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# **Outline of Guideline for Development and Utilization of Tsunami Disaster Management Map**

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**Port and Airport Research Institute, Japan  
The Overseas Coastal Area Development Institute of Japan  
Ports and Harbours Bureau,  
Ministry of Land, Infrastructure, Transport and Tourism, Japan**

# Guideline for Development and Utilization of Tsunami Disaster Management Map

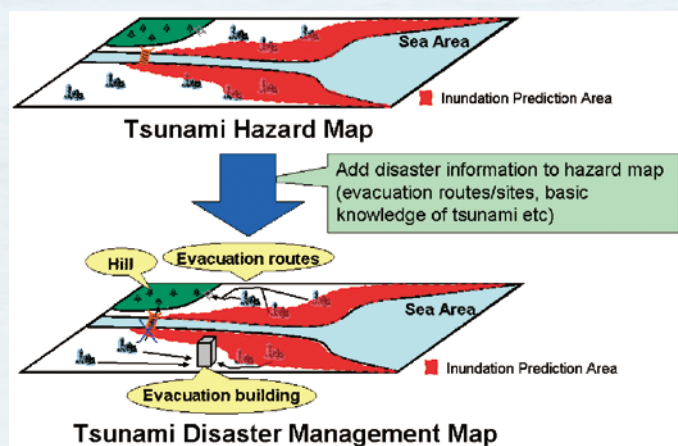
Reduction of tsunami disasters in a region and a community is attained with a comprehensive approach involving the integration of land use planning, construction of coastal protection facilities and measures for increasing the people's self-protecting capability against disasters. Tsunami disaster management maps indicate tsunami hazards and vulnerability in the region and community as well as countermeasures against the tsunamis. A tsunami disaster management map is a good tool to investigate and establish comprehensive disaster mitigation system, since it provides necessary graphical information to manage tsunami disasters and minimize damage in the region as well as regional tsunami hazards and vulnerability.

This guideline aims to assist developing countries, in particular countries affected by the 2004 Indian Ocean Tsunami and of ASEAN, in developing and utilizing the tsunami disaster management maps. It clarifies the basic concepts such as the purpose, role, method, and utilization of such maps.

## Features

- To describe the contents for those who have less knowledge of tsunamis and tsunami numerical simulation in an easy to understand manner
- To list actual examples of the utilization of disaster prevention maps in order to make it easy to understand for those in charge of administration in developing countries
- To prepare the storm surge hazard map and to analyze the effects of sea level rise due to global warming

## What is a Tsunami Disaster Management Map?



Definition of the tsunami disaster management map

Tsunami disaster management map contains two types of information to mitigate the tsunami disasters:

- Information of tsunami inundation areas predicted by possible tsunamis and recorded by historical tsunamis

This type of information provides tsunami hazard and vulnerable areas against tsunami in the community (Tsunami Inundation Map or Tsunami Hazard Map)

- Information for enhancing people's awareness of tsunami disaster, ensuring readiness, and reducing tsunami damages

## Contents of Guideline

**Chapter 1** : Introduction

**Chapter 2** : Outline of a tsunami disaster management map

**Chapter 3** : Procedure to prepare a tsunami disaster management map

**Chapter 4** : Applications of tsunami disaster management maps

**Appendix 1** : Examples of Tsunami Disaster Management Map

**Appendix 2** : Characteristics of tsunami



# How to use Tsunami Disaster Management Maps

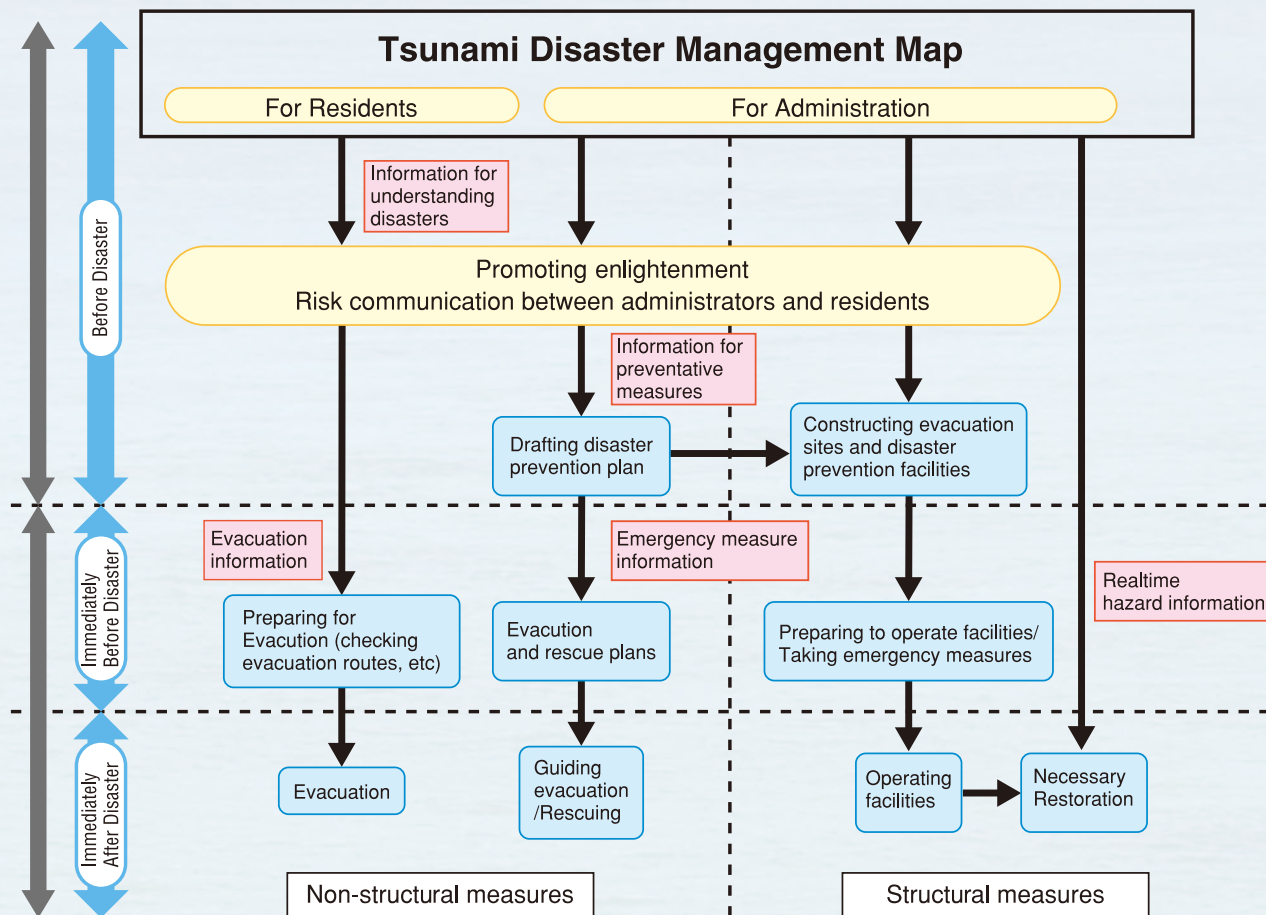
## Utilization of Tsunami Disaster Management Map

### • For use by residents :

Enhance their self-defense abilities and promote smooth evacuation activities.

### • For use by administrators and decision-makers:

Make plans for residential evacuation and for improving disaster prevention and mitigation facilities including evacuation facilities.



Utilization of tsunami disaster management map at each stage of disaster

## Educational Opportunities for Residents

Using the tsunami disaster management map in

### Following-up workshop

- to enhance residents' awareness of tsunami disaster prevention and mitigation
- to establish the importance of the map within the community

### School

- to continuously educate people about disasters from childhood
- to provide a chance for family members to talk about disaster prevention and mitigation

### Voluntary disaster prevention organization in each district

- to promote more precise tsunami disaster management in the district



Residents discussing evacuation sites and routes



## How to use Tsunami Disaster Management Maps

## Use of Maps in Japan

## Evacuation drills for children

It is important to implement evacuation drills for various conceivable situations, such as when elementary and junior high school students are on the way home from school, because tsunamis may strike at any time.



Evacuation drills conducted on the way back home from school Former Taiki Town, Mie Prefecture



### Informative brochure

To effectively promote residents' understanding of tsunamis and their disasters, the Susaki City Government in Kochi Prefecture has prepared "Our Town and the Nankai Earthquake and Tsunami - Let's Learn about Tsunami," to enhance the disaster prevention ability of communities.

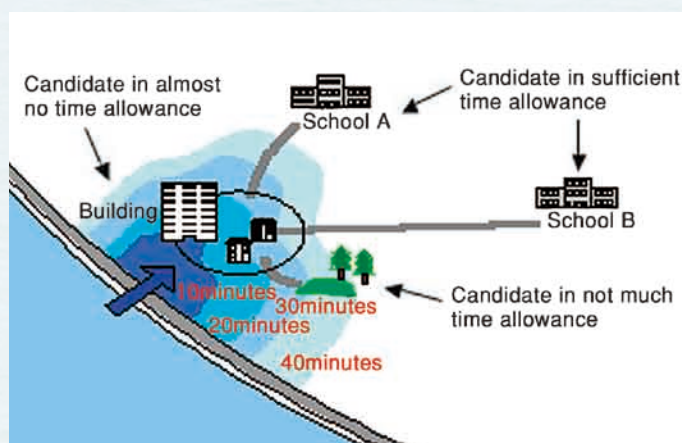
In particular, the brochure can be easily understood by children, who will be future disaster managers in the community and who can disseminate the information among their family members.



## Description of tsunami occurrence mechanism in "Our Town and the Nankai Earthquake and Tsunami - Let's Learn about Tsunami"

## Drawing up evacuation plans

Information of evacuation sites and places as well as inundation area and striking time of the expected tsunami results in identifying areas where it is difficult for people to evacuate, and planning of residents' and other persons' evacuation.

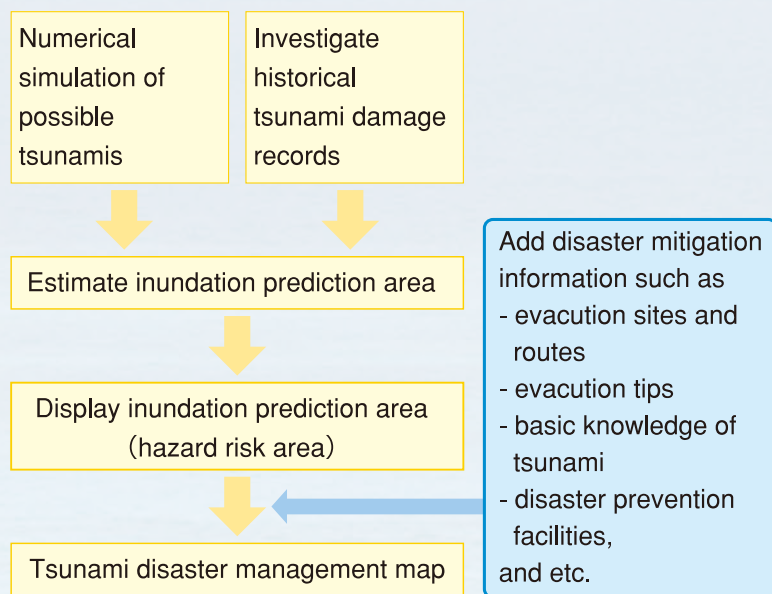


### Selecting evacuation sites for Community A depending on time allowance



# How to make Tsunami Disaster Management Maps

## Flow Chart of Making Tsunami Disaster Management map



Flow of preparing tsunami disaster management map

The tsunami disaster management map is, in general, developed to add various information on tsunami disaster prevention and mitigation in a tsunami hazard map

First step:

To indicate inundation areas predicted by numerical simulations with possible tsunamis and by investigations of historical tsunami damage records.

Second step:

To add information to provide tsunami disaster mitigation and protecting lives such as

- evacuation sites and routes, -
- evacuation tips
- basic knowledge of tsunami

## Additional Information for Tsunami Disaster Mitigation

The tsunami disaster management map can be utilized for various purposes besides evacuation: for instance, planning of preventative measures, evaluating the effects of structural measures and others.

According to the aim of the map, necessary information is indicated on the map together with tsunami hazard data. The map should be also prepared corresponding to intended users. Information on the map is recommended to be presented in a comprehensive but easy to understand manner.

Characteristics of each inundation prediction method

Category of information	Information (to be layered in the tsunami disaster management map)
Hazard	<b>Inundation risk areas (depth and time)</b> <ul style="list-style-type: none"> <li>The following information could be included in the map.</li> <li>Inundation area records based on historical tsunamis</li> <li>Inundation depth based on the expected tsunamis</li> <li>Inundation depth records based on historical tsunamis</li> <li>Initiation time of inundation based on the expected tsunamis</li> <li>Initiation time of inundation based on historical tsunamis</li> <li>Fluid velocity and wave force of the expected tsunamis</li> <li>Others</li> </ul>
Evacuation	<b>Evacuation sites or tsunami shelters</b> <b>Evacuation routes</b> <ul style="list-style-type: none"> <li>The following information could be included in the map.</li> <li>Population distribution in day and night times</li> <li>Facilities for those who require some assistance for evacuation</li> <li>Elementary schools and kindergartens</li> <li>Others</li> </ul>
Disaster awareness-raising and disaster study	<b>Basic knowledge of tsunamis</b> <b>Evacuation tips</b> <ul style="list-style-type: none"> <li>The following information could be included in the map.</li> <li>Characteristics of historical tsunamis and their induced disasters</li> <li>Others</li> </ul>
Other disaster management	<b>Telephone number of authorities related to disaster management</b> <ul style="list-style-type: none"> <li>The following information could be included in the map.</li> <li>Protection line,</li> <li>Land use,</li> <li>Disaster prevention centers</li> <li>Emergency transportation routes</li> <li>Police, fire department, hospital and other authorities related to disaster control</li> <li>Life lines such as power, gas and water supply facilities, and sewerage facilities</li> <li>Coast protection facilities such as breakwater, tide wall, and water gate)</li> <li>Others</li> </ul>



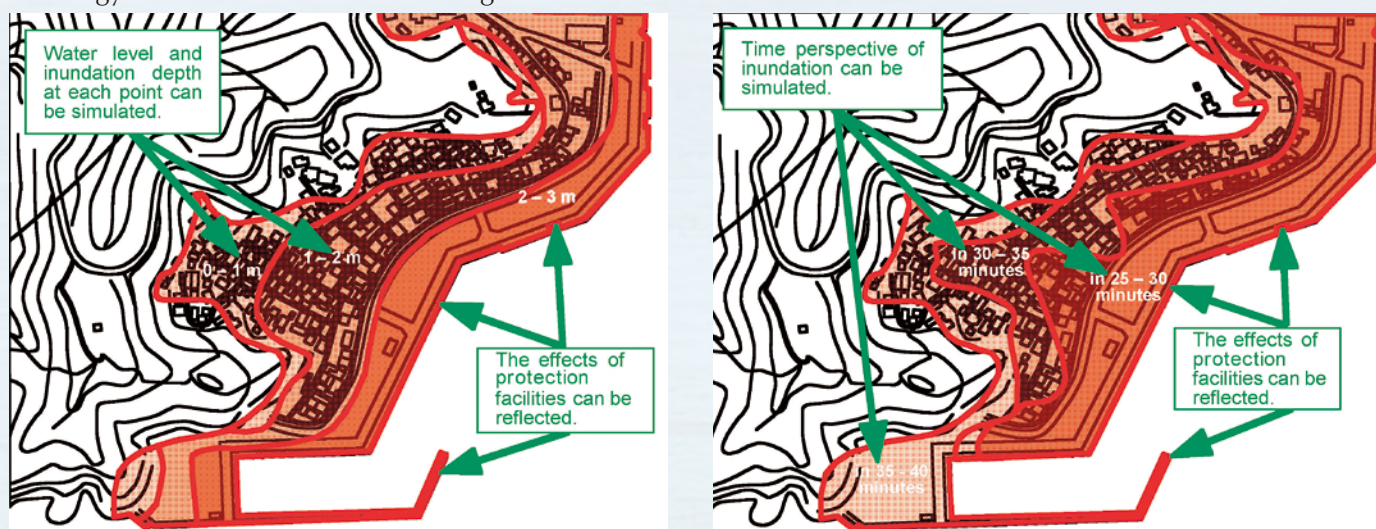
# How to make a Tsunami Disaster Management Map

## Recommended Method for Predicting Tsunami Inundation: Numerical Simulation

There are four kinds of inundation prediction methods:

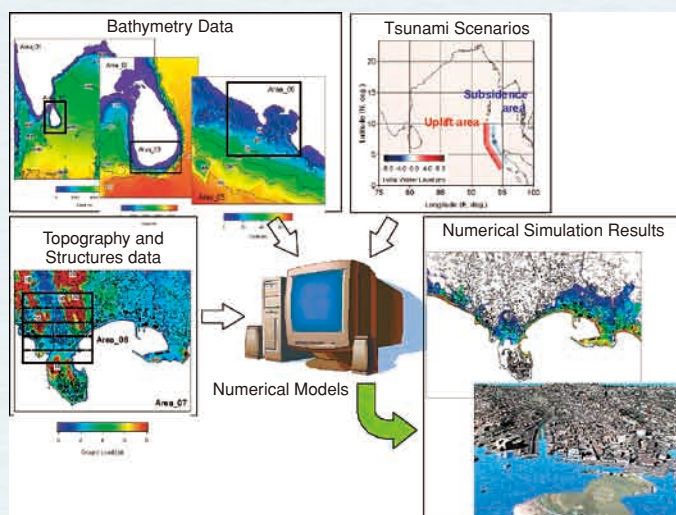
- Numerical simulation method
- Level filling method
- Method based on historical inundation records
- Estimation based on ground elevation

The numerical simulation is recommended to predict the inundation areas, which precisely estimates distribution of inundation depth, initiation time of inundation at each point and others and provides basic data in investigating a strategy and measures of disaster mitigation.



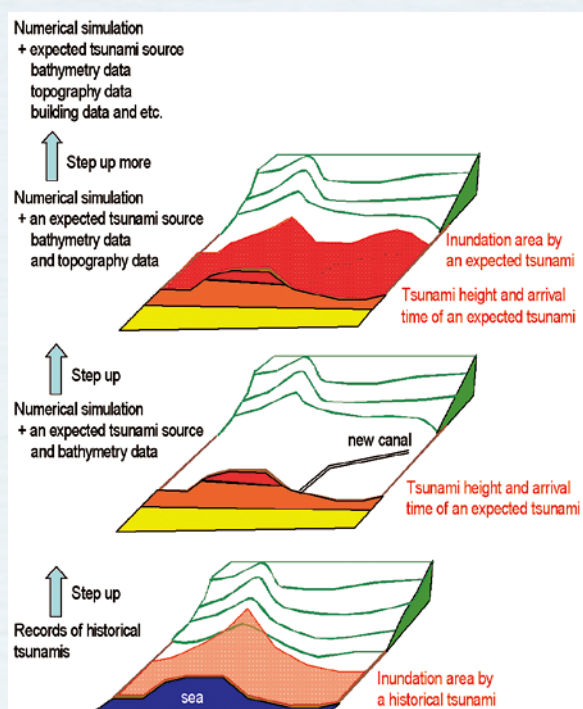
Characteristics of inundation prediction method

## Necessary data for Tsunami Numerical Simulation



Estimation of the tsunami hazard area with numerical simulations

If bathymetric data and tsunami scenarios to determine the tsunamis striking the community are prepared, numerical simulation can provide a tsunami hitting coasts from the tsunami source. If topographic data on land is available, moreover, the tsunami inundation areas are estimated with the numerical simulations. In recent numerical simulations, the effect of structures such as protection works and coastal buildings in tsunami reduction can be considered, using structure data that is obtained from airborne surveys.



Step-by-step development of tsunami disaster management map



# How to make a Tsunami Disaster Management Map

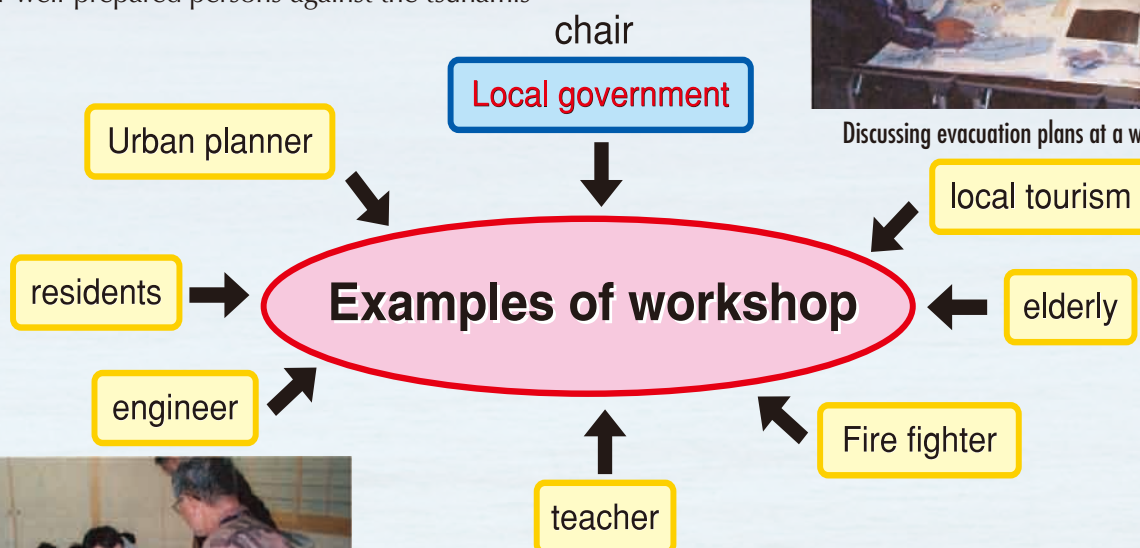
## Making in Workshop

Making the tsunami disaster management map in the workshops together with residents and other representatives

- to reflect local information
- to promote the understanding of inundation areas and evacuation sites
- to foster well-prepared persons against the tsunamis



Discussing evacuation plans at a workshop



Discussing evacuation plans at a workshop

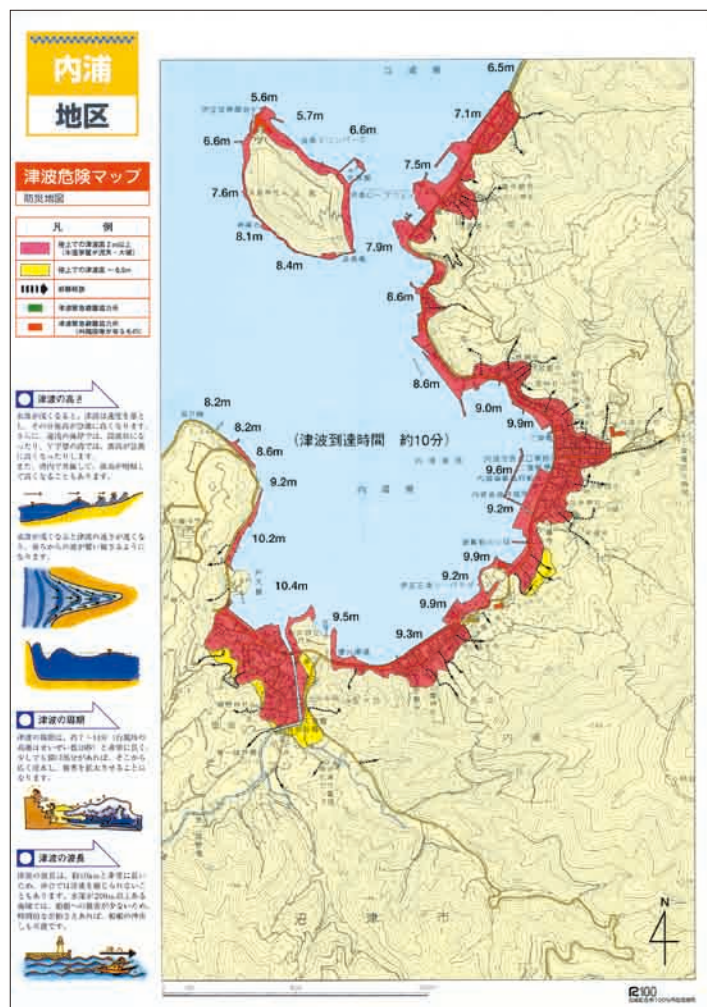
Workshops are effective for encouraging residents to participate in preparing tsunami disaster management maps, because it helps promote the residents' understanding and applications of the map.

Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan (MLIT) prepared the Japanese manual for tsunami disaster management map. Advanced case studies have shown that the disaster management map is an effective evacuation measure.

The exploratory committee on Guideline for Development and Utilization of Tsunami Disaster Management Map prepared a draft version of this guideline by referring to Japan's Tsunami and Storm Surge Hazard Map Manual.

## Guideline Exploratory Committee Members List

Position	Name	Organization
Chairman	Dr. Toshitaka KATADA	Professor, Department of Civil and Environmental Engineering, Gunma University
Vice-Chairman	Dr. Takashi TOMITA	Tsunami Research Director, Tsunami Research Center, Port and Airport Research Institute
Committee	Mr. Katsuya ODA	Head, Coastal Disaster Prevention Division, Coastal and Marine Department, National Institute for Land and Infrastructure Management
Committee	Dr. Kazumasa KATO	Visiting Professor, Musashi Institute of Technology
Committee	Dr. Shunichi KOSHIMURA	Associate Professor, Disaster Control Research Center, Tohoku University
Committee	Mr. Tatsuyuki SHISHIDO	Senior Executive, The Overseas Coastal Area Development Institute of Japan
Committee	Dr. Susumu NAKANO	Associate Professor, Department of Civil Engineering, the University of Tokushima
Committee	Mr. Satoru MIMURA	Team Director, Disaster Management Team, Japan International Cooperation Agency
Chief Secretariat	Mr. Takahiko SASAJIMA	Director for Special Research, Port and Airport Research Institute



Front of Japanese Tsunami Disaster Management Map  
(Numazu City, Shizuoka prefecture)

## 津波に対する避難の心得

- 地震＝津波→すぐ避難
  - ◇ 駿河湾を震源とする東海地震では、津波の発生が予想され、沼津市海岸部には、発震後5～10分程度で津波が襲来する。
- 津波警報をまたずに、大きな地震を感じたらすぐに避難する。
- 高い所へ避難する。
  - ◇ 津波に対しては、できるだけ早く、少しでも高い所へ避難する。  
(津波浸水予想地域からすみやかに脱出することが大切)
  - ◇ 日頃から、各家庭で非常時の避難経路を複数考えておく。  
(逃げ遅れた場合は、緊急避難協力ビルに避難する)
  - ◇ 津波は河川などを遡上するので、川沿いの避難は避ける。
  - ◇ 避難には、車を使わない。
- 一度避難したらすぐには家にもどらない。
- 津波は何度も押し寄せるので、「警報」が解除されるまで避難している。
- 津波の前に潮が引くとは限らない。
  - ◇ 潮が引いてから避難すればいいと考えるのは危険である。

## 内浦地区の被害想定及び避難

### 1 第3次地震被害想定での津波による被害

自治会名	想定震度	建物棟数	大破棟数	中破棟数	一部損壊	軽微被害
重 寺	6弱	2 2 1 棟	1 4 9 棟	0 棟	2 8 棟	0 棟
小 海	6弱	1 4 9 棟	9 3 棟	0 棟	2 0 棟	0 棟
三 津	6弱	4 1 6 棟	2 2 4 棟	3 2 棟	1 2 0 棟	1 3 棟
長 浜	6弱	1 7 5 棟	1 1 1 棟	0 棟	3 0 棟	9 棟
重 須	6弱以上	4 2 5 棟	2 2 7 棟	0 棟	7 2 棟	2 2 棟

### 2 安政東海地震 マグニチュード＝8.4 (1854年12月23日午前9時頃発生)

自治会名	想定震度	建物棟数	大破棟数	中破棟数	一部損壊	軽微被害
沼 津 市 の 被 害	○震度 6～7	○津波高 4～8m	○死者 多数			
重寺地区の被害	○津波高 約6m	○72戸水漬				
小海地区の被害	○津波高 約6m	○30軒のうち18軒流出				
三津地区の被害	○津波高 約6m	○130軒ほとんど全滅 家見え				
長浜地区の被害	○津波高 約6m	○60軒中半数が流出				
重須地区の被害	○津波高 約7m	○55軒中あまし流出	○死者 多数			
	○光明寺床上3尺まで津波つき諸所破損					

※ 突発地震時の避難→すばやく裏山・高台等へ避難する。

※ 警戒宣言時の避難→非常持ち出し品を携行し、  
地区集会所へ避難したあと、  
避難地へ避難する。

地区集会所	避難地
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Back of Japanese Tsunami Disaster Management Map  
(Numazu City, Shizuoka prefecture)

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