

# 2011 Tohoku Earthquake and Tsunami, the Aftermath and the Recovery Process

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Eleven years have passed since the 2011 Tohoku Earthquake and Tsunami (Tohoku tsunami) attacked the north coastline of Japan. After the tsunami, there was a major change in the engineering coastal disaster prevention philosophy regarding how to protect coastal areas from tsunamis. As a result, two levels of protection have been established. The "tsunami protection level" (level 1) is the level of the tsunami that can be handled by structures such as seawalls and represent the height of the tsunami used in the design of coastal protection facilities. The "tsunami protection level" represents an event with a return period of once every 100 years. The "tsunami disaster mitigation level" (level 2) is above the "protection level" and is the level of tsunami used for evacuation planning, representing the maximum height of the wave that can be expected in order to ensure the preservation of the life of coastal residents (with a return period of once every 1000 years or more).

In the aftermath of the Tohoku tsunami disaster, recovery activities were carried out through the use of consensus building in each region, using a 32 trillion yen (300 billion USD) reconstruction budget. Different choices were made in each region based on local disaster experience and the history of the community. The following are some of the most common choices, which represent instructive examples of the strategies that other coastal communities elsewhere in the planet might have to make decisions on following future tsunami events:

- 1) To rebuild the community by building higher and stronger tsunami seawalls to prepare for the next event:* In Taro District, the 10.0 m tsunami embankment before the Tohoku Tsunami was overtopped and destroyed by the overflow, so a new 14.7m embankment was built closer to the coastline.
- (2) To raise the ground level of entire towns using material sourced from nearby mountains:* In Rikuzentakata, a new urban area was built on top of the old one, 10-12 m above sea level. The surrounding hills (45 ha) and the new artificial hill (91 ha) were combined to create the new residential area.
- (3) To re-designate the urban zoning of towns:* In Onagawa, the old town is still used as a commercial area for shopping and the railway station remains in its original place. However, all residential areas are now on top of a natural hill, and residents were relocated to it.
- (4) To retreat and abandon a settlement completely:* The Arahama area was developed as a bedroom town for Sendai City before the tsunami. However, following this event, the settlement was abandoned, and all residents moved out and withdrew from this area.