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BUILDINGS SHOULD COME APART EASIER:

NATURAL DISASTERS, DESIGNING FAILURES IN A BREAKING WORLD.

PROJECT OUTLINE:

Thesis statement:

In a time in which climate change and waste management are exponentially growing more and more uncontrollable, a method in which we as designers can reuse and create design solutions to the apocalyptic dilemma of the present is needed. The world is breaking, and that's okay. This is the core sentiment rooted in this research project focused on designing failures in building systems to better allow recyclability. When failures are planned, predetermined, and designed, post disaster building materials may be reused to reestablish homes that once stood.

I. Premise:

1. Hurricanes are exponentially increasing due to climate change causing an uptick in building destruction and wasted construction materials.

II. Damage caused by Hurricanes:

2. Current means of damage prevention within storm riddled areas is to keep buildings standing using highly resilient materials and structural systems. This objectively keeps those buildings standing for a short period, but as storms get stronger, these tactics will become obsolete.
3. What materials are these buildings using?
4. What strategies on location, geometry, detail connections, and drainage are being utilized?
5. Contemporary Case study on hurricane prevention: Raised housing.

III. A new means of "damage prevention", designing failures:

6. What materials can be most easily recycled after a hurricane?
7. What new designed configuration of structural and non-structural joints can come apart the safest, and most efficient way (with the highest rate of recyclability)?

KEY TERMS:

HURRICANE:
noun
A storm with a violent wind, in particular a tropical cyclone in the Caribbean.

CLIMATE CHANGE:
noun
A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

BROKEN WORLD THINKING:
verb
Asserts that breakdown, dissolution, and change, rather than innovation, development, or design as conventionally practiced and thought about are the key themes and problems facing new media.

CARE:
verb
On the most general level, a species activity that includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible. That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web.

BUILDING FAILURE:
verb
Loss of the load-carrying capacity of a component or member within a structure or of the structure itself. Initiated when the material is stressed beyond its strength limit, thus causing excessive deformations or fracture.

RESILIENCE:
verb
The capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance.

MATERIAL RECYCLABILITY:
adj.
The ability to be reused or recycled into another building system.

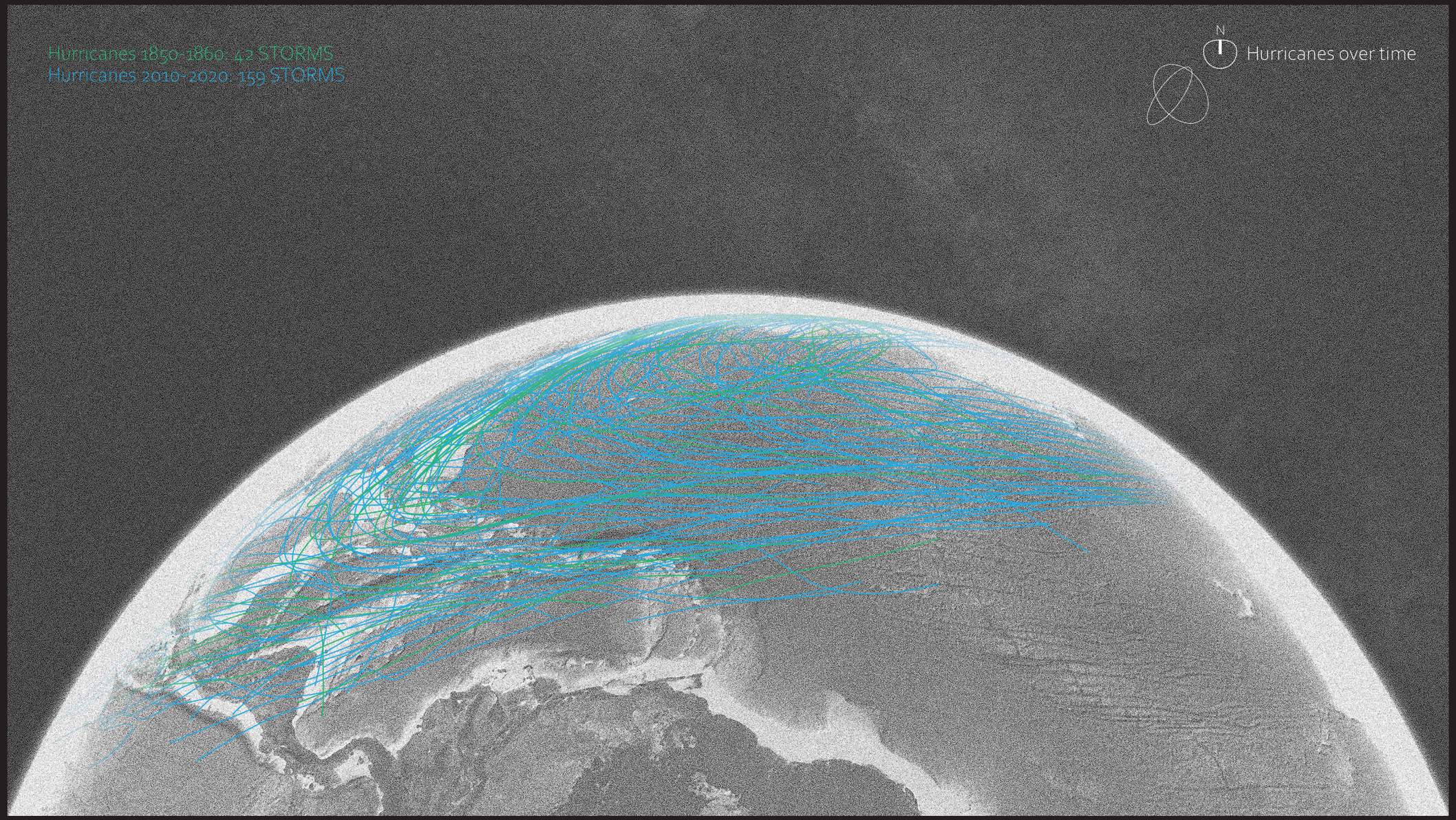
STORMS INCREASING:

As the ocean warms, surface waters have more energy to convert to hurricane winds, which scientists say is likely increasing the intensity of the most hurricanes. This trend is strongest in the Atlantic, where rising ocean temperatures correlate closely to an increase in Atlantic tropical cyclone strength.

Hurricanes are the most costly weather disasters for the United States; the damage from the 2021 Atlantic hurricane season, for example, is expected to top $70 billion.

Previous research has suggested a possible increase in Atlantic hurricane intensity in recent decades, tied to human-caused climate change. This study not only supports that, showing storms are becoming more destructive, but also finds that both hurricanes and major hurricanes are increasing in frequency, a more controversial idea.

WARM WATER MIGRATION



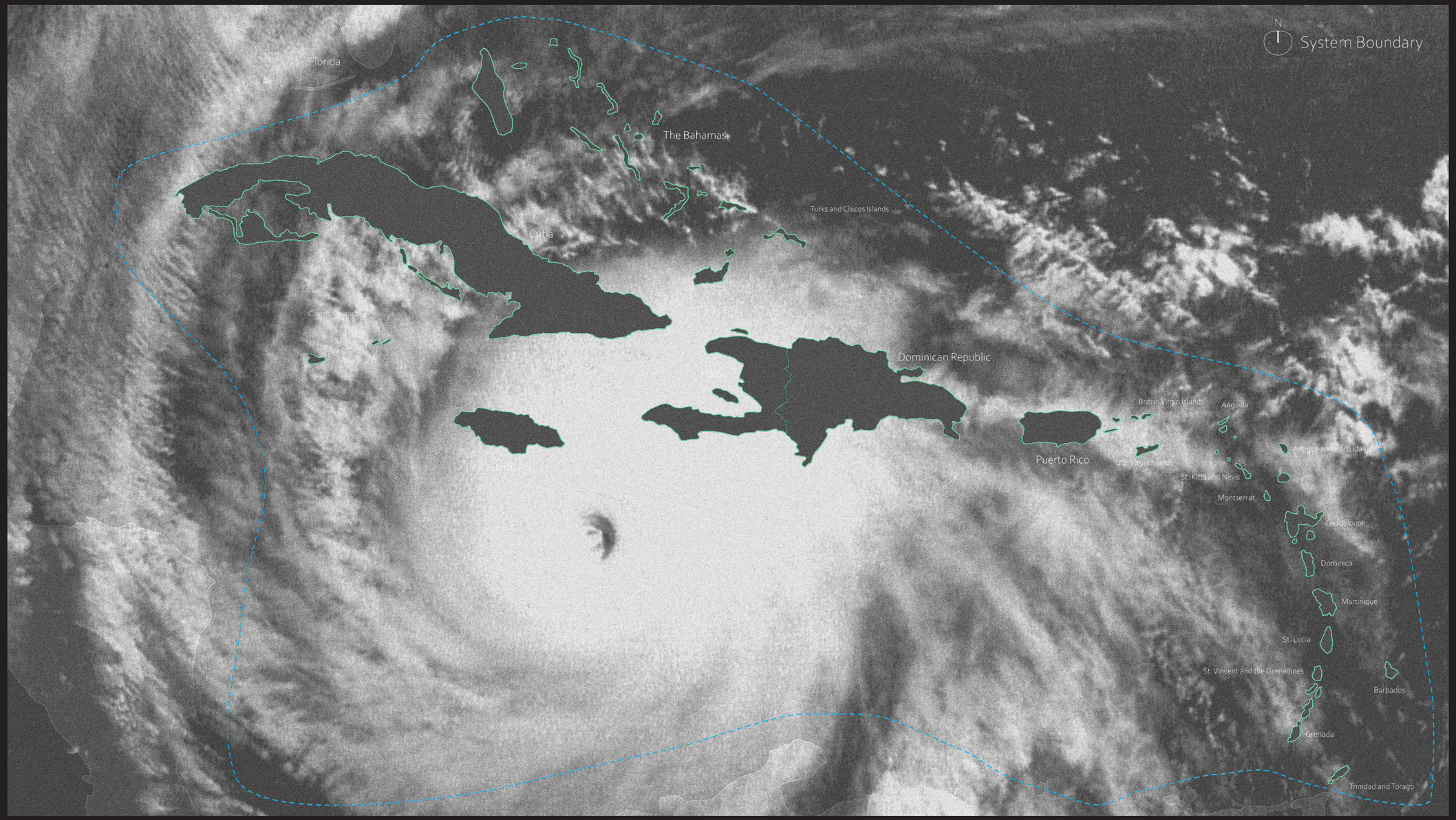
HURRICANE RATE COMPARISON

SYSTEM BOUNDARY

The system boundary is a conceptual line that divides the system that you want to study from 'everything else'. It is useful to think of a system's environment as being made up of those things that are not part of the system, but can either affect the system or be affected by it.

The Caribbean has been particularly hard-hit by devastating hurricanes since 2014, with the 2017 Atlantic hurricane season standing out as historic both in terms of storm strength and damage. The season had 10 hurricanes, six of which developed into Category 3 storms or higher.

According to IOM reporting on the effects of Hurricane Irma in 2017, "In the case of Antigua and Barbuda and (the British Virgin Islands), damages and losses amount(ed) to $155 million and $2.6 billion respectively. With maximum sustained wind-speeds of 185 mph, Hurricane Irma was at the time the strongest hurricane on record in the Atlantic, affecting more than 15 countries and territories. More than 1.7 million people were displaced in the Caribbean including in Cuba, the Dominican Republic, Haiti and Antigua and Barbuda.



DEMARCATING THE PROJECTS SYSTEM BOUNDARY AND AREA OF FOCUS (SITE)

REUSE

The reason such wreckage can't simply be stuck in the ground is its composition. Although debris varies from crisis to crisis - affected by, among other things, the type of disaster, geography, population density, and how rich or poor the area is - it will almost always comprise a wide range of solid and liquid waste.

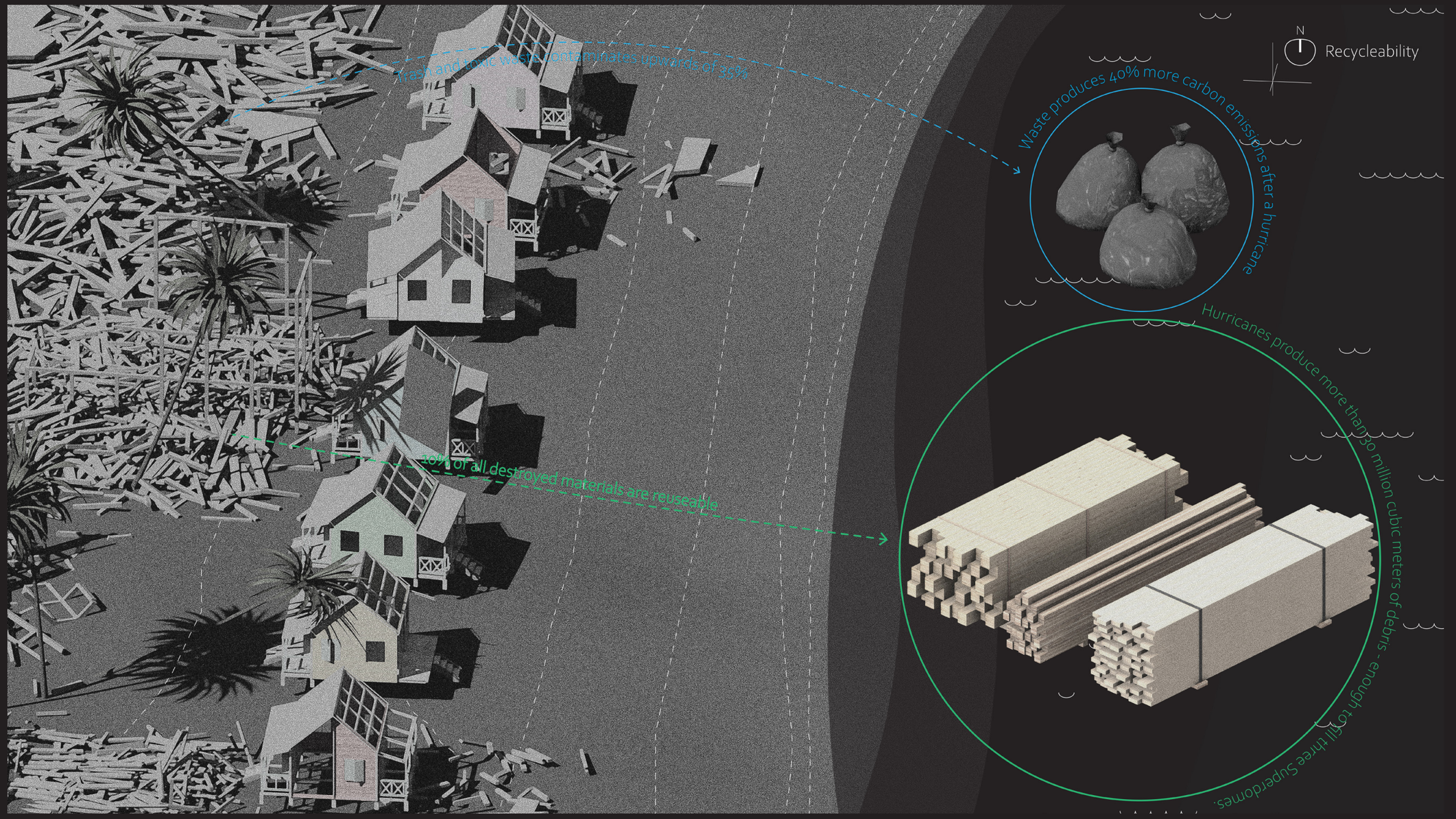
Construction materials from damaged buildings, furniture, electronics, trees and other organic matter, industrial materials, vehicles and personal belongings as well as hazardous waste - such as asbestos, pesticides, oils and solvents - could all be left behind.

Dumping such waste is an obvious threat to public health and it is also likely to have an impact on the environment.

You can bring in heavy machinery and experts, or engage the community and pay them to clear the debris in "cash-for-work" schemes.

Instead of waiting for the relief to come, community members become actors in the process.

THROUGHOUT THIS PROCESS, IS THERE A WAY TO INCREASE THE PERCENTAGE OF MATERIALS THAT ARE ABLE TO BE SAVED AND REUSED TO RE-ERECT HOMES.



CURRENTS WASTE MANAGEMENT AND RECYCLING

Types of Waste Management Issues After Hurricanes and Floods

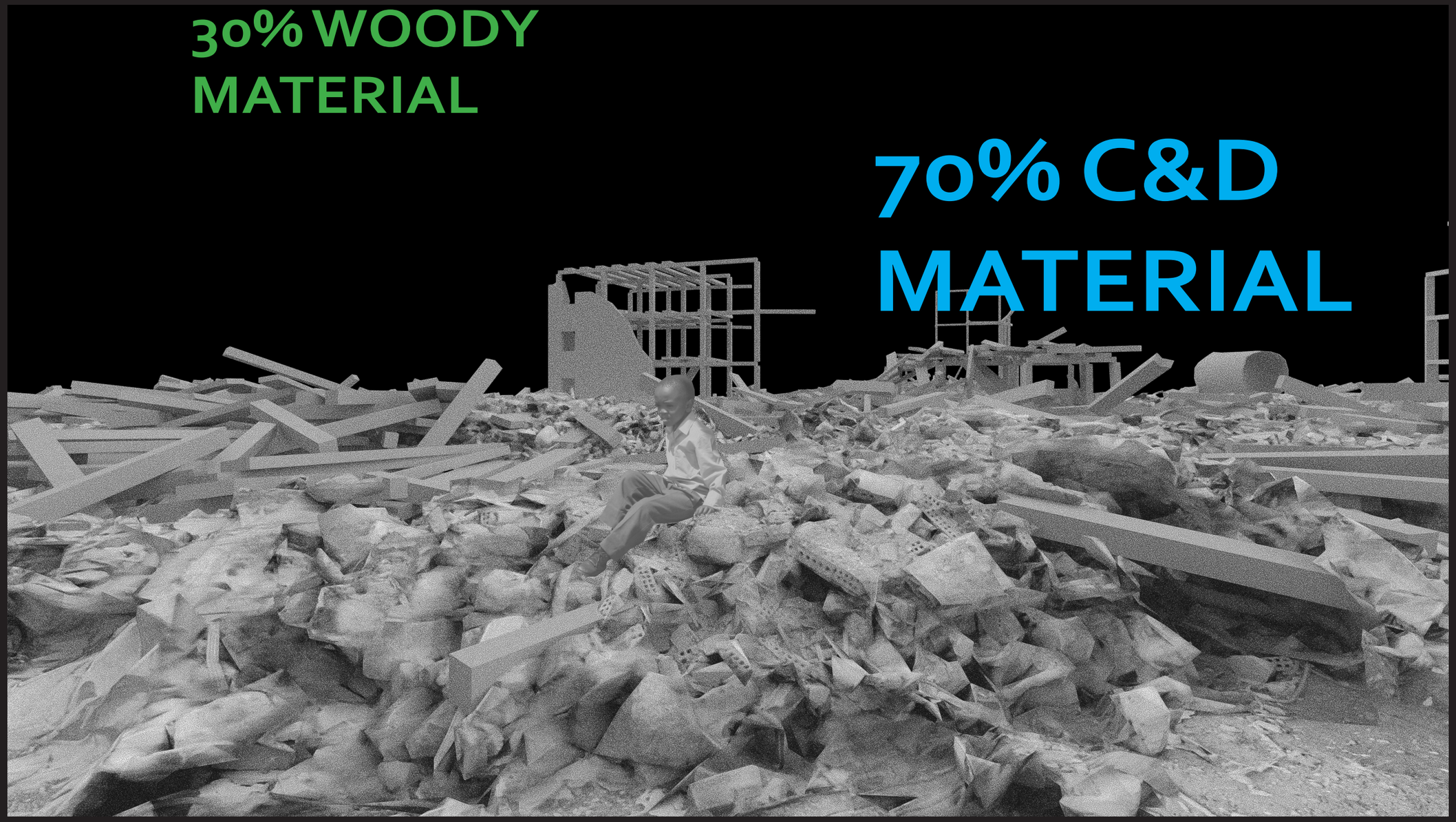
Delayed Debris Collection - These delays can also lead to more toxic chemicals leaching into the floodwaters since waste and debris are not being cleaned up immediately.

Recycling Challenges – Piles of waste sitting in contaminated water for days or sometimes even weeks before being picked up by haulers means additional cleaning and sanitation of the material needs to be done before reuse.

1. Planning is key – Before any natural disaster, organization and staff responsibilities should be established at national, regional and local government levels along with agencies and departments.

2. Identification of temporary waste storage sites. Select temporary sites at a convenient location for storing and processing debris that reduces travel time and expedites debris clean-up.

3. Proper separation of waste – With waste separation and waste reduction techniques, hurricane waste disposal can become easier and more efficient.



CONCRETE STRUCTURES CREATE UNSAFE RUINS DURING AND AFTER THE STORM.

WASTE MATERIAL AFTER A STORM

DAMAGE

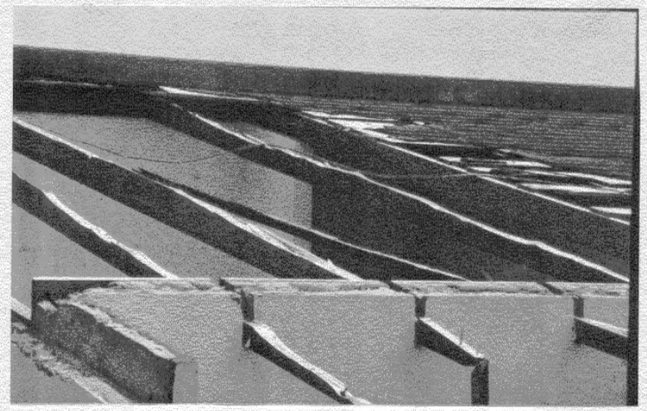


Photo 9 - Longitudinal splitting of timber rafters (Hugo)

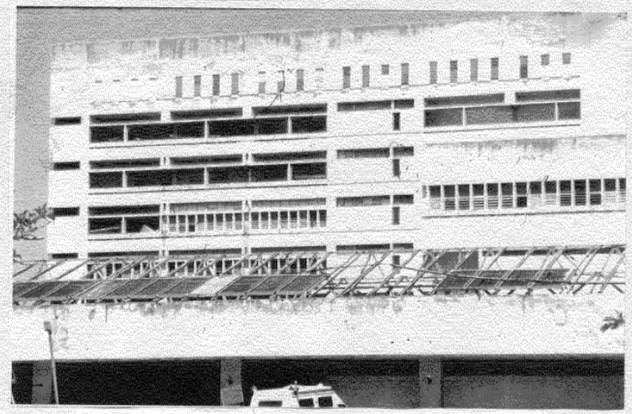


Photo 10 - Almost 100% loss of windows in the hospital (Gilbert)

Photo 5 - Destruction of reinforced-concrete frames (David)

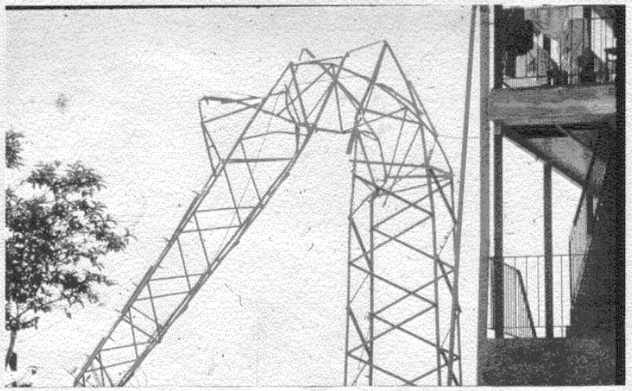


Photo 6 - Several lattice towers of this type collapsed in David, Gilbert and Hugo (David)

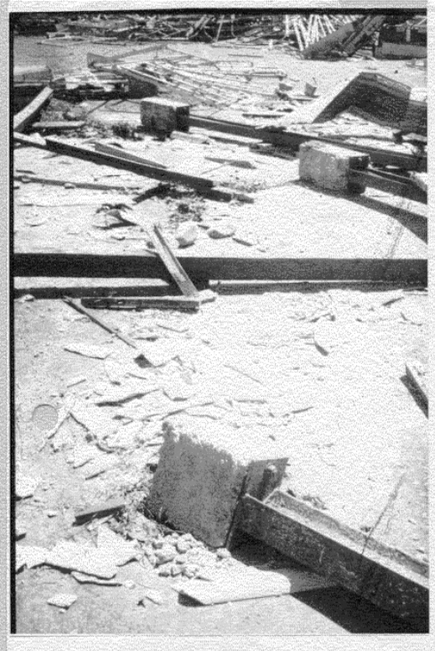


Photo 1 - Foundations (too small for lightweight building) pulled completely out of the ground (David)

Photo 2 - Dramatic and total destruction of large, steel, portal-frame building (David)

CURRENT MEANS OF DAMAGE PREVENTION

DAMAGE

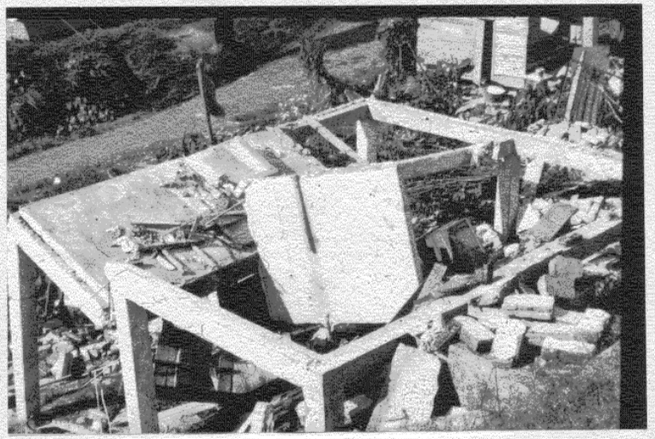


Photo 3 - Total loss of unreinforced concrete blockwalls and destruction of reinforced-concrete supports (David)

Photo 4 - Destruction of expensive, timber-framed residence (Andrew, Cat Cay, Bahamas)

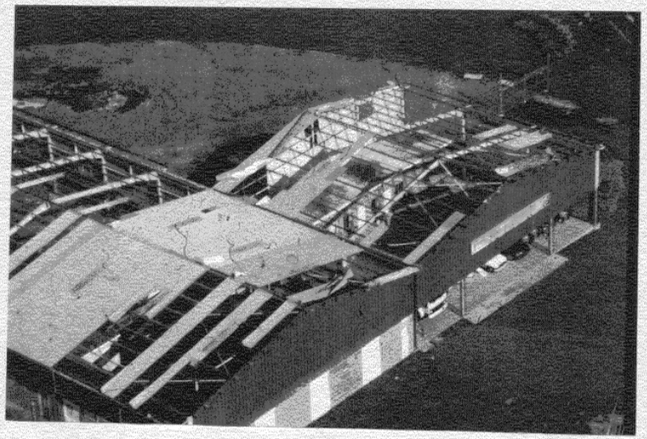


Photo 7 - Loss of corrugated, metal, roof sheets (Gilbert)

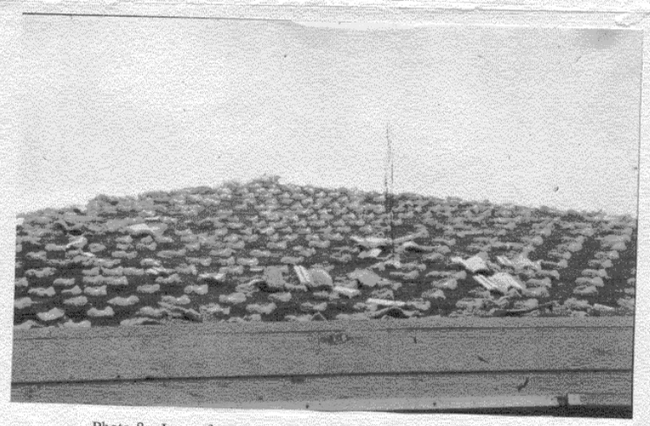


Photo 8 - Loss of precast-concrete, barrel tiles (Andrew, Florida)

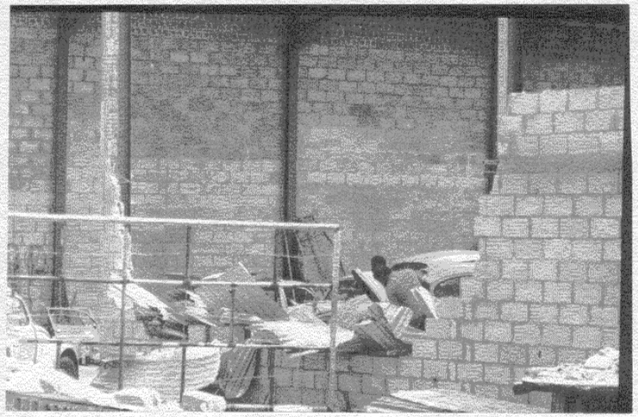


Photo 11 - Breaching of unreinforced blockwall (David)

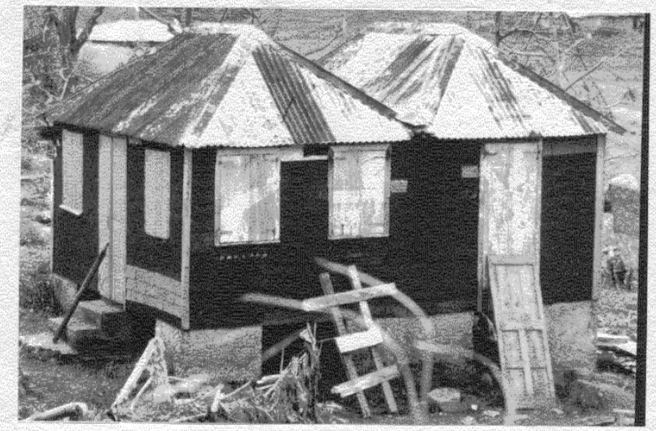


Photo 12 - The very favourable geometry saved this very modest house from any damage (Hugo)

CASE STUDY IN DAMAGE PREVENTION: DON'T DO THIS!

STRATEGY THAT INVOLVES RAISING HOMES IN STORM PRONE AREAS ALONG THE COAST OF NEW JERSEY.

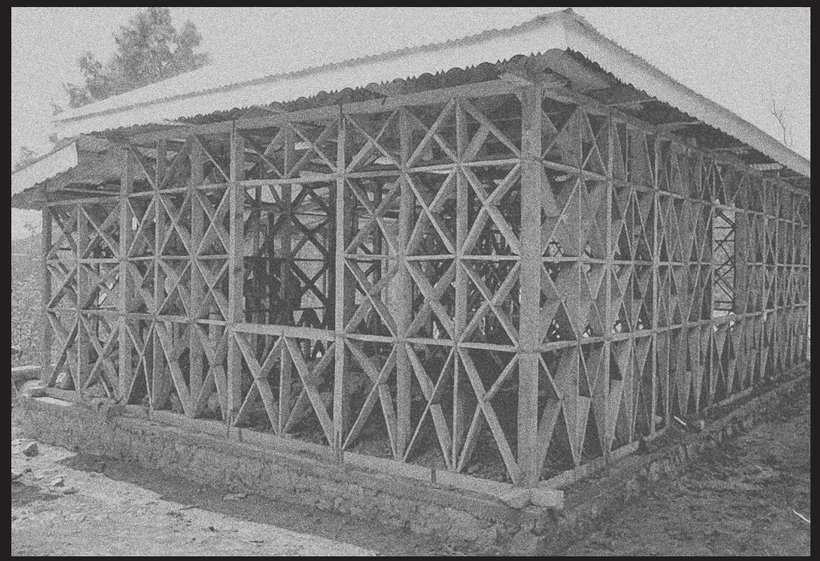
Typical Caribbean house type. Addressing light weight and recycled material construction

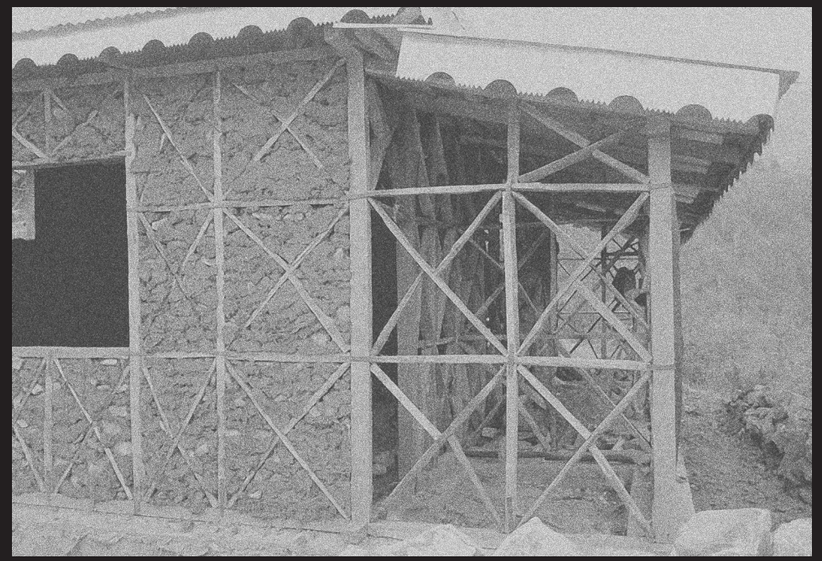
Buildings were constructed with entirely locally sourced materials, including multi coated layers of local mud render. In Haiti 2010, just as in previous earthquakes, it was often not the earthquake that killed, but the buildings which were unable to withstand the forces and collapsed on their inhabitants. Seismic forces are similar to wind forces.

A shocking comparison of the effects of earthquakes around the globe demonstrates how the death toll is a measure of the standard of buildings and the level of preparedness, as much as the force of the earthquake. Lightweight timber frame with lighter roofs provides a much safer home.

Many small bracing members spread seismic energy and reduce the risk and effect of collapse. Local contractors and laborers received training through workshops, so that construction based on local skills continues.

Our prototype proposal offers another idea. One that relies on preparation and efficient deconstruction. By deconstructing the building before the storm happens, residents can take down rebuild their homes easily to avoid damage all together.





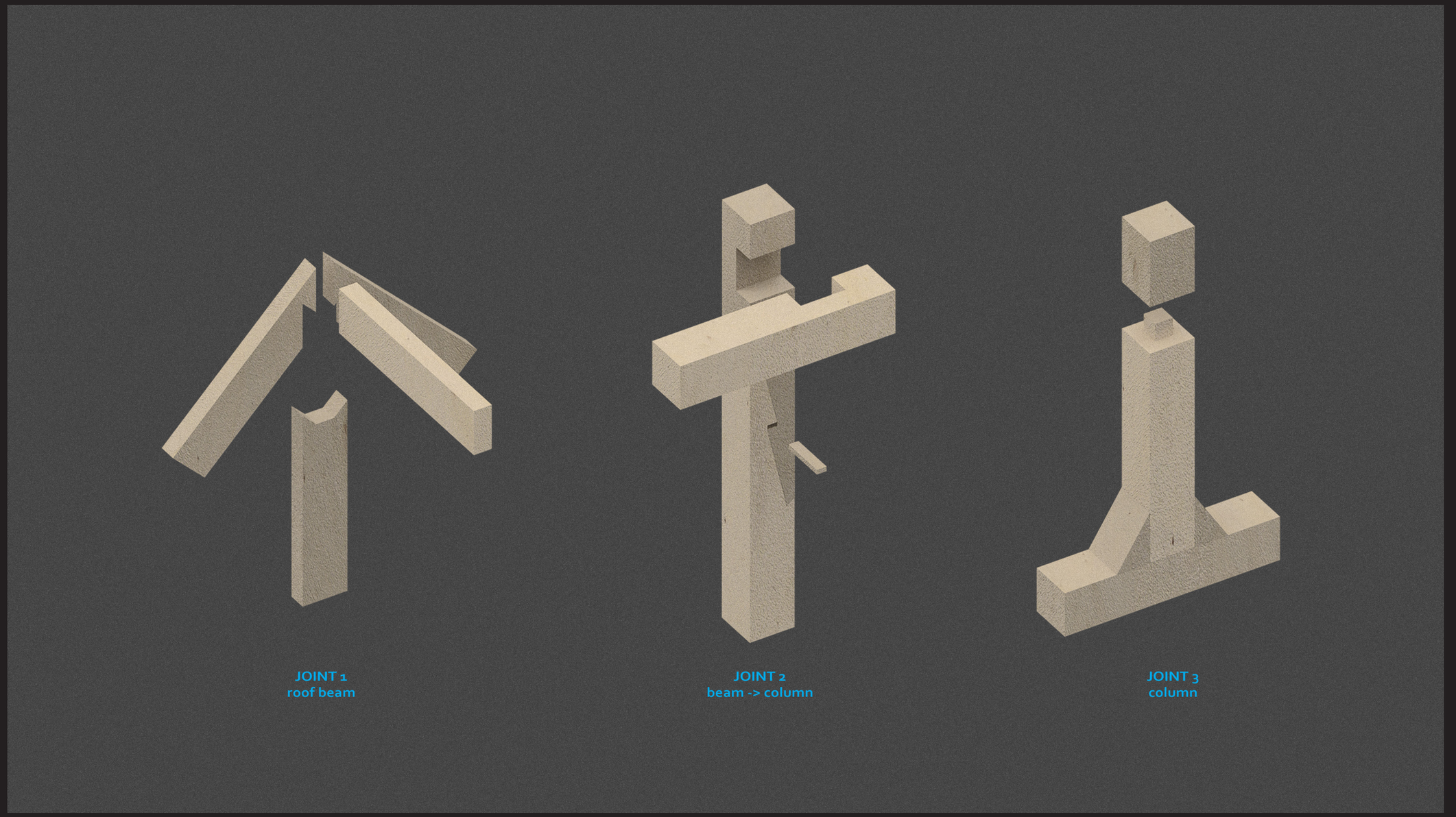
TOP: LIGHT WEIGHT WOOD FRAME STRUCTURES IN CUBA. BELOW: CASE STUDY IN PAKISTAN, EARTHQUAKE RESISTANT STRUCTURES. LEFT COLUMN: UNSAFE CONDITIONS OF CONCRETE IN HAITI

New approach for storm management Disassembly PRIOR to A hurricane

Is it possible to disassemble a home in these disaster areas prior to the catastrophic event? If so, how can the primary joints of the home be easily taken down in a days worth of work and reestablished in the same amount of time following the storm.

This process could efficiently prepare the community to salvage homes and valuable material as a preparation tactic.

Residents could flatten homes down and secure the collapsed building materials to the foundation. This theoretical prototype starts with construction joints that are not nailed together, but easily slotted and unslotted together.



JOINT 1
roof beam

JOINT 2
beam -> column

JOINT 3
column

PROTOTYPE DISASSEMBLED JOINTS FOR LIGHT WEIGHT TIMBER FRAME HOUSES

New approach for storm management Disassembly PRIOR to A hurricane: COLLAPSIBLE HOME

The next scale when proposing this strategy is that of the wall. We propose a fold down wall, built of recycled wood from the community and past storms. The wall easily folds down like a horizontal door using human power of about 5 community members.

The light weight timber frame is then folded down and strapped to the foundation. Effectively avoiding and/or mitigating damage from an impending storm… In theory, and therefore able to reassemble after the storm.

PROTOTYPE DISASSEMBLED WALLS AND ROOF FOR LIGHT WEIGHT TIMBER FRAME HOUSES