

PART



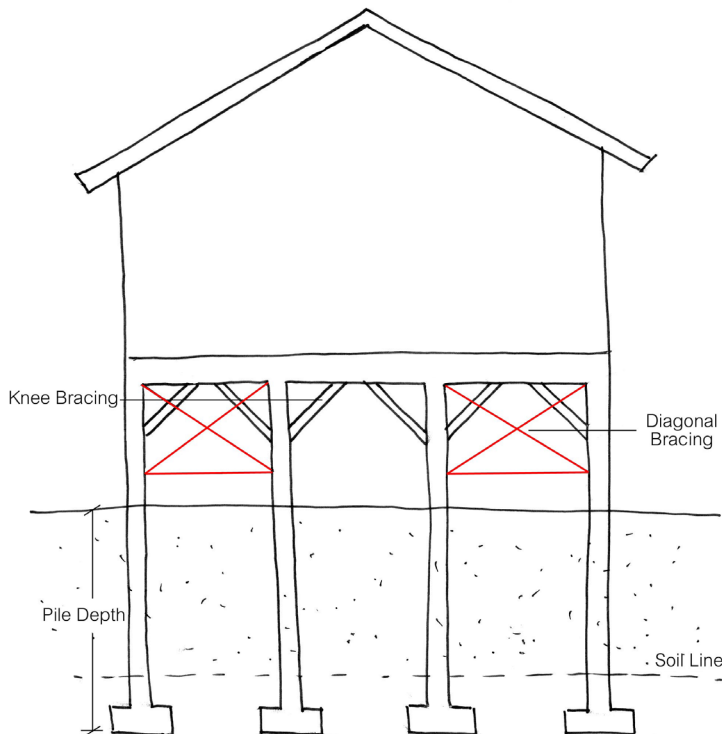
Hurricane and Flood Resistant Structural Typologies

1. Foundations

- In coastal areas that are subject to flooding, buildings should be elevated which can be achieved through knee walls or piles.
- If using piles, columns should be reinforced using either knee or diagonal bracing (or truss if above 10' off ground).

Local Professional Notes:

Building on pilotis close to the sea is a widely used practice in Haiti.

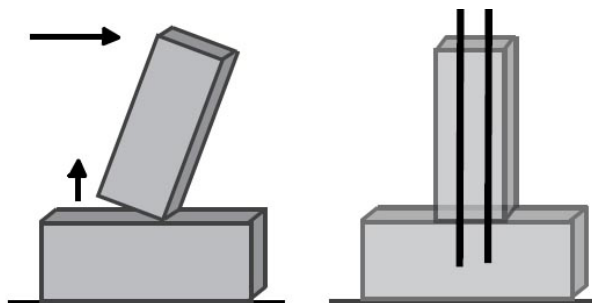


2. Floors

- Building slabs often receive lateral wind forces and subsequently transfer loads to connecting walls. Avoid large holes (i.e. for pipes) in the slab that would disrupt load transfer, and floors should be tied to walls and foundation.

Local Professional Notes:

Windows with rotating panels are generally used and preferred. They are hurricane resistant since they have metal framing and do not require protection. Shutters are expensive in Haiti and not typically used. Fer forge is preferred locally to prevent intrusions and for decorative purposes. You would not be able to use both.



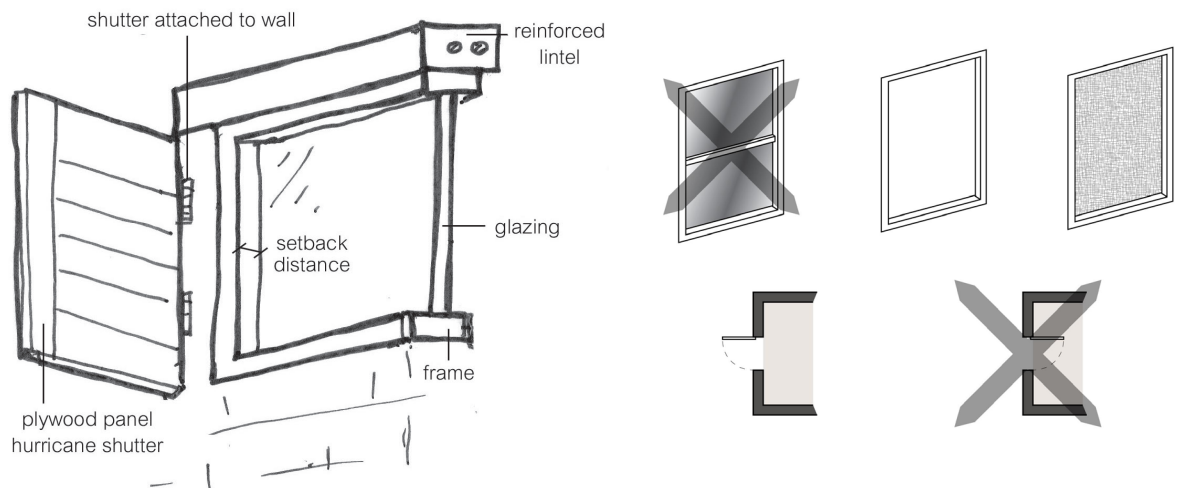
STRUCTURAL RESEARCH | HURRICANE AND FLOOD RESISTANT HOUSING

4. Windows & Doors

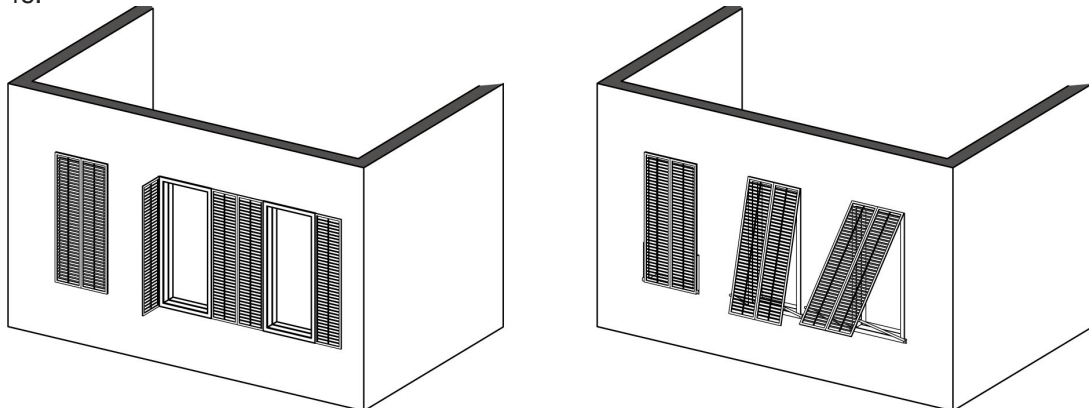
- It is recommended to leave windows open or screened, but they must be framed and supported by a reinforced lintel.
- If using glass (try to avoid) it should be tested against 150 mph, be plastic or shatterproof and **MUST** be protected by hurricane shutters.
- Hurricane shutters must be constructed of plywood panels or wooden boards (attached to wall, not window frame) and be set far enough from glazing.
- Doors should swing outward to avoid becoming an interior projectile if unhinged during severe winds.
- Doors should also be protected from corrosion (if close to coast); aluminum or painted galvanized steel doors are recommended.

Local Professional Notes:

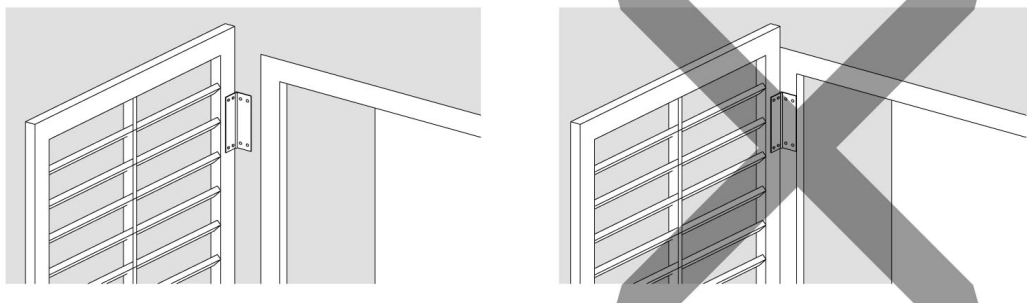
Windows with rotating panels are generally used and preferred. They are hurricane resistant since they have metal framing and do not require protection. Shutters are expensive in Haiti and not typically used. Fer forge is preferred locally to prevent intrusions and for decorative purposes. You would not be able to use both.



4c.



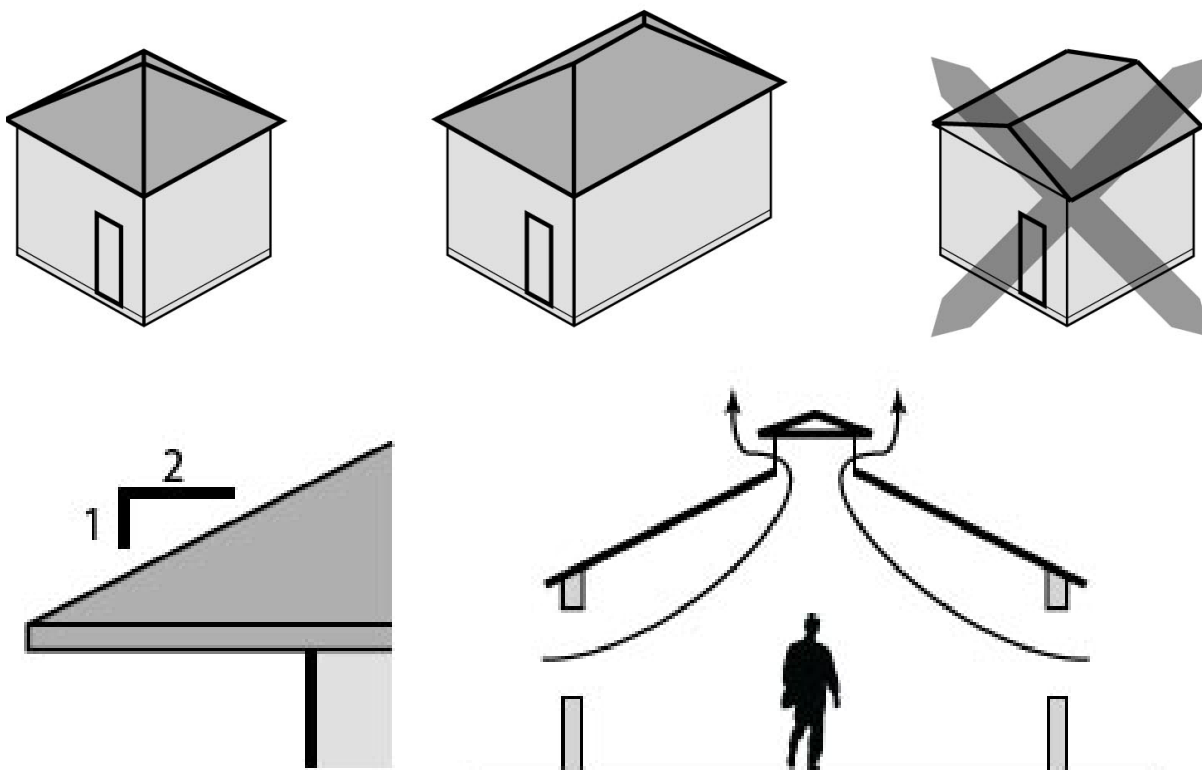
4d.



STRUCTURAL RESEARCH | HURRICANE AND FLOOD RESISTANT HOUSING

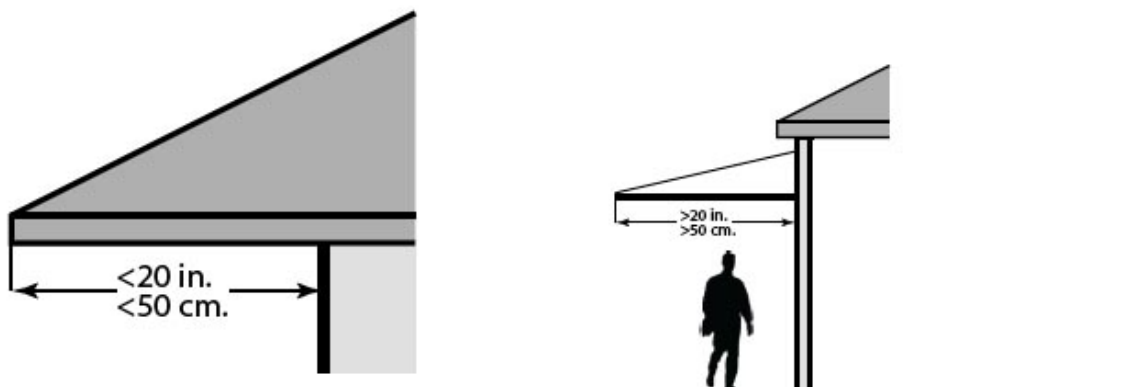
5. Roofs

- a) Although more expensive to construct, hip roofs (4 slopes) perform better in severe weather, namely hurricanes, than gable roofs (2 slopes).
- b) A 1:3 to 1:2 rise/run ratio is optimal as a steeper slope leads to greater uplift forces from the wind.
- c) Structural Separation is recommended for homes with double-span roofs. If one roof fails, the other will likely fail if the structural systems are connected.
- d) To reduce uplift forces during storms, placing an opening near the top of the ridge is encouraged. This balances the positive and negative pressure zones on either side of the roof during extreme winds. An opening in the roof also facilitates natural ventilation through the building, which is essential in the Caribbean due to its hot climate.
- e) Avoid tile as it doesn't perform well in hurricanes and concrete makes the building too top-heavy. Instead, it's best to use metal sheeting; properly attached wood shingles and shakes can perform well also.



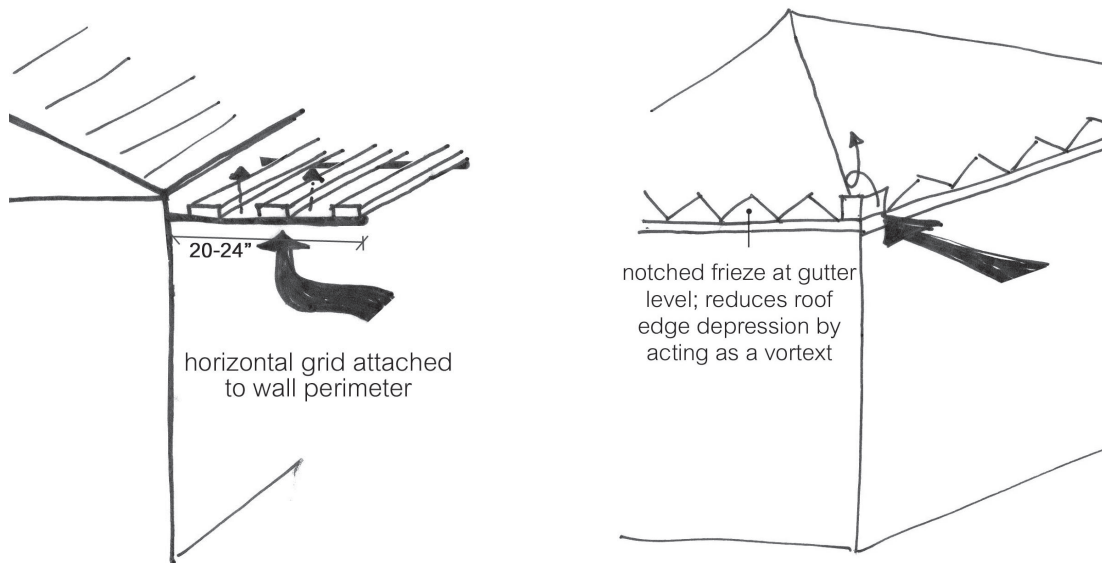
Overhangs

- f) Roof overhangs should be kept less than 20" (50 cm) and detached from the roof structure.
- g) If overhang is longer than 20", then an opening 1/3 of the length of the overhang must be created to

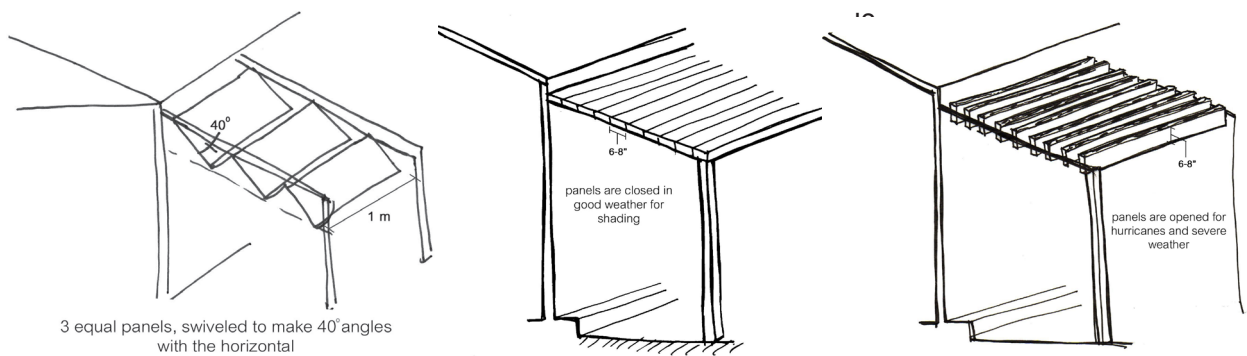


STRUCTURAL RESEARCH | HURRICANE AND FLOOD RESISTANT HOUSING

h) CSTB center in Nantes, France found two overhang solutions that could reduce localized wind loads on roof edges by a factor of 1.5-2, they are shown below:



i) CSTB also recommends two solutions for porch roofs, shown below:



(Architecture for Humanity "Rebuilding 101" & Rima Taher "Improved Building Practices for Hurricane and Earthquake Prone Areas")