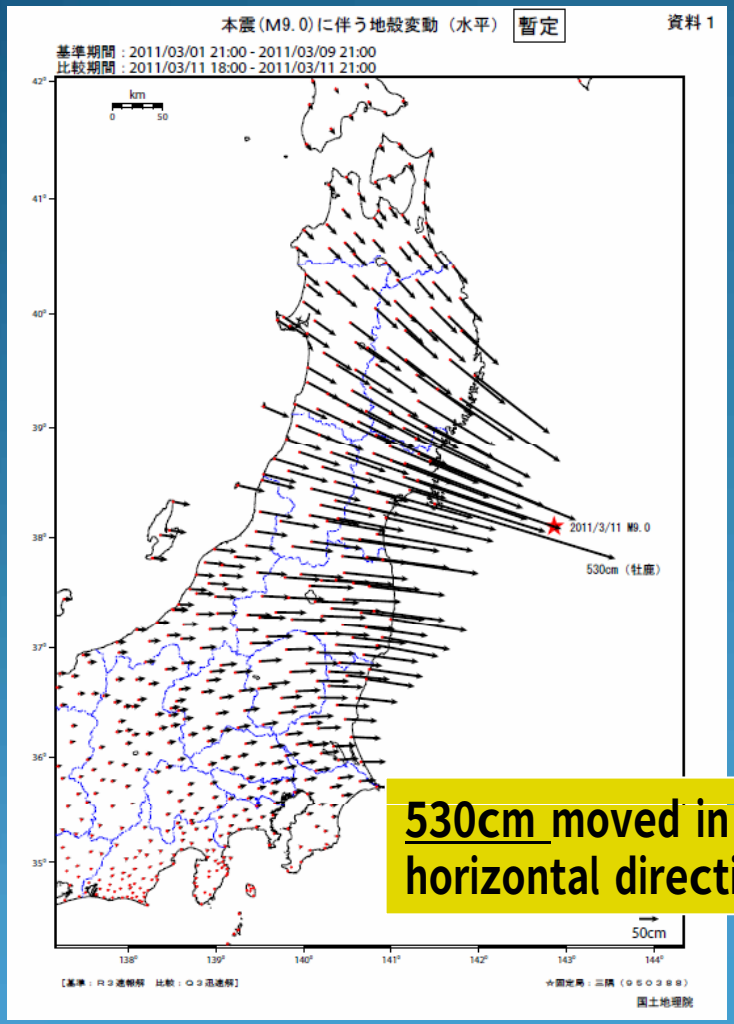
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
M>=5.0	3	11	15	3	3	2	3	3	1	5	1
M>=6.0	0	4	1	1	1	0	0	1	1	1	1
M>=7.0	0	0	0	0	0	0	0	0	0	0	0

	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10
M>=5.0	3	2	2	3	0	2	1	1	2	0
M>=6.0	1	0	0	0	0	0	1	0	0	0
M>=7.0	0	0	0	0	0	0	1	0	0	0

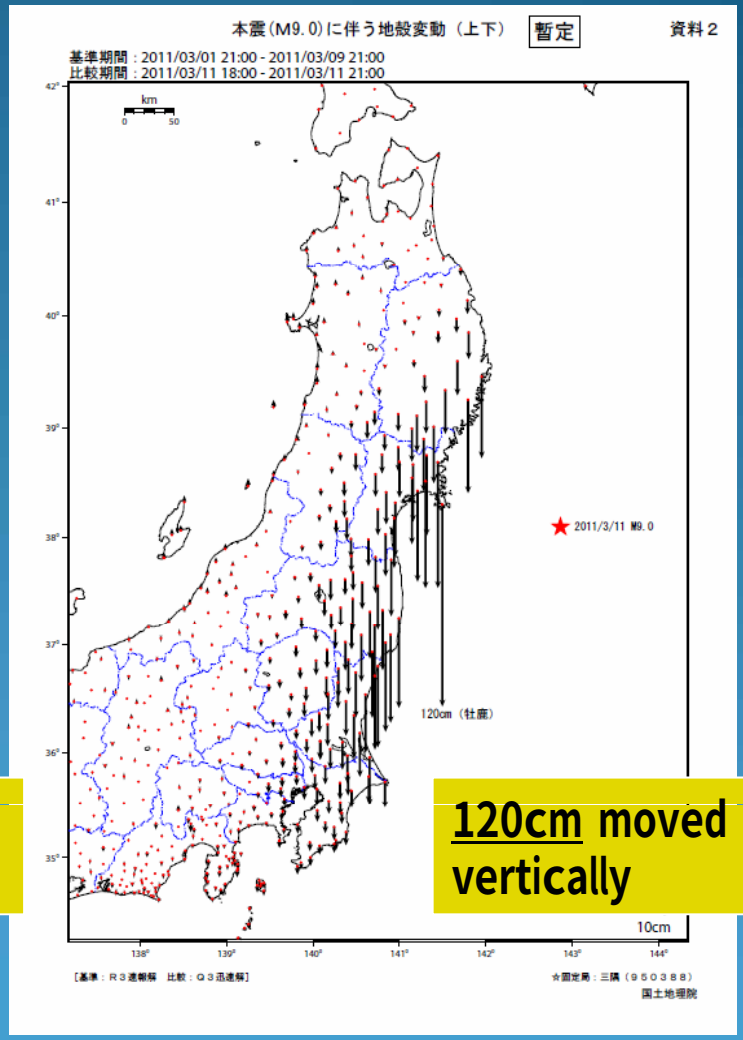
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
M>=5.0	7	4	3	7	1	1	1	0	0	0
M>=6.0	1	2	0	2	0	0	0	0	0	0
M>=7.0	1	0	0	0	0	0	0	0	0	0

	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	Total
M>=5.0	5	0	2	0	2	2	0	1	435
M>=6.0	2	0	1	0	0	0	0	0	75
M>=7.0	0	0	0	0	0	0	0	0	5

C. Land Deformation caused by the Earthquake



530cm moved in horizontal direction



120cm moved vertically

(Reference: GSI)

2. History
of
EARTHQUAKE and TSUNAMI
occurred in Japan

A. Comparison with Other Great Earthquake Disasters in Japan

	Kanto Great Earthquake Disaster	Hanshin-Awaji Great Earthquake Disaster	East Japan Great Earthquake Disaster
Date of Occurrence	1 September **1923**	17 January **1995**	11 March **2011**
Magnitude	7.9	7.3	9.0
Main Area damaged tremendously	Tokyo, Kanagawa, Chiba	Hyogo (near Kobe, Osaka)	Iwate, Miyagi, Fukushima
Deaths toll/Missing number	105,385 persons	6434 persons /3 persons	15,421 persons/ 7,937 persons (11 June)
Persons injured	103,733 persons	43,773 persons	5,367 persons (11 June)
Refugees (at peek)	Over 1,900 thousand	Over 310 thousand	Over 400 thousand
Houses destroyed (Completely, Partially)	Over 210 thousand	249,180 houses	Over 230 thousand
Total loss/ Financial damage	5.5 billion yen/1.5 billion yen	70 trillion yen/10 trillion yen	85 trillion yen/16～25 trillion yen
Temporary house households	Over 20 thousand	46,617	60～70 thousand (planed housings)
Feature	**Fatality by Fire** (Wooded house dominated at that time) Restoration Budget (1.9 billion 50 million yen)	City-typed Disaster **Fatality crushed** by furniture or collapsed building	Super wide area typed Disaster **Complex Disaster** of Earthquake and **Tsunami**

(Reference: Committee for Restoration 2nd meeting , Revised by NILIM)

B. Other Huge TSUNAMI ” In Recent History ” in East Japan Area

	MEIJI Sanriku TSUNAMI	SHOWA Sanriku TSUNAMI
Date of Occurrence	15 June **1896** (Meiji-Era)	3 March **1933** (Showa-Era)
Epicenter	Latitude 39’5 north Longitude 144 east	Latitude 39’7 north Longitude 144’7 east
Focal Depth	unknown	10km
Magnitude	8.5	8.1
Height of TSUNAMI (as maximum)	38.2 m	23-29 m
Fatality	21,915 persons	1,522 persons
Missing	44 persons	1,542 persons
Feature	・Arrival time from main quake:35minutes(first wave) and second wave (8 minutes later)	・Arrival time form main quake: 30 minutes to 60 minutes ・10 and several times attacked by TSUNAMI in 6 to 7 minutes interval

3. Disaster Prevention Policy and Strategy in Japan

A. **Law and Act**

- **Basic Act for Disaster Countermeasures (1961)** －Organization, Planning, Prevention, Emergency response, Restoration -

- **Regional Disaster Prevention Plan**－Governor/Mayor must make the Plan through the consultation of Disaster Prevention Committee

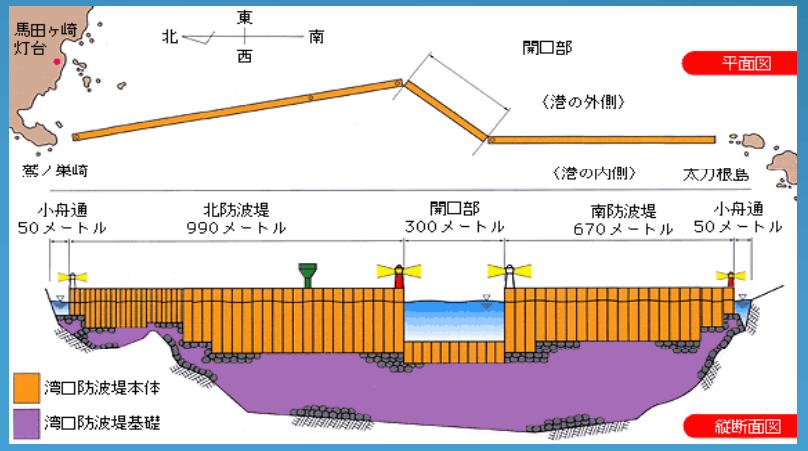
(White paper report)

B. **Warning system**

- **TSUNAMI Warning** through Radio
- **Disclose** the Height of TSUNAMI
- **Hazard mapping**
- **Training of Evacuation**

C. **Investment into related Infra.**

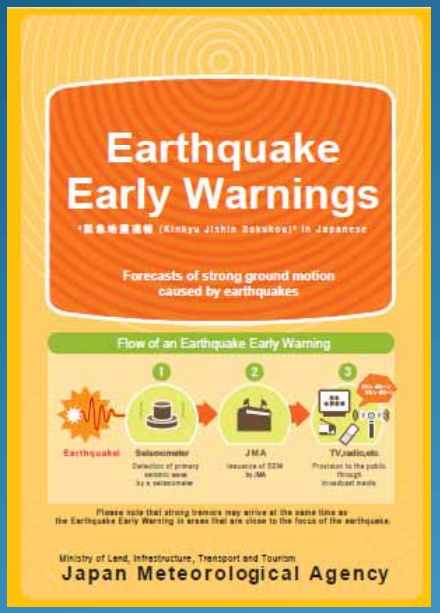
- **Coastal Levee**
  under 63 m depth in the sea
- **Largest in the world (Port Kamaishi)**
  →Mitigated the increasing the depth and spread of TSUMANI



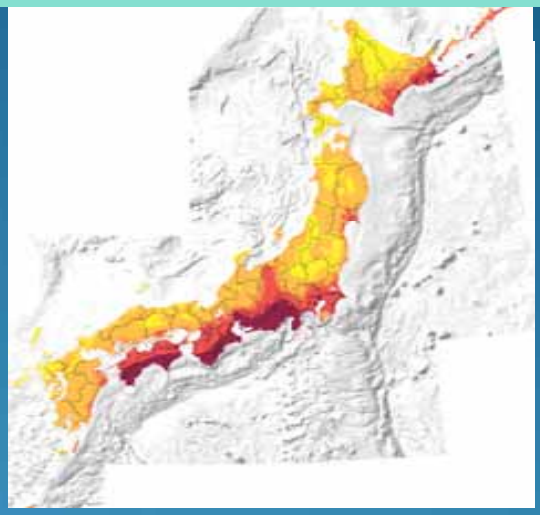
(Reference: Kamaishi Port Office MLIT)

D. **Information**

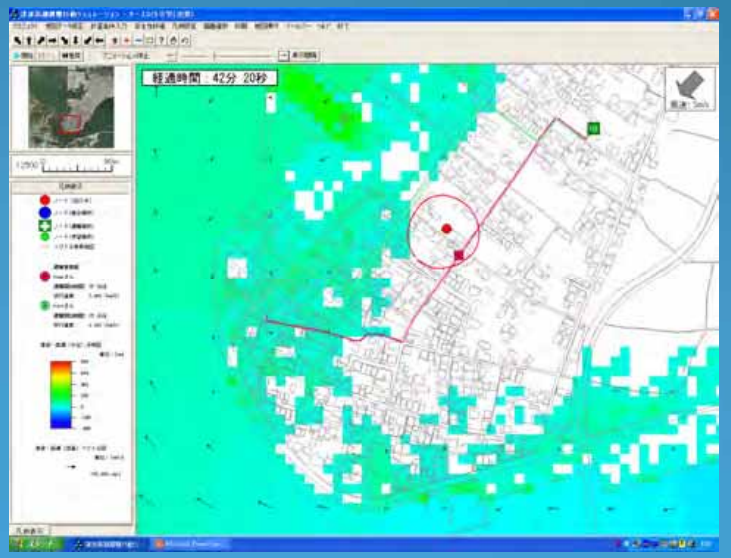
Earthquake Early Warnings System (JMA)



Probabilistic Seismic Hazard Maps (HERP)



TSUNAMI Hazard Map (NILIM)



4. Emergency Actions conducted by NILM Just After The Earthquake

TEC-FORCE of NILIM,MLIT

(1) **Mission** : Once the earthquake or other disasters occurred, Experts of NILIM are to go the site to investigate the situations from the scope of technology and engineering to support rescue activities and/or advice emergent countermeasures

(2) **Activities**:

i) Survey of damages (Depth of Tsunami in land, Damage of Structures, Safety of Roads etc.)

ii) Evaluation of the ability/safety for using facilities in service

iii) Proposal of methods for emergency restoration

TEC-FORCE of NILIM delivered to the site

Area of Specialty	Experts
Sewage	15
River Engineering	5
Coast Engineering	8
Bridge	14
Dam Engineering	3
Road/Pavement	2
Architecture	32
Archi. Fire protection	5
Airport facility	3
Port Facility	8
Sabo (Sediment Disaster)	17
Earthquake resistant	8
Total	120

(10 June 2011)

ACTIVITIES in ROAD and BRIDGE research Team

◆Damage of Road Facilities

【Damage by the Earthquake】
/Damage of Shoe
/Damage of old typed-non earthquake proof structure

【Damage by Liquefaction】
Moving of bridge abutment

【Damage by TSUNAMI】
Washed out of Superstructure

◆Evaluation of the ability/safety of roads to support the rescues and restorations

◆Evaluation of load bearing ability of substructure for restoration

◆Technical advice for emergency inspection and restoration

ACTIVITIES in PORT research Team

◆Damage in port facilities

【Damage by Quake/Liquefaction】

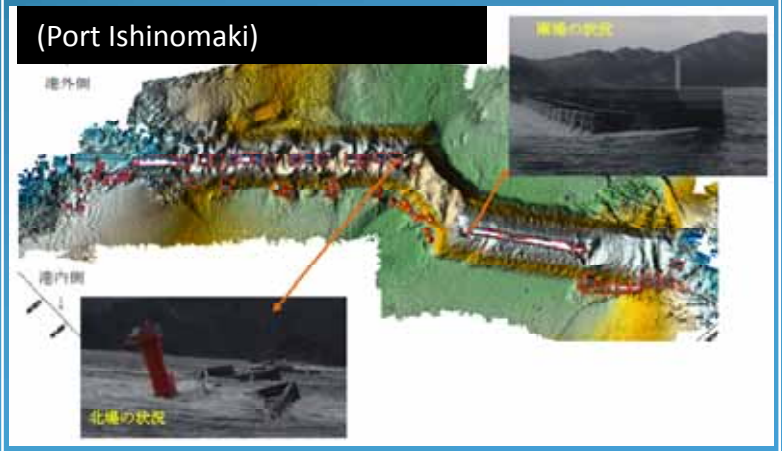
Moving of mooring to sea side, Slanting of caisson structure, Sinking of apron

(Port Soma)

【Damage by TSUNAMI】

Disaster of breakwater

(Port Ishinomaki)



・Measuring the exposure depth in Port facilities
・Surveillance the damages of breakwater
・Supplying the safety information of facilities
・Participation as experts in the working committee for the countermeasure against TSUNAMI and Earthquake
・Technical advice for Earthquake proof designing

ACTIVITIES in COAST research Team

◆Damage of Coastal facilities

【Damage by Quake/Liquefaction】
Sinking of coastal levee
【Damage by TSUNAMI】
Collapse of Coastal levee
Scouring of breakwater

Collapse
(Miyagi Prefecture)

Partial Collapse
(Miyagi Prefecture)

Partial Collapse
(Iwate Prefecture)

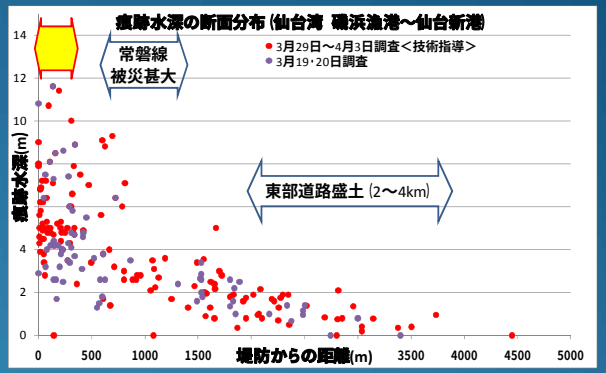
◆Disaster Survey

・Survey of the evidence (height) of TSUNAMI

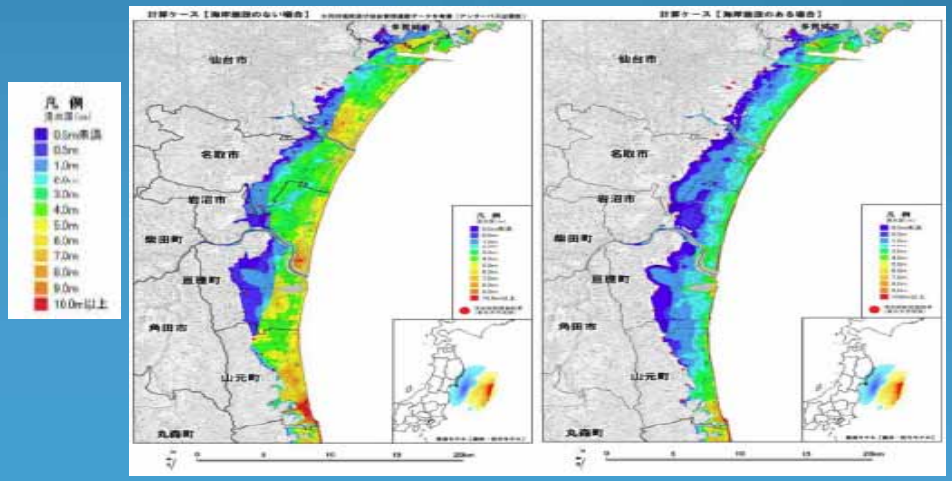
・Advice for local office

・Technical advice of the preparation for Typhoon season

(Figure) Results of Survey (Height of TSUNAMI)



◆Evaluation of external force by TSUNAMI for a basis of restoration planning



Without coastal levee

With coastal levee

ACTIVITIES in SABO research Team

◆Damage of Slopes by Quake

Collapse of slopes、Landslide

◆Evaluation the safety of slopes in residential area

- as a technical judgment for evacuation order to residents by local governments

In Miyagi Prefecture

ACTIVITIES of BUILDING research team

◆Damage of House and Building

Collapse 111,206 (house)
Half Collapse 72,809
Partial 322,470
(08/06/2011)

【Damage by Earthquake】
Medium floor collapse, Shear failure of column

【Damage by liquefaction】
House sinking, Sedimentation of blew-sand in town etc

【Damage by TSUNAMI】
Huge wreckage at the site
Collapse, Moving and Scouring of houses and buildings etc.

◆Survey the situations of disasters

Airport building

◆Study for amendment/modification of related technical standard

1. SUMMARY : General Feature of the East Japan Huge Earthquake

1) Caused by Plate of the earth (not the type caused by active fault)
2) Huge Fault occurred (450km in length, 200km in width)
3) Maximum Record in Magnitude : 9.0 (In Japanese record)
4) Quake Duration : 3 minutes
5) Huge Tsunami happened
6) After quakes - many and large -

2. MAIN FEATURE of the Infra Disasters caused by the Earthquake

1) Disaster by **TSUNAMI** (beyond prepared countermeasures)

2) Structure damaged **not** so severely as in 1995 by **Earthquake** itself

(Reference: Wave cycles (periods) were mostly out of " Killer Pulse ")

(Reference) Type of the Wave Cycle in Earthquake

Period Range (Type of Wave Cycle)	Period (second)	Feature	EAST JAPAN Earthquake
Very short	Cycle < 0.5 second	Sensitive to furniture	◎
Short	0.5< Cycle <1.0 sec.	Sensitive to human	◎
Sort of Short	1.0< Cycle <2.0 sec. **(Killer Pulse)**	Sensitive to Wooded house, Low and middle height of buildings	△
Sort of long	2.0< Cycle <5.0 sec.	Sensitive to Tank, Tower	—
Long	5.0 sec.< Cycle	Sensitive to Tall building	—
Super long	More than 100 sec.	Sensitive to Earth itself	—

5. Restoration Planning

Basic Act for Restoration from East-Japan Great Earthquake Disaster (enacted on 20 June 2011)

1)Secretariate setting up in Cabinet (Government, headed by Prime Minister)

2)Agency for Restoration from East-Japan Great Earthquake Disaster is to be established

(Role) Planning, integrated arrangement and instrument etc.

3)New government bond for restoration

4)Special area identified for related Acts applied effectively to encourage the restoration

Act on Regional Development for Tsunami Disaster Mitigation (enacted on 14 December 2011)

(1)Basic principle formulated by MLIT minister

(2) According to (1), the anticipated Tsunami depth and inundation area set by governor, and be in public.

(3) According to (1) and (2), the action plan of development elaborated by municipality

In the areas designated in the plan, the reduction of bulk ratio of Tsunami evacuation building can be applied.

(4) Making clear the responsibility of Governor or Mayor for maintaining protection facilities (levies, gates etc.)

(5) Warning area against Tsunami and special warning area

Warning area be specially improved for easy evacuation.

“Special” warning area be developed under the limitation of land using.

14 April, “ East Japan Huge Earthquake Disaster Restoration Planning Committee, Launched in the Gov.

7 Principles for the Reconstruction Framework

(1)For us, the surviving, there is no other starting point for the path to recovery than to remember and honor the many lives that have been lost. Accordingly, we shall record the disaster for eternity, including through the creation of memorial forests and monuments and we shall have the disaster scientifically analyzed by a broad range of scholars to draw lessons that will be shared with the world and passed down to posterity.

(2)Given the vastness and diversity of the disaster region, we shall make community-focused reconstruction the foundation of efforts towards recovery. The national government shall support that reconstruction through general guidelines and institutional design.

(3)In order to revive disaster-afflicted Tohoku, we shall pursue forms of recovery and reconstruction that tap into the region’s latent strengths and lead to technological innovation. We shall strive to develop this region’s socioeconomic potential to lead Japan in the future.

(4)While preserving the strong bonds of local residents, we shall construct disaster resilient safe and secure communities and natural energy-powered region.

(5)Japan’s economy cannot be restored unless the disaster areas are rebuilt. The disaster areas cannot be truly rebuilt unless Japan’s economy is restored. Recognizing these facts, we shall simultaneously pursue reconstruction of the afflicted areas and revitalization of the nation.

(6) We shall seek an early resolution of the nuclear accidents, and shall devote closer attention to support and recovery efforts for the areas affected by the accidents.

(7) All of us living now shall view the disaster as affecting our own lives, and shall pursue reconstruction with a spirit of solidarity and mutual understanding that permeates the entire nation.