ICG/PTWS Working Groups, Task Teams
ICG/PTWS Steering Committee
4-8 June 2018
Honolulu, Hawaii

UNESCO IOC TOWS
Task Team on
Disaster Management and Preparedness
1. Marine & Ports Tsunami Guidance
2. Structural Design & Vertical Evacuation Guidance

Laura Kong
Director, ITIC

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- **Met annually since ~2007**

TOWS Activities

Develop Maritime and Ports Guidance:

- ✓ TT noted the ***Maritime Planning & Preparedness Guidelines for harbours and ports*** developed by the US National Tsunami Hazard Mitigation Programme (in draft); methodology is a useful reference for other countries. USA draft planned for finalization (2019?)
- ✓ There is a **wealth of information available from Japan (but in Japanese).** Some work is also underway in New Zealand, while Israel also have material. Indonesia may also be able to assist.

Action: ITIC will send best practices to the TT with informal translations and pursue formal translations of the documents from Japan.

Marine Preparedness : Ports and Harbors

– New policy in Japan after Tohoku tsunami –

Japan Meteorological Agency

May 2018

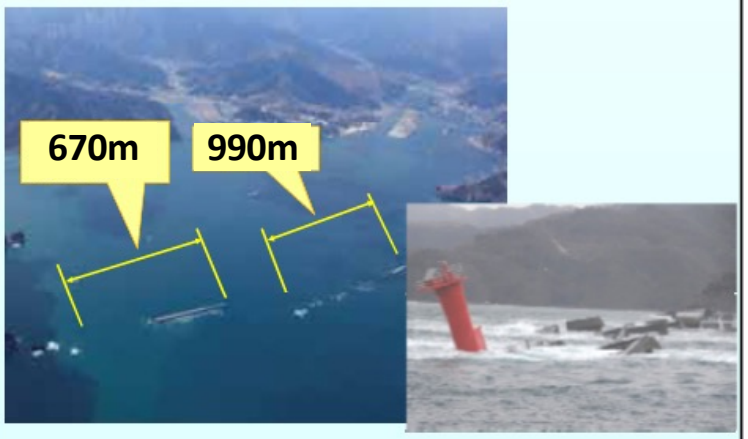
Laura Kong, ITIC (NTHMP, July 2018)

Damages at ports and harbors by Tohoku tsunami

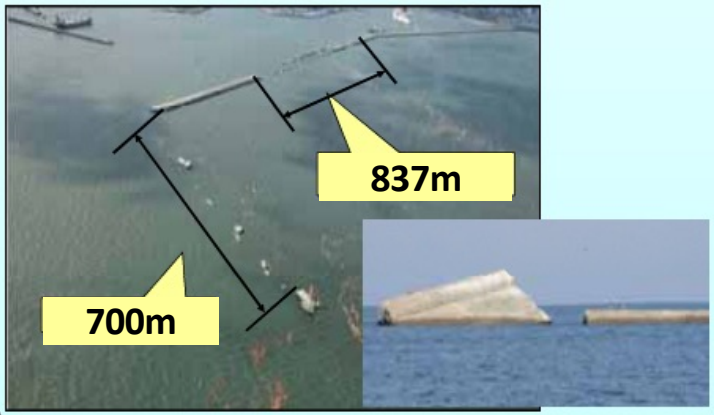
Damages at ports and harbors were seen in wider area of Pacific coast of East Japan (Aomori, Iwate, Miyagi, Fukushima, Ibaraki and Chiba) by Tohoku tsunami in 2011.

Failure of breakwater

○Kamaishi port, Iwate



○Hachinohe port, Aomori



Collapse of seawalls

○Ofunato port, Iwate

Machine Damage

○Shiogama port, Miyagi

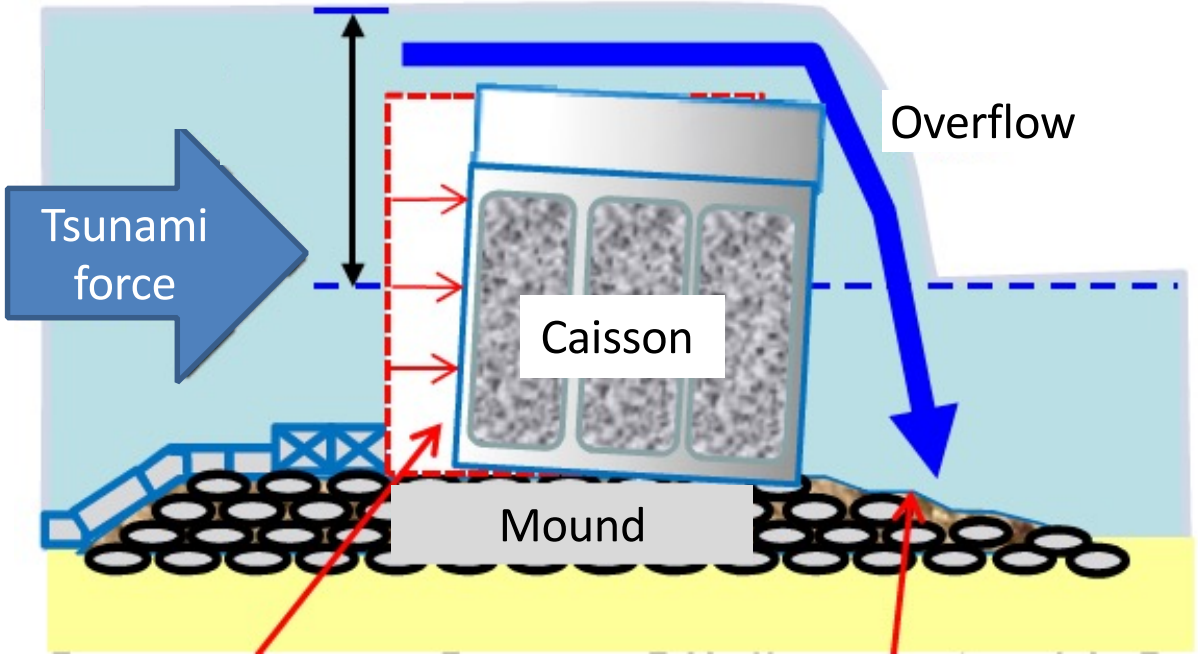
Damage by sea wracks

○Shiogama port, Miyagi

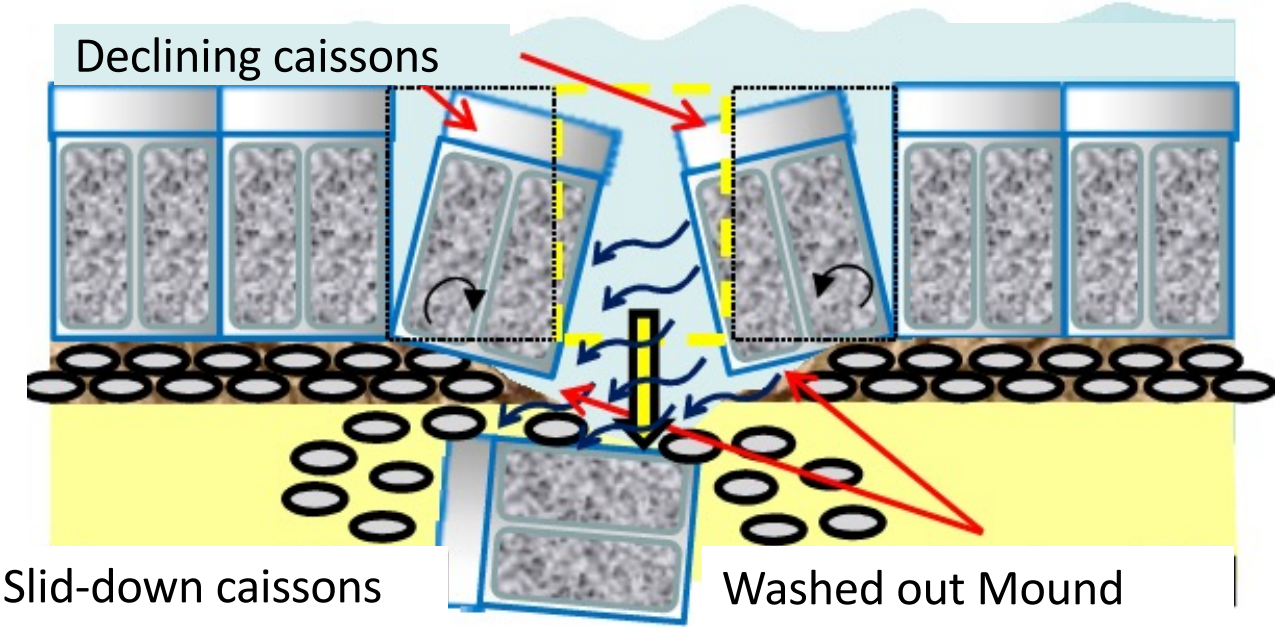
Scattered Containers

○Shiogama port, Miyagi

Mechanism of Breakwater Failure



Some caissons slid down due to tsunami force and mound wash-out by the overflowed tsunami



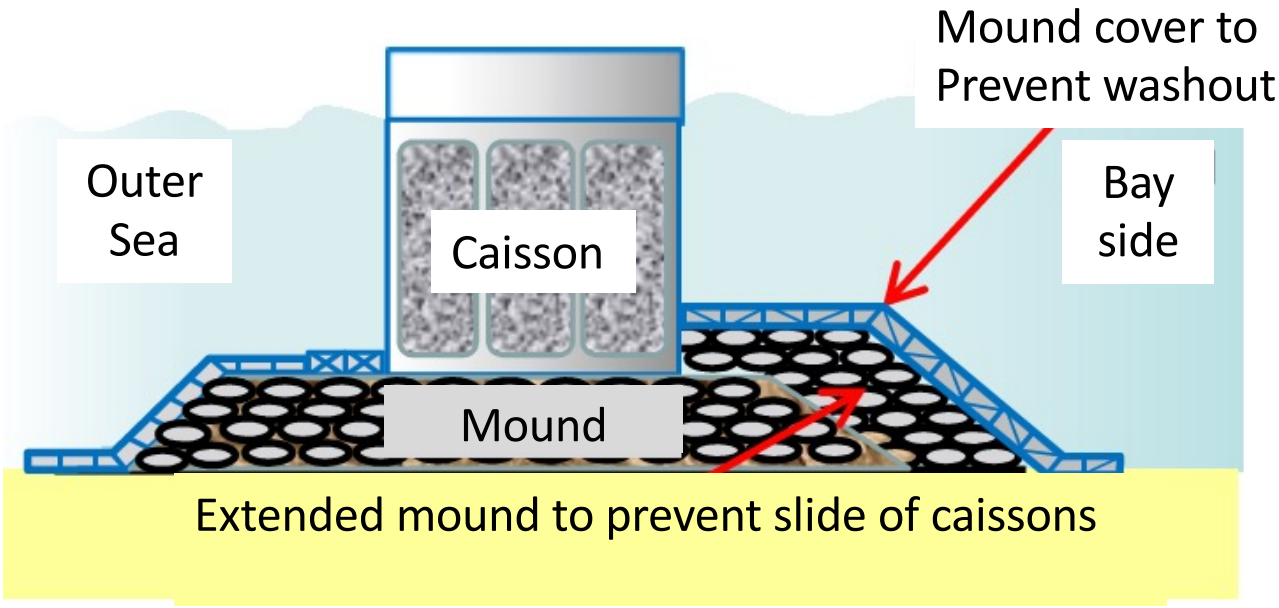
Tsunami flow concentrated to slid-down caissons
It washed out mound and makes decline of caissons

Failure of Breakwater at Kamaishi

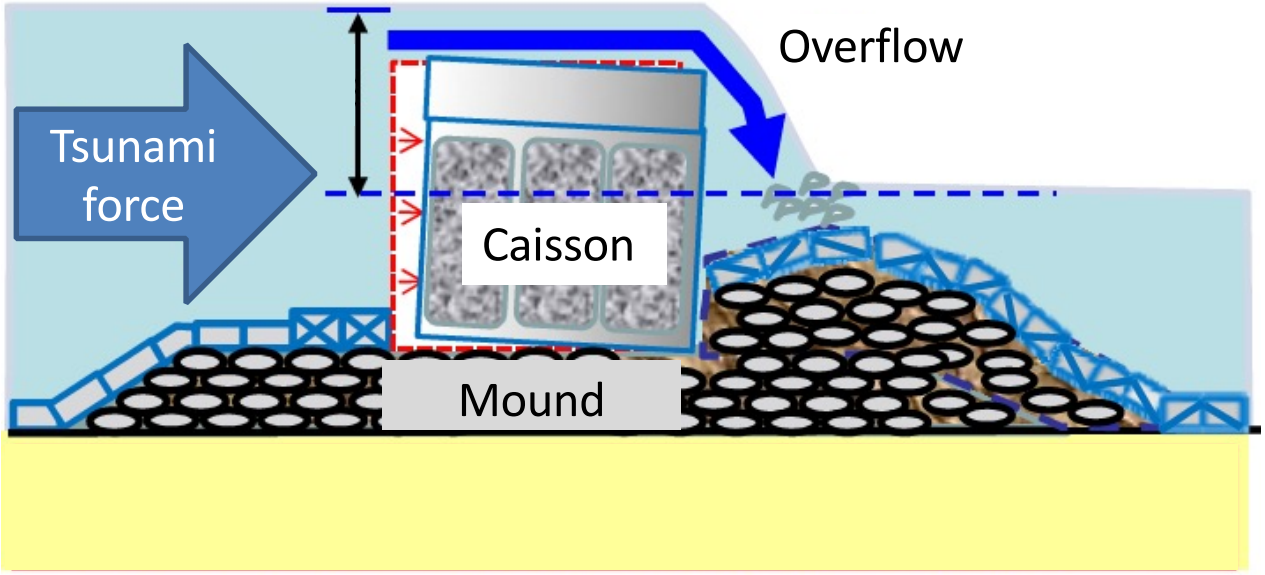
TOHOKU REGIONAL BUREAU MINISTRY OF LAND , INFRASTRUCTURE AND TRANSPORT

(c) MLIT

Reconstruction and Reinforcement of Breakwater



Even tsunami pushed caissons, extended mound can prevent sliding down of caissons



Mound is also protected by cover to prevent washout

Protection of ports/harbors against tsunami

- Promotion of tsunami protection/evacuation measures along with targets for disaster prevention/mitigation
  - ✓ Two kinds of measurements – for high-frequency tsunamis and largest class tsunamis
  - ✓ Protection of inner area by seawalls
  - ✓ Evacuation plan at ports and harbors
  - ✓ Enhancement of decision-making system

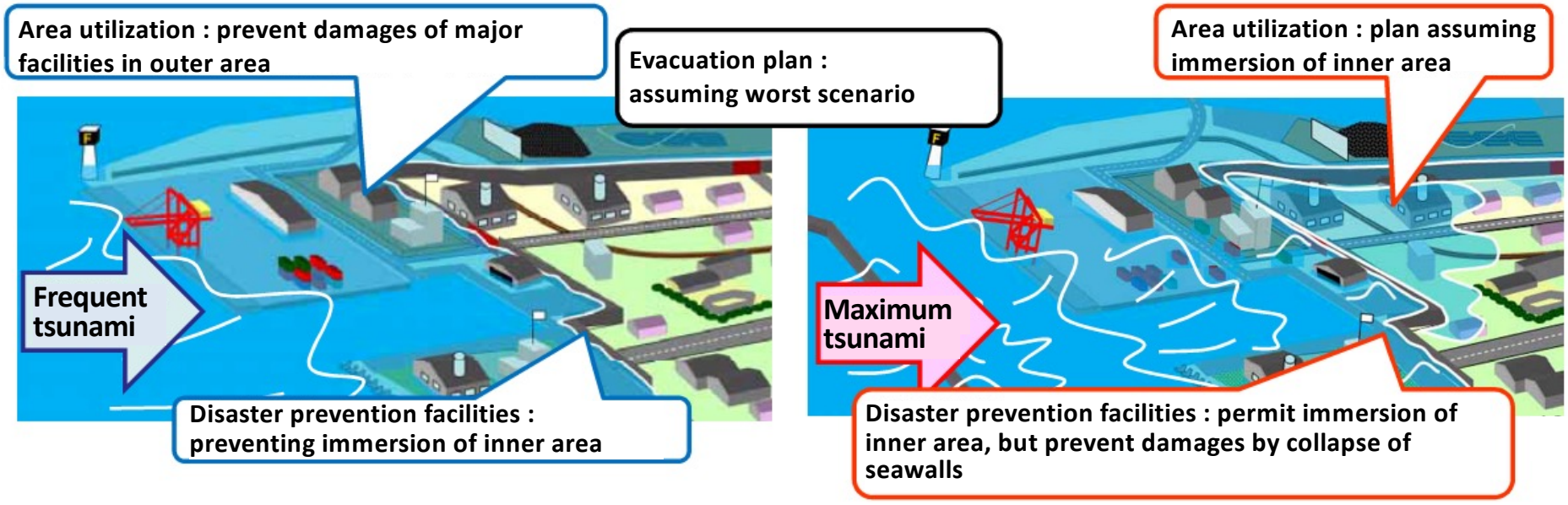
- Establishing water gates facility management and operation
  - ✓ Safety-first management
  - ✓ Promotion of automation and remote control

Protection of ports/harbors against tsunami

For high-frequency tsunami (once in several tens of years)	For largest class tsunami (once in several hundreds of years)

Targets for disaster prevention/mitigation

Protect human lives	
Protect properties at inner area	Minimum economy loss
Business continuity at inner area	Preventing large secondary disaster
Continuous port/harbor functions after disaster	Early recovery



Resilient ports/harbors against earthquake and tsunami

Proceed resilient ports and harbors, considering cost effectiveness and risk of damage due to the earthquake and tsunami

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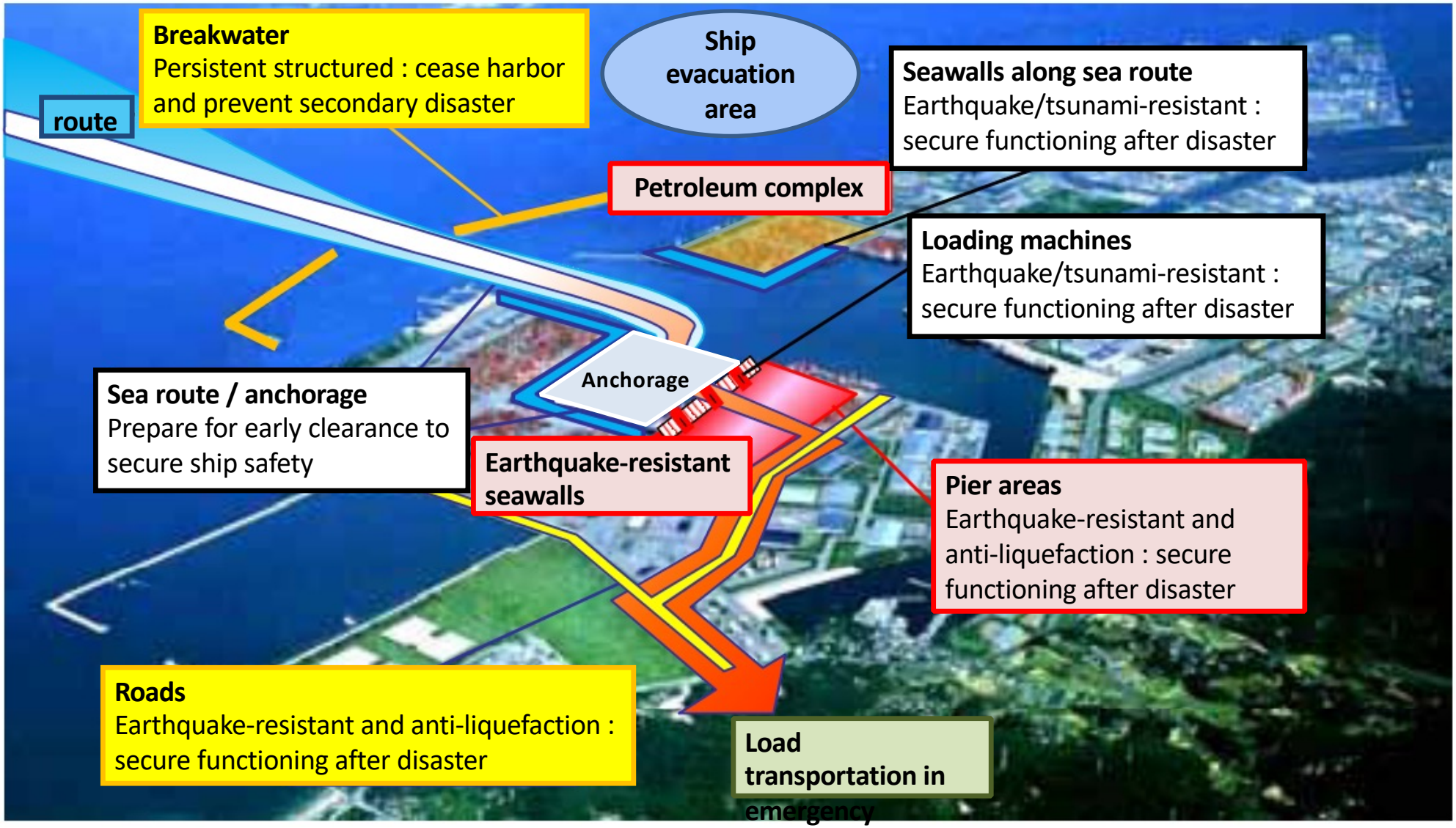
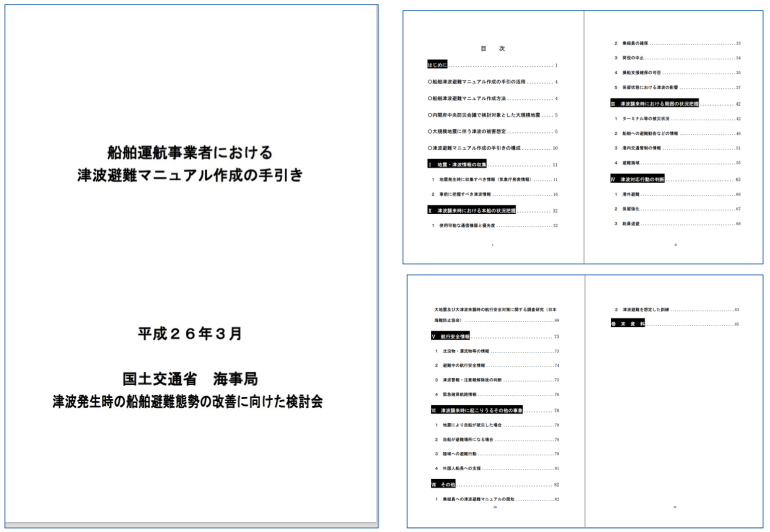


Handbook for making tsunami evacuation manual (in Japanese) – Google translate only

International SOLAS
Handbook for making tsunami evacuation manual – Ship Operators

Study Meeting for Improving Ship Evacuation during Tsunami
Ministry of Land, Infrastructure and Transport
March, Heisei 26 (2014)



Introduction
- Utilization of creation guidance
- How to prepare ship tsunami evacuation manual
- Large-scale earthquake targeted for consideration at the Cabinet Office Central Disaster Prevention Council
- Assumption of damage of tsunami caused by a large-scale earthquake
- Tsunami evacuation manual preparation Structure of guidance

I Collection of earthquake and tsunami information
1. Information to be collected at the occurrence of the earthquake (Meteorological Agency Presentation Information)
2. Tsunami information to be grasped in advance

II Determine the status of the ship at the time of the tsunami attack
1. Available communication equipment and priority
2. Securing crew
3. Canceling cargo handling
4. Possibility to secure navigation support
5. Influence of tsunami in mooring state

III Grasp the surrounding situation at the time of the tsunami attack
1. Damaged situation at a terminal
2. Information such as evacuation advice to ships
3. Port in port transport Information on control
4. Evacuation area

IV Judgment of tsunami correspondence behavior
1. Evacuation outside the port
2. Mooring enhancement
3. Remaining all members
4. Survey research on navigational safety measures at the time of major earthquake and large tsunami incidents (Japan Marine Accident Prevention Association)

III Navigation safety information
1. Information on sinks, drifting objects, etc.
2. Safety information on navigation during evacuation
3. Judgment after tsunami warning / warning notice
4. Emergency secured route information

VI Other events that may occur at the time of the tsunami attack
1. When your ship is damaged by an earthquake
2. When your ship is to be evacuated
3. Evacuation to the land area Action
4. Support for foreign captain

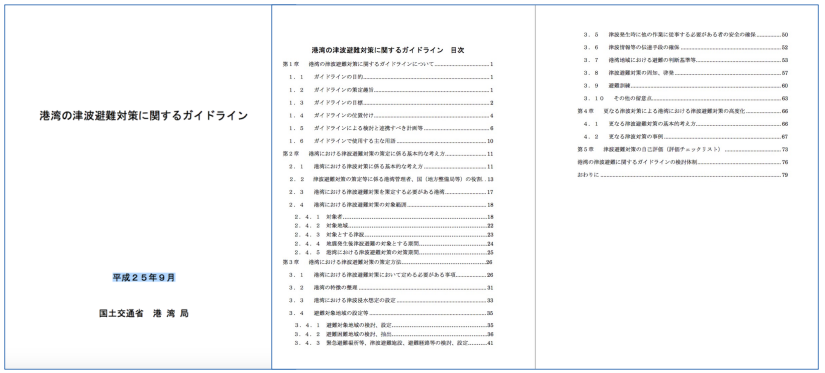
VII Other
1. Broadcast of tsunami evacuation manual to crew
2. Training assuming tsunami evacuation

Guidelines on harbor tsunami evacuation measures (in Japanese) – Google translate only

National - Guidelines on harbor tsunami evacuation measures

September Heisei 25 (2013)

Ministry of Land, Infrastructure and Transport Harbor Bureau



港湾の津波避難対策に関するガイドライン

平成２５年９月

国土交通省　港 湾 局

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1　About the guidelines on harbor tsunami evacuation measures ...

- 1.1 Purpose of guideline
- 1.2 Formulation of guidelines Purpose
- 1.3 Goal of the guideline
- 1.4 Positioning of guidelines
- 1.5 Review based on guidelines and plan to cooperate
- 1.6 Major terms used in guidelines

2 Basic idea concerning formulation of tsunami evacuation countermeasures in ports

- 2.1 Basic idea on tsunami countermeasures at ports
- 2.2 The role of port administrator, country (regional development agency, etc.) related to the formulation of tsunami evacuation measures etc
- 2.3 Ports that need to formulate tsunami evacuation countermeasures at ports
- 2.4 Scope of Tsunami Evacuation Measures at Harbor
  - 2.4.1 Target person
  - 2.4.2 Target area
  - 2.4.3 Target tsunami
  - 2.4.4 Tsunami after the earthquake Target period for evacuation
  - 2.4.5 Countermeasure period for tsunami evacuation measures at ports

3 How to formulate tsunami evacuation countermeasures at ports

- 3.1 Matters that need to be determined in tsunami evacuation measures at ports
- 3.2 Arrangement of characteristics of harbors
- 3.3 Establishment of Tsunami Inundation Assumption at Harbor
- 3.4 Setting of evacuation target area
  - 3.4.1 Review and setting of areas subject to evacuation
  - 3.4.2 Examination and Extraction of Evacuation Difficult Areas
  - 3.4.3 Examination and setting of emergency evacuation sites, tsunami evacuation facilities, evacuation routes, etc.
- 3.5 Securing the safety of those who need to engage in other tasks when a tsunami occurs
- 3.6 Securing means of transmission of tsunami information etc.
- 3.7 Criteria for evacuation judgment in port area
- 3.8 Communicating the tsunami evacuation measures, enlightenment
- 3.9 Evacuation drills
- 3.10 Other points to keep in mind

4 Advancement of tsunami evacuation measures in harbors by further tsunami countermeasures

- 4.1 Basic idea of further measures against tsunami evacuation
- 4.2 Further case of tsunami countermeasures

5. Self assessment of tsunami evacuation measures (evaluation check list)

Study system of guidelines on harbor tsunami evacuation

Conclusion

Protect ships from Tsunami

- Probability of a large, M8-M9 class earthquake occurring within 30 years is appx. 70%.
- A large tsunami may arrive at a short notice on several fronts in Japan.

To decide on evacuation actions quickly, it is important to make

Ship's Tsunami evacuation manual & Response against Tsunami Checklist in advance.

Damaged ships by Tsunami in Great East Japan Earthquake

Response against Tsunami Checklist

Format of the "Ship's Tsunami Evacuation Manual" with **one sheet (front/back)** for **3 important steps** on tsunami evacuation measures

① **Basic items to be filled in advance**

② **Information to be confirmed when earthquake / tsunami occurs**

How to Fill out 'Response against Tsunami Checklist'

- Check the guidance on "How to Fill out 'Response against Tsunami Checklist' " in our website.
- In preparation for a Tsunami occurring, it is recommended to actively seek information on tsunami
- in advance.
- Each Ship's Captain fills in the blanks **on consultation with ship's agents.**
- **Even if Captain may not fill in all the blanks in the front page**, this sheet can work as a checklist.
- It should be noted that the use of this sheet is not obligatory by statute.

Example of information collection from related organizations

Table of Response against Tsunami

Tsunami Warning & Recommendation		Time Allowance to Tsunami Arrival	Actions to be Taken by a Ship			
			Ships Berthing in a Port			
			Large/Mid-Sized Ships (including Fishing Trawlers)		Small Ships	
			Ships Carrying Dangerous Goods	General Ships (including Cargo-handling/Working Ships)	Pleasure Boats, Fishing Boats, etc.	Anchored Ships/Buoy-mooring Ships
Tsunami Warning	Major Tsunami	No	Suspend Cargo handling Works Essentially, Emergency Departure	Suspend Cargo handling Works, Evacuate to the Land	Evacuate to the Land	Use of Engine
		Yes	Suspend Cargo handling Works Emergency Departure	Suspend Cargo handling Works, Evacuate to the Land	Grounding-living (Evacuate to the Land, if necessary)	Emergency Departure
	Tsunami	No	Suspend Cargo handling Works Essentially, Emergency Departure	Suspend Cargo handling Works, Evacuate to the Land or Stay Alongside	Evacuate to the Land	Use of Engine
		Yes	Suspend Cargo handling Works Emergency Departure	Suspend Cargo handling Works, Evacuate to the Land or Stay Alongside	Tie the Lashing Tool, Evacuate to the Land, if necessary	Emergency Departure
Tsunami Recommendation	Tsunami Advisory		Suspend Cargo handling Works Staying Alongside or Emergency Departure	Suspend Cargo handling Works, Stay Alongside or Emergency Departure	Tie the Lashing Tool or Evacuate to the Land	Note: Use Engine in case of Emergency Departure if necessary

Time series chart | Tsunami caused by earthquakes in the past | Assumed Tsunami submergence map

Example of Required Working Time

		Working Time (minutes)	
Emergency Departure	Suspend the cargo handling works	5	30
	Call the crews	2	
	Prepare for leaving pier/port (Start the engine and thruster)	17	
	Release/cut the Mooring → Departure	5	
	Notify the land and operating company after departure	1	
Staying Alongside	Call the crews	2	15
	Tight and add mooring lines and tighten the brake of mooring winch	3	
	Prepare for anchoring	2	
	Prepare the engine and thruster as a readiness for mooring the break and drifting	3	
	Discuss and instruct to suspend cargo handling	3	
	Check the waterproofing, and close the waterproof doors and sea water valves	1	
	Notify and confirm with the land and operation company	1	
Evacuation to the Land	Count the number of crews and check the tally	3	10
	Instruct to complete evacuation to the land	3	
	Shipside works required until evacuation to the land is completed	4	

Fill in the blank table (decision guideline) based on the information obtained.

Response against Tsunami by Arrival Time (decision guideline)

Warning Level	Tsunami Height	Berthing		Anchoring	
		Within 30 minutes	More than 30 minutes	Within 30 minutes	More than 30 minutes
Major Tsunami Warning	More than 3m	Evacuation to the Land	Emergency Departure	Emergency Departure	Emergency Departure
Minor Tsuna-mi Warning	1 – 3 m	Staying Alongside	Emergency Departure	Emergency Departure	Emergency Departure
Low Tsunami Recommendations	Less than 1m	Staying Alongside	Emergency Departure	Emergency Departure	Emergency Departure

Example

Name: John Smith 【Port: Port of XX 】Cargo Ship

Response against Tsunami Checklist

(This the sheet is not authorized as obligation by statute.)

Port and Ship Information

Port: Port of XX | Berthing direction: Inbound / Outbound

Berth / Quay: Berth A | Quay: Seismic design / Non-seismic design

【Port: Port of XX 】Cargo Ship

Basic Response List

(Fill in the as far as practicable)

Keep monitoring the latest information of Tsunami. (from TV, Radio or VHF)

Confirm Tsunami occurrence indication from Port master, Harbor administrator, etc...

Japan MLIT

Response against tsunami checklist (in English)

Name: 【Port: 】 Cargo Ship

Response against Tsunami Checklist

(This the sheet is not authorized as obligation by statute.)

Confirming before port entry in advance

Port and Ship Information

Port:		Berthing direction: Inbound / Outbound
Berth / Quay:		Quay: Seismic design / Non-seismic design
Ship name:		Gross Tonnage:
Ship type:	Crew:	Cargo:

Basic Information

Safe water area: From ( ) , ( ) Degree ( )m Water depth: m
Location : Latitude: Longitude: Distance from berth to safe water area : nm
Time to arrive safe water area: minutes

Place of evacuation area on land :	Handling support: Tug (Yes ・ No)

Contact Point

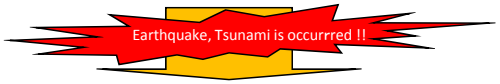
Agent:	Operating company:
Stevedore:	Harbor Master:
Liner:	Japan Coast Guard:
Tug Company:	Other:

Confirm Tsunami information in advance, if possible.	The assumed maximum Tsunami height: m (time of arrival:)

Response against Tsunami (Basic Policy)

Response against Tsunami (Basic Policy)

Warning level	Tsunami height	On berthing		On anchoring	
		Within ～minutes	More than ～minutes	Within ～minutes	More than ～minutes
Major Tsunami warning	More than 3m				
Tsunami warning	1～3m				
Tsunami advisory	Less than 1m				



Judge if Earthquake, Tsunami is occurred

Captain shall Judge

Earthquake Information (Date -)

Time	Scale	Place	Seismic Intensity
h m	M		

Tsunami Information

Major Tsunami warning Tsunami warning Tsunami advisory

Time to arrival of Tsunami m	Anticipated height m

Captain Judgement

Emergency departure / Stay alongside / Evacuation to the land

【Port: 】 Cargo Ship

Basic Response List

(Fill in the as far as practicable)

Keep monitoring the latest information of Tsunami. (from TV, Radio or VHF)

Confirm Tsunami occurrence indication from Port master, Harbor administrator, etc...

Emergency departure

*Continue to obtain the information of Tsunami (from TV, Radio or VHF)

- ☐ ① Interruption of cargo work (minutes)
- ☐ ② Crew readiness (minutes)
- ☐ ③ Standby for departure (Engine and Thruster if provided) (minutes)
- ☐ ④ Consider support Tug, handler and Mooring crew are necessary or not
- ☐ ⑤ Confirm store landing facilities (Crane, Loading Arm, Bellows Chute, etc...) available
- ☐ ⑥ Check the suitability of the departure route (Proximity of hazards and other vessels in way of departure route) (minutes)
- ☐ ⑦ Unmooring or cutting lines
- ☐ ⑧ Give notice to the shore (relevant departments or the operating company), after departure
- ☐ _____ (minutes)

Staying alongside

*Continue to obtain the information of Tsunami (from TV, Radio or VHF)

- ☐ ① Crew readiness (minutes)
- ☐ ② Tending mooring lines / Tightening brakes of mooring winches (minutes)
- ☐ ③ Standby anchor (minutes)
- ☐ ④ Standby engine and thruster if provided (To avoid damaging of lines, Surging) (minutes)
- ☐ ⑤ Discuss or instruct for the interruption of Cargo work, etc... (minutes)
- ☐ ⑥ Check watertight measures (close all the watertight doors /openings, etc...) (minutes)
- ☐ ⑦ Give notice to the shore (relevant departments or the operating company) (minutes)
- ☐ ⑧ Check the ways to obtain the latest information.
  (Preparing vessel on the advice or the indication from Harbor Master/ Harbor administrator, etc...)
  (Check the safe water area in advance for the emergency departure)
  (Check the safe area, the evacuation route for evacuation to the land)
- ☐ _____

Evacuation to the land

*Continue to obtain the information of Tsunami (from TV, Radio or VHF)

- ☐ ① Crew readiness (minutes)
- ☐ ② Check the safe area, the evacuation route, the required time to evacuate etc...
- ☐ ③ Instruct crew to evacuate to land (minutes)
- ☐ ④ Carry out the required work on board till Evacuation to the land (minutes)
  (Disengaging the connections such as loading facilities between the ship and the land) (minutes)
- ☐ _____

Attention in case of drifting （Additional points）

When the ship drifts from berth, the mooring may break, and cargo handling facilities, such as cranes etc. may collapsed, therefore crew shall evacuate to the safe area.

Countermeasure of ship for tsunami disaster (in Japanese)

Type of Tsunami Forecast		Available Time before tsunami arrival	Countermeasures of ships					
			Docked at pier			Anchored & mooring buoy	Navigating	
			Vessel and medium-sized vessel (including fishing vessel)		Small boat		Vessel (including fishing boat)	Small boat
			Vessels with hazardous material	Standard (include a working ship)	Pleasure boat & fishing boat			
Tsunami Warning	Major 3m, 4m, 6m, 8m, Over 10m	imminent	Halt cargo handling and all other operation & (B) (general rule)	Halt cargo handling & (A)	(A)	(E)	(B)	(B) or (A) after getting a shore
		medium	Halt cargo handling and all other operation & (B) (general rule)	Halt cargo handling & (B) or (A)	(D) or (A) ((B) in some case)	(E) or (B)		(B) or (D) ((A) in some case)
		enough	Halt cargo handling and all other operation & (B)	Halt cargo handling & (B)	(D) ((B) in some case)	(B)		(B) or (D)
	Tsunami 1m, 2m	imminent	Halt cargo handling and all other operation & (B) (general rule)	Halt cargo handling & (A) or enforce mooring	(A)	(E)	(B)	(B) or (A) after getting a shore
		medium	Halt cargo handling and all other operation & (B) (general rule)	Halt cargo handling & (B) or (A) or enforce mooring	(D) or (A) ((B) in some case)	(E) or (B)		(B) or (D) ((A) in some case
		enough	Halt cargo handling and all other operation & (B)	Halt cargo handling & (B) or enforce mooring	(D) ((B) in some case)	(B)		(B) or (D)
Tsunami Advisory	Tsunami Attention 0.5m		Halt cargo handling & enforce mooring or (B)	Halt cargo handling & enforce mooring or (B)	(D) or (B)	(C) ((B) or (E) in some case)	(B)	(D), (B) or enforce mooring
Remarks			The enterprise shall prepare a manual in advance.		If there is appropriate evacuation area in out of port for small boat, (B) is also recommended.	(ZZZ) see below		

(A) Evacuation on land : All crew shall evacuate to the higher ground because an evacuation by ship is expected to be high risk. Make an effort to prevent the flowing out of ships and security actions for hazardous materials as much as possible.

(B) Evacuation out of port: Evacuate to the deep water depth and broad area of out of port. (If there is no time to evacuate, stay in the designated emergency evacuation area in the port.)

(C) Monitor : No action for evacuation is taken, but all available safety measures shall be taken collecting the available information until Tsunami Advisory is cancelled.

(D) Land a boat : Land a small boat such as pleasure boat and fishing boat, and bind a landed boat not to flow out by tsunami.

(E) Start an engine : Start an engine of anchoring ship, and take an appropriate action as required.

TOWS Activities

Develop Vertical Evacuation Guidance:

- ✓ TT noted **US ASCE 7-16 Tsunami Loads engineering provisions on high capacity structures (that can serve as evacuation shelters for tsunami) now part of 2018 International Building Code**.
- ✓ **New Zealand MCDEM (2008/2016)** Tsunami Evacuation Zone guidelines (Tsunami Evacuation Zones, DGL 08/16) - nationally consistent approach to developing tsunami evacuation zones, maps, and public information - revised includes information on land use planning and vertical evacuation.

  (2018-2019) - vertical evacuation promoted as last resort, 2-phased approach for designation and design considerations of tsunami safe structures. **Phase 1 (2018) - decision making process for local authorities to assess** whether or not, given residual risk. Includes assessment costs to retrofit existing buildings and build new. **Phase 2 (2019) - engineering design requirements**
- ✓ **Indonesia ITB & BNPB (I2014, Bahasa):** Bandung Institute of Technology (ITB) & National Disaster Management Agency (BNPB) developed material for **plan, design / build new tsunami evacuation structures,** as well as **identify potential existing buildings**. Also guidelines on **plan / design of artificial hills** (man-made) for evacuations. IOTWS WG1 chair and IOTIC will pursue options for translation.
- ✓ Japan: **wealth of information available (in Japanese).**

PTWS Steering Committee, 7-8 June 2018

- **Action:** SC agreed that **ITIC will host websites to centralize information on**
  - Marine and Ports Tsunami Guidance and Best Practices
  - **Structural Design and Vertical Evacuation Guidance and Best Practices.**

JAPAN

To make evacuation measures, Japan set two levels of tsunami:

1. **maximum tsunami : occurs once in several hundreds years**
2. **frequent tsunami : occurs once in several tens years**

Ideally, tsunami evacuation facilities (tsunami evacuation buildings/towers) for maximum tsunami are needed.

On the other hand, considering constructing time constraint, tsunami evacuation facilities for frequent tsunami should be prepared for in the time being.

Local governments are requested to:

- **Utilize public and/or national properties for tsunami evacuation facilities as much as possible.**
- **Report regularly on progress pf preparation for tsunami evacuation facilities to the residents.**
- **Promote to designate existing reinforced buildings as tsunami evacuation facilities.**

Sendai City, Japan

Tsunami Evacuation Guidelines

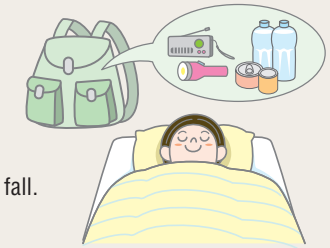
- This guide summarizes tsunami hazard zones, evacuation facilities, shelters and important locations for quick evacuation based on the present topography, following the damage caused by the 2011 Great East Japan Earthquake and Tsunami.
- Think about where you and your family spend time during normal conditions, and be prepared for a quick evacuation when a large or long period earthquake is felt, or when receiving tsunami information.

Preliminary version

3rd version March 2015 Sendai City

For those who have the first version published in October 2011, or the second version published in April 2013, please discard it as details on evacuation facilities and shelters have changed.
(Dispose of as miscellaneous paper can be recycled.)

❶ Start preparing now.



- Prepare an emergency bag including such as light, portable radio, canned food and drinking water.
- Secure a route to quickly exit the room, and secure furniture near the exit so that it does not fall.

❷ Locate your tsunami evacuation facility or shelter and visit the actual location.

- Practice evacuating to the facility or shelter so that your response is quick during a real event.
- Locate the tsunami evacuation facility or shelter you should use during school or work hours.
- Attend an evacuation drill every year.

❸ Rapidly evacuate if you feel a strong or long shake.

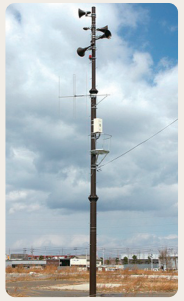
- Evacuate without waiting for tsunami information.
- Evacuate quickly far inland of the tsunami hazard area, or evacuate quickly to an evacuation facility or shelter.
- Evacuate to high ground or far inland as quickly as possible.

- Do not stay close to sea or river.
- **In general, evacuate on foot.**
  (Traffic jam or accident might occur if using cars.)
- Take the lead in evacuating whilst calling out with loud voice [Tsunami is coming!] or [Evacuate!].

❹ Check tsunami information positively.

Actively check tsunami information from the public address system, **TV**, or **radio.**

- **Tsunami information transmission system (Outdoor speaker installation)** ※Japanese version only
  Information is disseminated through outdoor speakers installed in tsunami inundation areas, and door-to-door receiving device. Tsunami warning and evacuation information are immediately transmitted, all at once, through siren or voice announcement.



▲Outdoor speaker installation

- **City of trees disaster prevention mail** ※Japanese version only
  Tsunami information delivered by Sendai City. Need to pre-register →

▲City of trees disaster prevention mail

- **Emergency rapid mail** ※Japanese version only
  Evacuation advisory / instructions are delivered through each mobile phone company during the announcement of a tsunami warning.

- **Twitter of Sendai City Crisis Management Department** ※Japanese version only
  For further information on disaster prevention, please search for and register with the Sendai City Crisis Management Department or "@sendai_kiki". Need to pre-register →

For further details and registration instructions then please see the city homepage (disaster prevention and emergency information).

❺ Do not leave the evacuation facility or shelter until the cancelation of the tsunami warning.

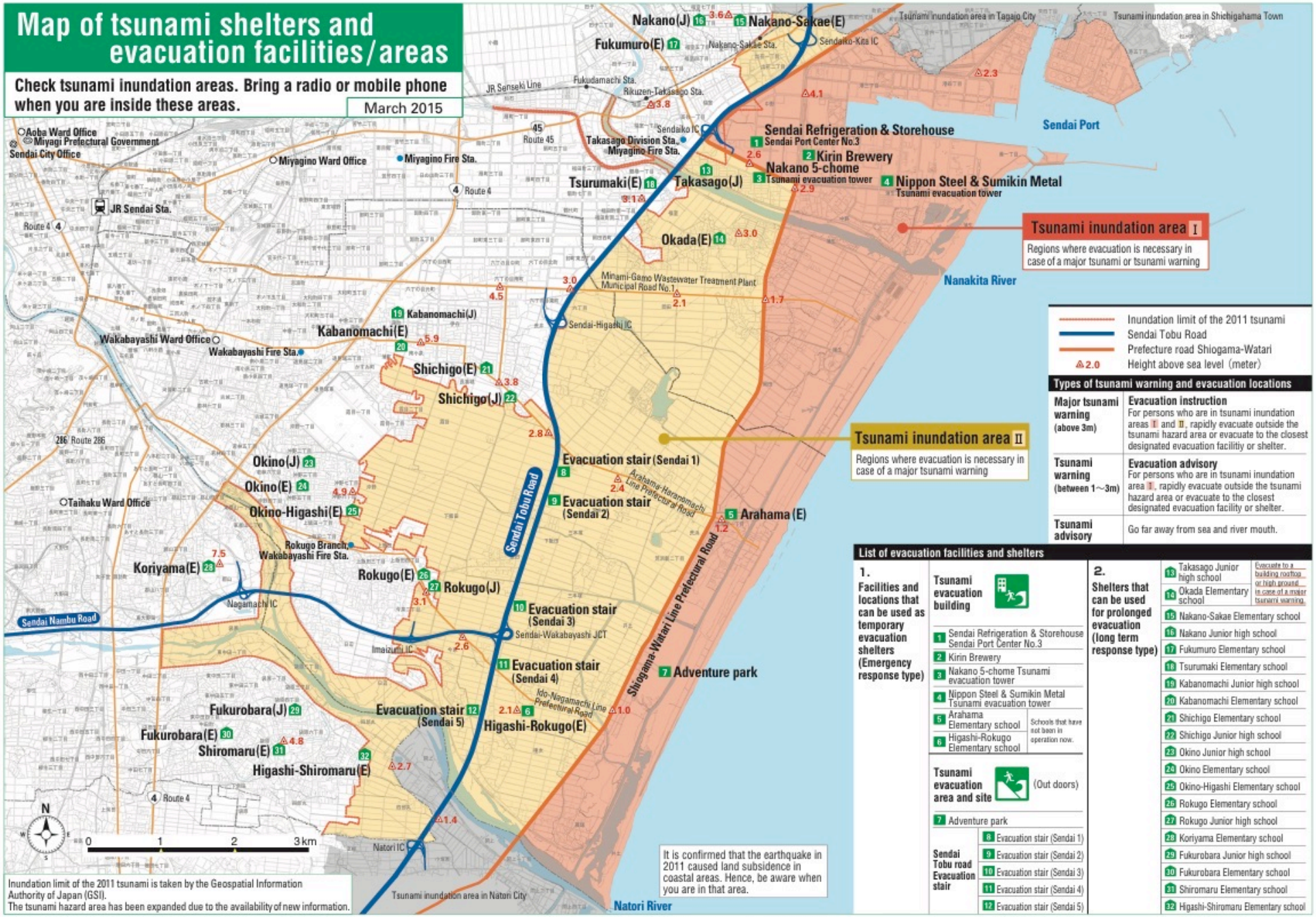
- Remain vigilant and stay away from the hazard area until the cancelation of the tsunami warning.
- A tsunami is a series of wave and the second or later waves may bigger than the first wave.

The same for the case of far-field tsunami (Tsunami generated by a distance earthquake): collect information and evacuate quickly.

These guidelines were prepared based on advices by International Research Institute of Disaster Science, Tohoku University.

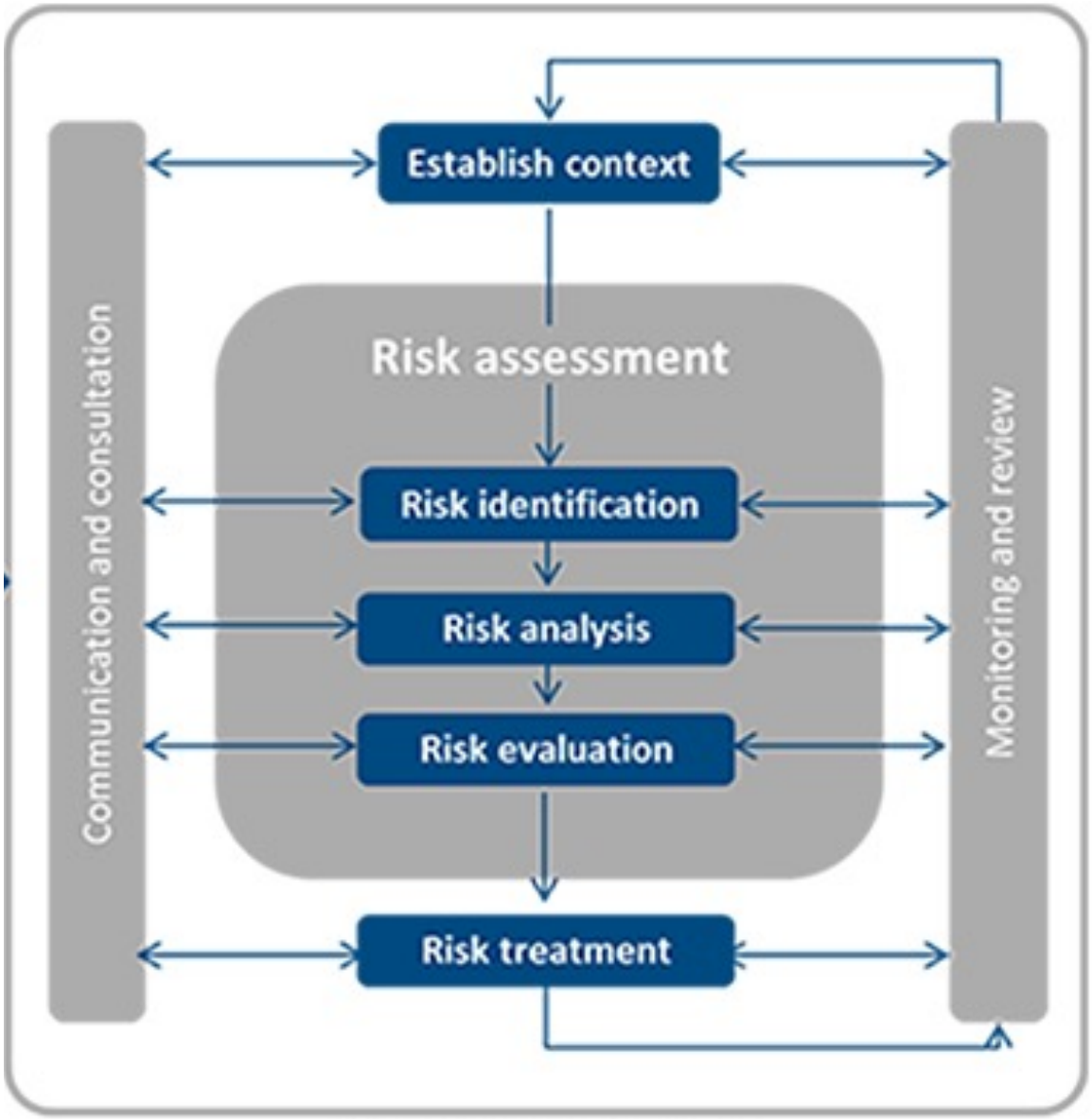
Inquiries
Disaster-resilient City Promotion Section, Crisis Management Department 022-214-3047
Disaster Risk Reduction Promotion Section, Crisis Management Department 022-214-3049
Living Environment Section, Miyagino Ward Office 022-291-2111
Living Environment Section, Wakabayashi Ward Office 022-282-1111
Living Environment Section, Taihaku Ward Office 022-247-1111

Sendai City, Japan



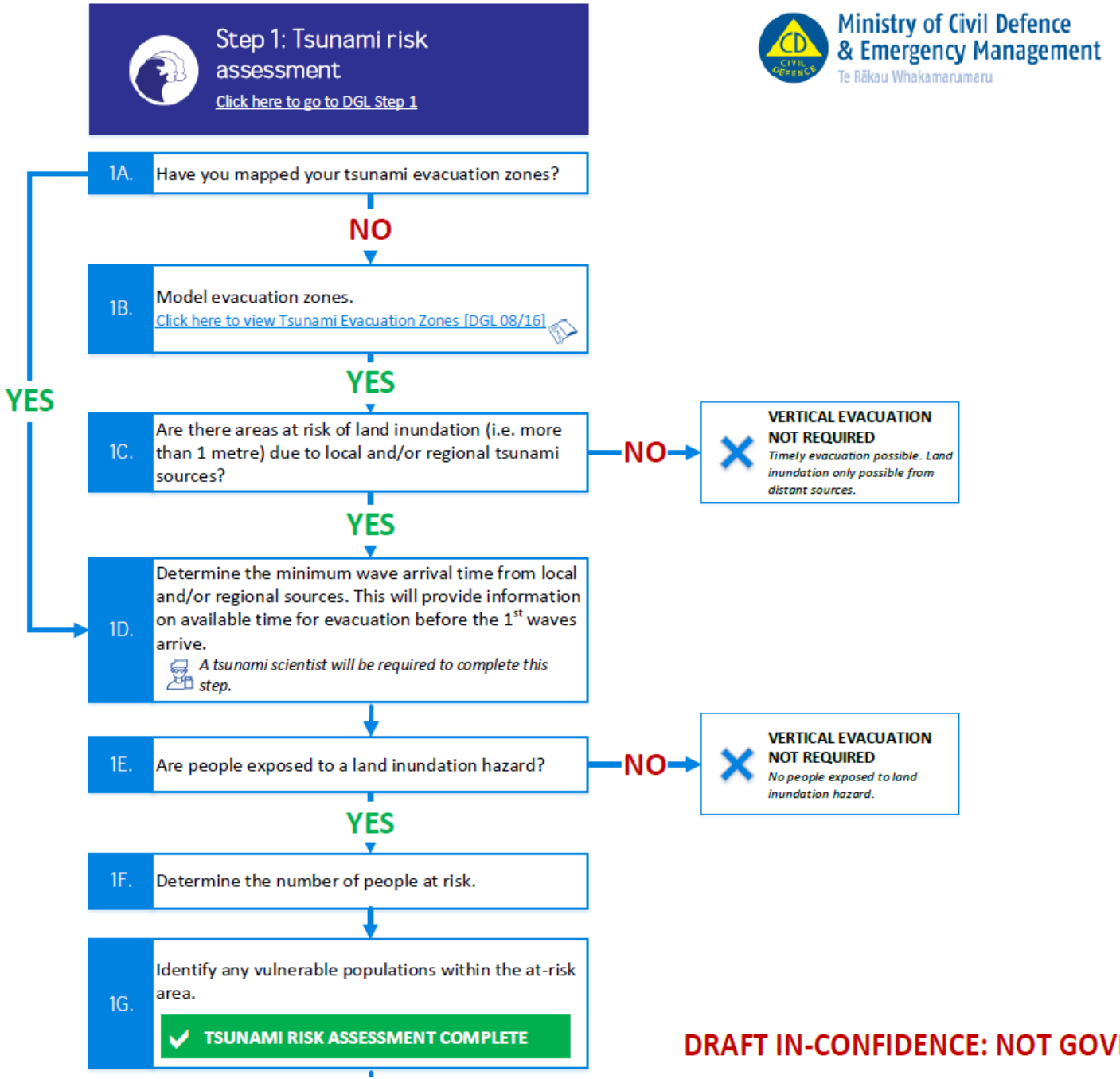
New Zealand Tsunami Vertical Evacuation – Phase One

Risk based approach to assessing need



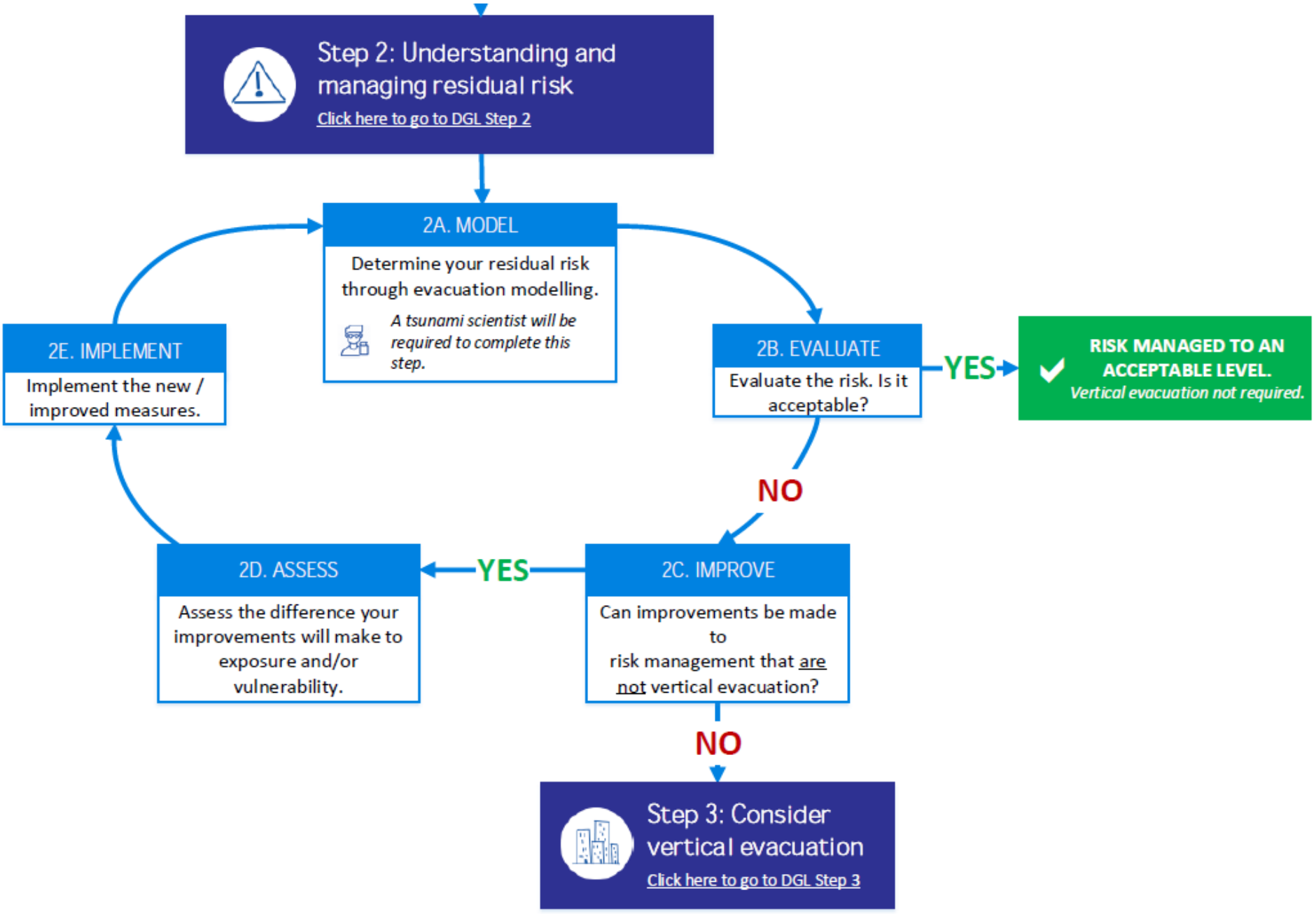
Process for managing risk

Risk based approach to assessing tsunami vertical evacuation need



DRAFT IN-CONFIDENCE: NOT GOVERNMENT POLICY

Risk based approach to assessing tsunami vertical evacuation need



DRAFT IN-CONFIDENCE: NOT GOVERNMENT POLICY

An example of some challenges and considerations

Public Messaging – difficulties associated with ensuring advice is not conflicting or confusing for the public. It requires a reasonable level of technical expertise to determine whether building damage is superficial or structural. If future advice to the public includes messaging on staying in/entering buildings that are designated as suitable for tsunami vertical evacuation, all public messaging must be clear that such advice applies to only those buildings that have been through a thorough assessment and designation process.

Building Stock and Standards – Buildings must have the ability to withstand seismic shaking and tsunami forces. It may be impossible or prohibitively expensive to retrofit existing structures or build new structures.

Different exposure and vulnerability – geographic and demographic variance results in differing exposures and vulnerabilities. E.g. on coastal plains modelled evacuation zones can extend several kilometres inland, making rapid evacuation on foot impractical. Some coastal communities may have retirement homes, where predominantly elderly population are less mobile. Urban CBD's in coastal locations have high density populations living and/or working in high-rise structures, making evacuation out of zones complex due to congestion. Some coastal communities are physically isolated by waterways or barriers such as walled motorways.

Legislative framework – Emergency and building management guidance and standards will have to be reviewed/updated to reflect tsunami evacuation. It will need to ensure it is fit-for purpose and able to be used by all, despite differing geographic or demographic requirements.

Vertical Evacuation Mound in New Zealand

Thank You

Laura Kong
Director, International Tsunami Information Center