



Infraestructura para la mitigación de tsunamis

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Seawalls

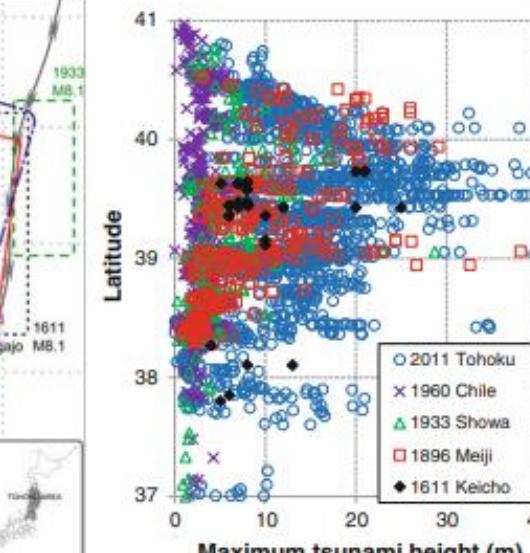
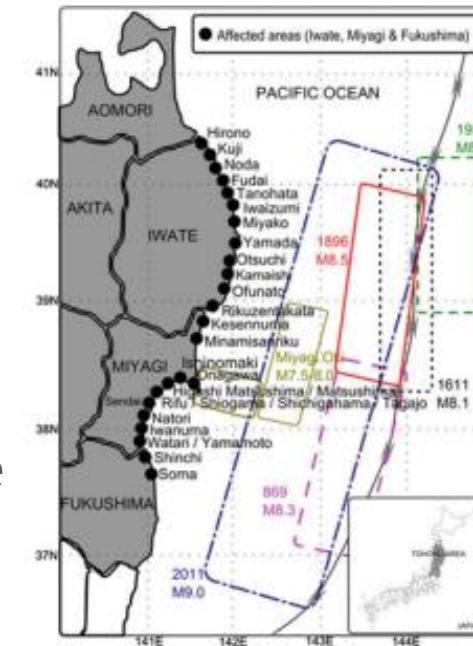
- Taro town in Iwate ken → Primeros seawall construidos en 1934 luego de los tsunamis de 1896 (Meiji-Sanriku) y 1933 (Showa-Sanriku).
- Longitud de 2.4 km (*Banri no chojo*), 10 m de altura, 24 años de construcción (1958, 1979)/ “Great wall”. Diseñado para una altura de tsunami de 8 m.
- 190/ 300 km de seawalls destruidos luego del 3/11 (GEJE 2011).
- Mayor tiempo disponible para evacuar/ sensación de seguridad.



Before (Ishikawa et al., 2011)



After (Ishikawa et al., 2011)



Suppasri et al. (2013)

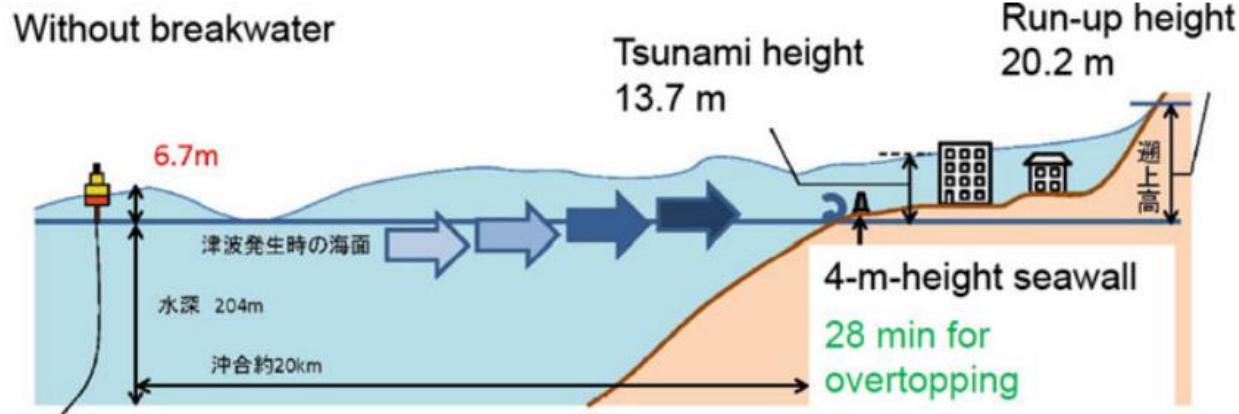


Suppasri et al. (2013)

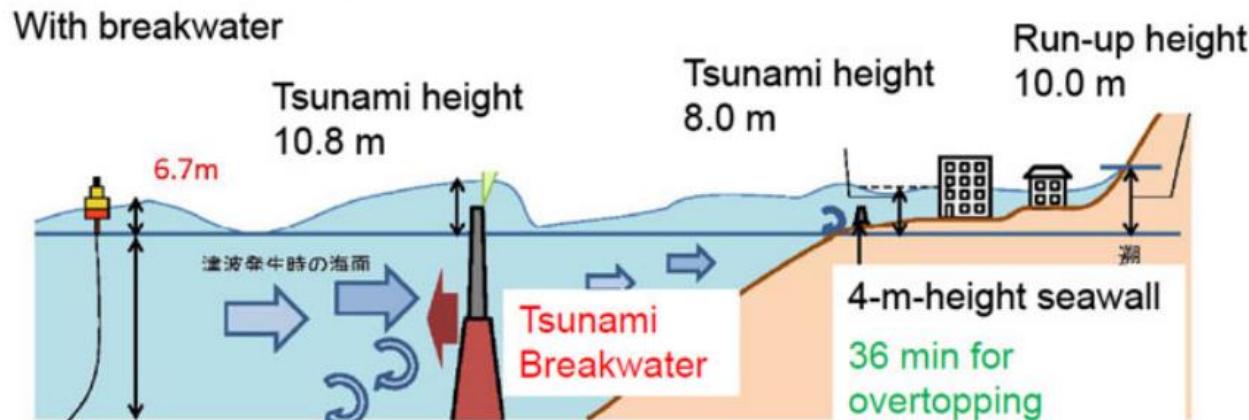


Kamaishi breakwaters

- Construcción finalizada en 2009 (1.6 B USD). 63 m de profundidad. 670 and 990 m de longitud.



Suppasri et al. (2013)



- Disminución de la altura de tsunami
- Disminución del tiempo de arribo del tsunami ~ 8 min
- 70% de los bloques fueron destruidos

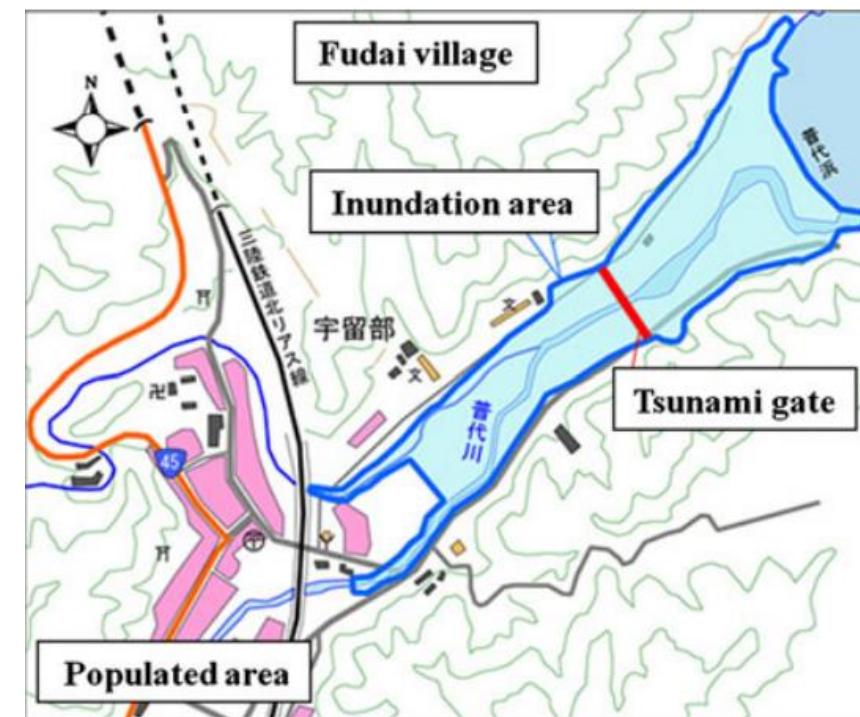
Compuertas

- Fudai village → En 1984 compuertas de 15.5 m de altura fueron construidas como respuesta a los daños de los tsunamis de 1896 y 1933.

Aunque la altura de tsunami de 17 m sobrepasó la compuerta, la experiencia fue exitosa durante el 3/11 debido a que la inundación fue acotada aguas arriba (no casualties).



Suppasri et al. (2013)



Suppasri et al. (2013)

Compuertas

- Minami-Sanriku → Seawalls y compuertas construidas luego del tsunami 1960 (Chile) a +4.6m MSL

La destrucción severa de compuertas desencadenó daños en el 95% de la ciudad. Cerca de la mitad de los pobladores fueron reportados desaparecidos luego del tsunami.

Se reportaron fallecimientos de bomberos durante el cierre de compuertas.



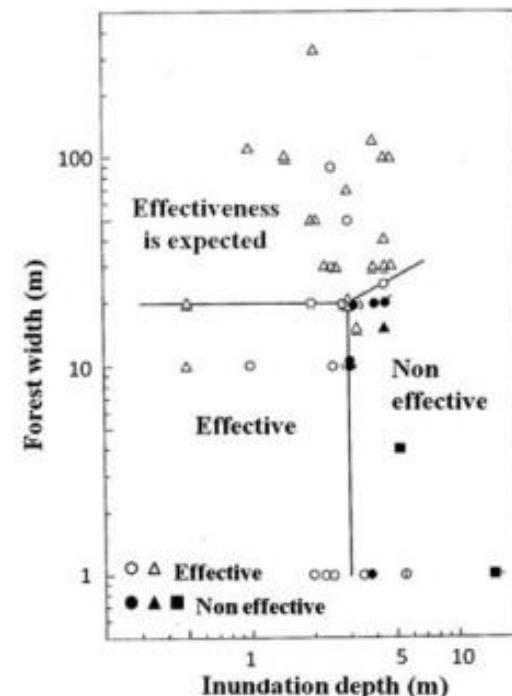
Suppasri et al. (2013)

Bosques de mitigación

- En Rikuzentakata, 70.000 pinos fueron arrasados por alturas de tsunami de 20 m (debris).
- En Ishinomaki, el bosque de mitigación disipó energía del tsunami y atrapó debris.
- Bosques de mitigación son efectivos para alturas de tsunami entre 3-5 m (historical Japanese data from 43 locations).

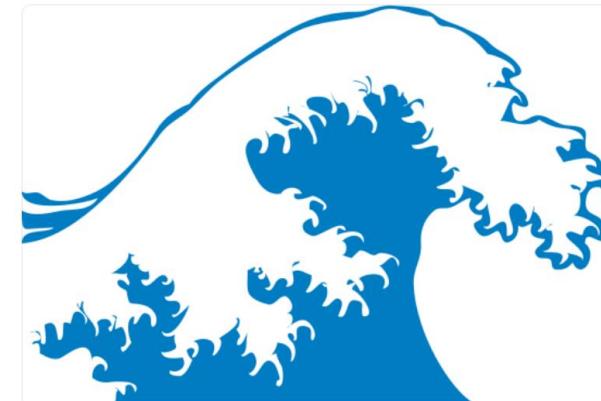


Rikuzentakata city, 150 m forest width (Suppasri et al., 2013)



Comentarios

- Las estructuras pueden fallar, es necesario además contar con medidas complementarias.
- Reforzar educación, simulacros y memoria de desastres son aspectos claves para una mejor respuesta ante la ocurrencia de tsunamis.



Raby et al. (2015) "Implications of the 2011 GEJT on sea defence design"

Enfoque integral



Ishinomaki, Memorial Park



Tsunami evacuation tower at Nakano 5-chome, Sendai city

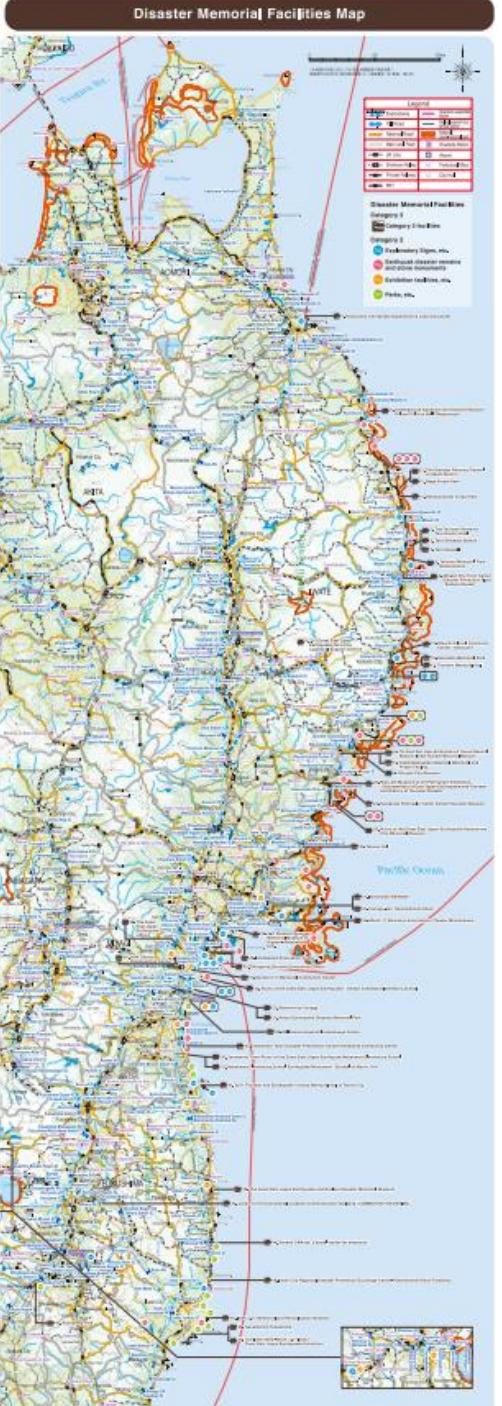
https://sendai-resilience.jp/en/efforts/government/development/evacuation_facilities.html



https://sendai-resilience.jp/en/efforts/government/development/evacuation_facilities.html



Surroundings of Arahama Elementary School



Disaster Memorial Facilities

- 2** You can learn more details in the "Disaster Prevention Study" guide (reservation needed).
The Tsunami Remains Taro Kanko Hotel
TEL 0193-77-3305
city.miyanokiwate.jp/kanko/miyanok_tarokankouhotei.html
- 3** This is a center for learning about earthquakes and disaster prevention in the Tarō area.
Taro Shiosato Station
TEL 0193-65-7506
thr.mlit.go.jp/sinsaidensyou/sisetsu/facility/iwate-3-002.htm
- 4** This facility is open and free for anyone to visit, with a rest area available.
Miyako City Civic Center Disaster Prevention Plaza "Eastpia Miyako"
TEL 0193-63-4166
eastpia-miyako.jp
- 26** A facility preserved as it was directly after the disaster.
Ruins of the Great East Japan Earthquake Kesenuma City Memorial Museum
TEL 0226-28-9671
kesenuma-memorial.jp/
- 27** A facility that provides tsunami disaster learning to visitors from all over the country and cares for the memory of local residents. Learn the importance of life from the experience of the Great East Japan Earthquake.
Mémoire de Yurigae
TEL 022-738-9221
tsunami-memorial.org/
- 28** A facility for learning about disaster prevention and environmental conservation.
Millennium Hope Hills Exchange Center
TEL 0223-23-8577
sennen-kibouno-oka.com/
- 5** Here, you can look out on the newly built seawall and a reconstruction of its original form at the same time.
Taro Seawall
TEL 0193-65-0031
city.miyanokiwate.jp/kanko/tarobochotei.html
- 6** When you stand on the Memorial Hill, at a glance, you can see the height of tsunami.
Tsunami Memorial Park Nakanohama
TEL 0193-62-3912
city.miyanokiwate.jp/kanko/nakanohama.html
- 7** A short film on the Great East Japan Earthquake and tsunami is shown here, in addition to a display of records from tsunami that hit Ofunato in the past.
Ofunato City Museum
TEL 0192-29-2161
city.ofunato.iwate.jp/site/hakubutsukan/
- 29** This facility combines a museum, ruins, and a monument in a single location.
3.11 Disaster Recovery Memorial Museum of Higashimatsushima City
TEL 0225-86-2985
city.higashimatsushima.miyanji.jp/index.cfm/19.0.64.htm
- 30** This facility communicates the threat of natural disasters and the importance of disaster prevention.
Takano Hall
TEL 0226-46-2442
thr.mlit.go.jp/sinsaidensyou/sisetsu/facility/iwate-3-013.htm
- 31** The park grounds consist of five zones, including a prayer zone.
Natori Earthquake Disaster Memorial Park
TEL 022-384-2111
thr.mlit.go.jp/sinsaidensyou/sisetsu/facility/iwate-3-014.htm
- 8** Data are displayed via smartphones and tablets.
Underground Aquarium and Science Museum Oil and Culture Hall "Mogurania"
TEL 0194-75-3551
mogurania.com/
- 9** Records of the logistical support activities that the government and people united to provide are displayed.
3.11 Great East Japan Earthquake Tono City Logical Support Archive
TEL 0190-62-2111
city.tono.iwate.jp/index.cfm/50.31346.308.html
- 10** The facility to pay tribute to victims of the Great East Japan Earthquake, and teaches lessons of the earthquake to future generations.
Kamaishi Memorial Park
TEL 0193-27-5666
unosumai-tonosu.jp/inorinopark.html
- 32** Recording and exhibition centered on the first week after the Great East Japan Earthquake.
Shiogama Tsunami Evacuation Center
TEL 022-794-7232
thr.mlit.go.jp/sinsaidensyou/sisetsu/facility/iwate-3-015.htm
- 33** This facility introduce the process from initial response to restoration / recovery on the panel etc.
Ishidawara Evacuation Center
TEL 022-253-7110
town.miyan-matsushima.tj.jp/index.cfm/6.24662.57.184.htm
- 11** A facility that conveys the events and lessons learned from the earthquake and promotes disaster prevention.
Tsunami Memorial Hall
TEL 0193-27-5666
en.unosumai-tonosu.jp
- 12** A facility where many residents can gather alongside exhibits showing records of the disaster.
Otsuchi Cultural Community Center "Oshachii"
TEL 0193-27-5181
town.otsuchi.iwate.jp/gyoze/osyatta/
- 13** The collapsed seawall is preserved as it was at the time of the disaster.
The Disaster Remains Seawall of Akeo District
TEL 0194-34-2111
vill.tanohata.iwate.jp/kankou/seishinsaikou-akeo.html
- 35** A facility that strives to pass down useful knowledge about tsunami, utilize it for disaster prevention education, and raise disaster prevention awareness.
Yamamoto Town Disaster Prevention Center/Yamashita Community Center
TEL 0223-37-5532
thr.mlit.go.jp/sinsaidensyou/sisetsu/facility/iwate-3-018.htm
- 36** This ruin preserves the traces of the great tsunami and the threat of the earthquake that cannot be conveyed by photographs and images.
Yamamoto Town Ruins of the Great East Japan Earthquake: Nakahama Elementary School
TEL 0223-23-1171
town.yamamoto.miyanji.jp/soshiki/20/8051.htm
- 14** This park was built on the site of the former Shimanokoshi Station building, which was washed away by the tsunami.
Shimanokoshi Fureai Park
TEL 0194-34-2111
vill.tanohata.iwate.jp/kankou/see/fureai-park.html
- 15** The boulders washed ashore by the 1896 Meiji Sanriku Tsunami and the stone monuments for the 1933 Showa Sanriku Tsunami have been relocated here.
Raga Fureai Park
TEL 0194-34-2111
thr.mlit.go.jp/sinsaidensyou/sisetsu/facility/iwate-3-014.htm
- 16** A facility for communicating the tsunami's facts and lessons to people in Japan and abroad and to people in the future.
The Great East Japan Earthquake and Tsunami Memorial Museum "Iwate Tsunami Memorial Museum"
TEL 0192-47-4455
iwate-tsunami-memorial.jp/
- 38** This facility preserves scars from the disaster, such as ground subsidence due to the earthquake.
Aquamarine Fukushima
TEL 0246-73-2525
aquamarine.or.jp/
- 39** A facility that conveys the journey from the earthquake to recovery and reconstruction. It also conveys Iwaki as it is today.
Live Iwaki Mew-seum "3.11 Iwaki Great East Japan Earthquake Exhibition"
TEL 0246-92-3701
jalame.jp/live_museum/
- 40** Situations and experiences during the disaster are described by videos and panels.
Iwaki City Regional Disaster Prevention Exchange Centre-Hisanohama/Ohsuna Fureai Kan
TEL 0246-82-2111
kankou-iwaki.or.jp/split/10039
- 17** A place for mourning, for communicating the disaster memorial and for showing the will to reconstruction.
Takamatsumabura National Memorial
TEL 0192-22-8912
takamatsumabura-park.com/
- 18** This facility describes the support activities performed by community cooperatives.
The Great East Japan Earthquake Library
TEL 022-374-8531
miyanji.coop/support/shien/study_data/
- 19** The gateway to the eastern coastal area damaged by the tsunami.
Sendai 3/11 Memorial Community Center
TEL 022-390-9022
sendai311-memorial.jp/
- 41** This facility preserves the original landscape of Soma, which was lost in the disaster, for future generations.
2011 Tsunami and Earthquake Victims Memorial Hall of Soma City
TEL 0244-32-1366
soma-kankou.jp/trip/tinkonkinerikan/
- 42** The passage of time, starting from the occurrence of the disaster, is told through videos and newspaper reports.
Center for Environmental Creation Communication Building "COMMUTAN FUKUSHIMA"
TEL 0247-61-5721
com-fukushima.jp/
- 43** The Tourism Guide explains the reconstruction from the earthquake and facilities.
Shiroyama Park
TEL 0248-22-1111
city.shirakawa.fukushima.jp/page/page000397.html
- 20** 320 people, including children, teachers, local residents, took refuge here.
Ruins of the Great East Japan Earthquake : Sendai Arahama Elementary School
TEL 022-355-8517
city.sendai.jp/kankyo-shitsutei/uin_anahama_elelementaryschool.html
- 21** Displays the handwritten newspapers that were posted on the walls of evacuation shelters.
Ishinomaki NEWSee
TEL 0225-98-7323
hibishinbun.com/newssee/
- 22** Scheduled to move as "MEET Kadonowaki" near the Ruins of the Great East Japan Earthquake Kadomatsu Elementary School in March 2021.
Tsunagu-kān (Remembrance Room)
TEL 0225-98-3691
311support.com/learn311/learning_space
- 44** The exchange facility, which is a symbol of reconstruction, reflects the opinions of the townspeople.
Naraha CANVAS, a social center for everyone
TEL 0240-25-5670
naraha-canvas.com/
- 45** It is a facility that surely conveys the experiences of the Iwaki City earthquake and the memories and lessons learned from the earthquake to future generations.
Iwaki 3.11 Memorial and Revitalisation Museum
TEL 0246-38-4894
memorial-iwaki.com/
- 46** A facility that reliably passing down the experiences. Lessons learned, and reconstruction steps of the Great East Japan Earthquake, tsunami and nuclear accident.
The Great East Japan Earthquake and Nuclear Disaster Memorial Museum
TEL 0240-23-4402
fipio.or.jp/fore

Disaster Memorial sites



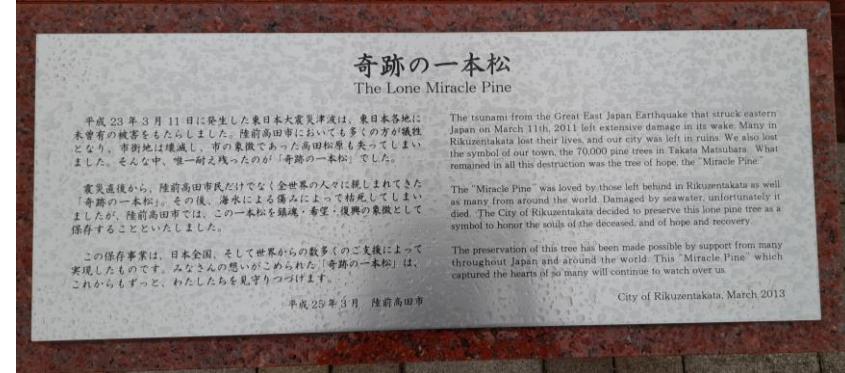
Ruins of the GEJE. Kesennuma <https://www.kesennuma-memorial.jp/english/>



Tsunami memorial museum



Iwate Tsunami Memorial Museum (16), Rikuzentakata



The Lone Miracle Pine
Iwate Tsunami Memorial Museum (16), Rikuzentakata



Iwate Tsunami Memorial Museum (16), Rikuzentakata. <https://iwate-tsunami-memorial.jp/en/>



Muchas gracias

感谢