DESIGN AND CONSTRUCT NEW BUILDINGS TO MINIMIZE TSUNAMI DAMAGE

Any developments located in a tsunami hazard area requires special design, construction, materials, and building configuration to be able to withstand the force and reduce the risk of possible damage.

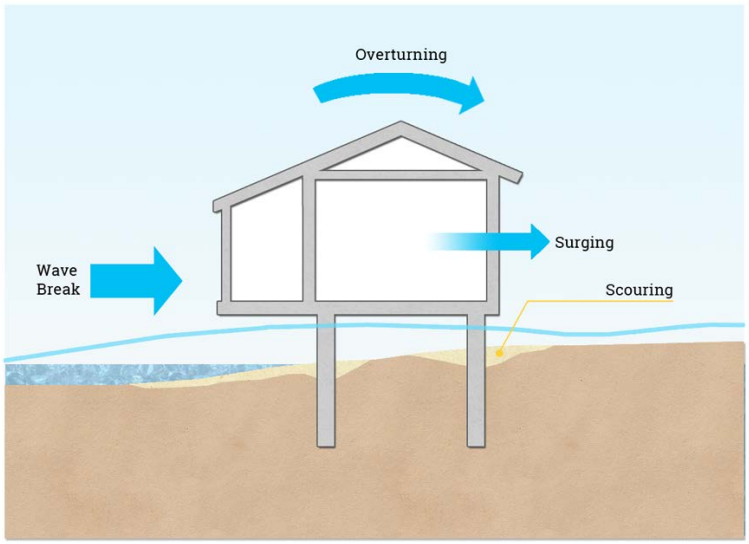

Figure 1: Forces on structures created by tsunamis

There are several factors to determine a building's performance objectives, which are (NTHMP, 2001):

1. Location
2. Configuration (size, shape, elevations, and orientation)
3. Design standards
4. Structure and materials
5. Utilities system
6. Integrated design
7. The quality of construction

Several stages of implementing the construction strategies:

1. Strictly adopt the building codes and design guidelines that address all the potential hazards.
2. Adapt and apply the local tsunami hazard information.
3. Define possible future threats.
4. Examine Building's Performance Level.

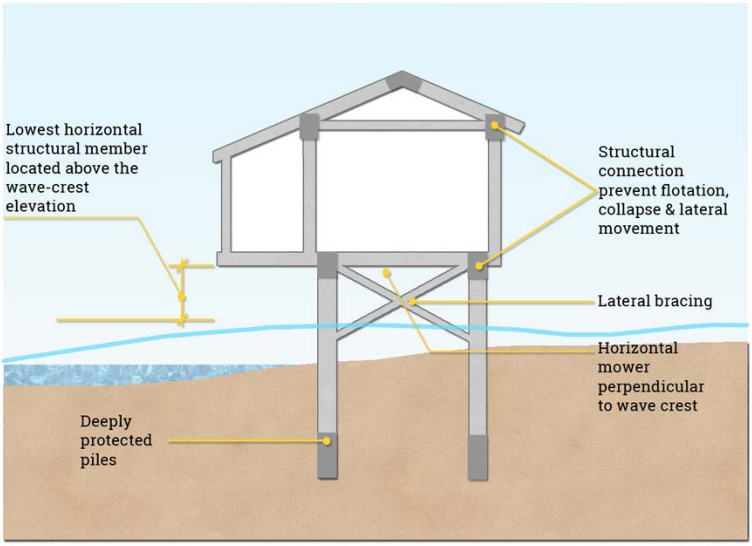

Figure 2: Design solutions to tsunami effects

Table of Tsunami Effect and Design Solutions (Pacific Disaster Center, 2005)

Phenomenon	Effect	Design Solutions
Inundation	• Flooded basements. • Flooding of lower floors. • Fouling of mechanical, electrical and communication systems and equipment. • Damage to building materials, furnishings, and contents (supplies, inventories, personal property). • Contamination of affected area with waterborne pollutants.	• Choose sites at higher elevations. • Raise the building above the flood elevation. • Do not store or install vital material and equipment on floors or basements lying below tsunami inundation levels. • Protect hazardous material storage facilities that must remain in tsunami hazard areas. • Locate mechanical systems and equipment at higher locations in the building. • Use concrete and steel for portions of the building subject to inundation. • Evaluate bearing capacity of soil in a saturated condition
	• Hydrostatic forces (pressure on walls caused by variations in water depth on opposite sides).	• Elevate buildings above flood level. • Anchor buildings to foundations. • Provide adequate openings to allow water to reach equal heights inside and outside of buildings. • Design for static water pressure on walls.

	• Buoyancy (flotation or uplift forces caused by buoyancy).	• Elevate buildings • Anchor buildings to foundations
	• Saturation of soil causing slope instability and/or loss of bearing capacity.	• Evaluate bearing capacity and shear strength of soils that support building foundations and embankment slopes under conditions of saturation. • Avoid slopes or provide a setback from slopes that may be destabilized when inundated.
Currents	• Hydrodynamic forces (pushing forces caused by the leading edge of the wave on the building and the drag caused by flow around the building and overturning forces that result).	• Elevate buildings • Design for dynamic water forces on walls and building elements • Anchor buildings to foundations
	• Debris impact	• Elevate buildings. • Design for impact loads.
	• Scour	• Use deep piles or piers. • Protect against scour around foundations.
Wave break and bore	• Hydrodynamic forces	• Design for breaking wave forces.
	• Debris impact	• Elevate buildings. • Design for impact loads.
	• Scour	• Design for scouring and erosion of the soil around foundations and piers.
Drawdown	• Embankment instability	• Design waterfront walls and bulkheads to resist saturated soils without water in front. • Provide adequate drainage.
	• Scour	• Design for scouring and erosion of the soil around foundations and piers.
Fire	• Waterborne flammable materials and ignition sources in buildings.	• Use fire-resistant materials. • Locate flammable material storage outside of high-hazard areas.

Figure 3: Table of Tsunami Effect and Design Solutions; Source: (Pacific Disaster Center, 2005)