Rebuilding After Harvey Pt. 4: Building for Damage Mitigation and Prevention in the Future

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As people begin to return to areas of Houston where the floodwaters have receded, the assessment of the damage and the clean-up continue. Meanwhile, Texas and the nation have an unprecedented opportunity to rebuild using lessons learned from Hurricane Harvey and the storms that came before.

Recovery will take a decade or more before it is complete but this time should be used to seek out and implement the best of new technology, resilient construction techniques, and effective urban planning. There is no question that the south Texas coastline will continue to be battered by dangerous storms. Since we cannot control the weather, our response must be to limit the damage and loss of life from such catastrophic events.

Where to Start

We must start with the knowledge that most of the damage from Harvey occurred from extensive and prolonged flooding rather than the high winds that came ashore with the hurricane. Yes, many structures were flattened by the wind while others lost roofs and windows. However, installing highly wind-resistant roofing and shatterproof glass are relatively easy and inexpensive repairs to make.

Preventing damage from floodwaters requires a more extensive and sustained rebuilding effort. Planning and execution will involve wide swaths of land and infrastructure that cross jurisdictional lines and impact everyone within the flooded areas. Businesses and residences alike must be rebuilt or relocated to keep them from being inundated in future flood events.

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There are two ways to mitigate flood damage: elevation and flood-proofing.

Elevation

In the aftermath of Hurricanes Katrina and Rita, FEMA and home insurance entities required structures to be raised above the predicted flood levels of future events. How high depended on how close the structure was to the coastal bays and bayous. Homes nearest the coast were required to be raised over ten feet from ground level.

Reconstruction after Superstorm Sandy took a similar route; new buildings were designed so the main floor was substantially above street or ground level. The design placed the second story significantly higher than normal, about 20 feet above street level, allowing for a mezzanine to house the fire alarm system and other electrical switchgear that was previously installed in the basement.

Other utilities such as water heaters and generators have been relocated to higher floors or the roof. Elevation is the primary requirement for preventing flood damage.

Flood-Proofing: Wet and Dry

When it is not possible to elevate structures or equipment above the design flood elevation or DFE (one to three feet above the base flood elevation or BFE), the equipment and/or the part of the building that is expected to flood can be flood-proofed.

Wet flood-proofing refers to constructing assemblies made of water-tolerant materials that can be drained, dried, and returned to service without replacement. According to building scientists, building codes do not prohibit the use of these materials so there is no obstruction to using them in the recovery.

FEMA considers wet flood-proofing a second-tier defense and some insurance policies restrict flood insurance coverage for buildings using it as primary prevention. One example of an allowed primary use is a detached garage built below the level of the main residence. It is not feasible to raise the garage, therefore wet flood-proofing is an insurable defense. Certain waterfront commercial structures and historic buildings may also be covered when elevating the structure is not a realistic accommodation.

Wet flood-proofing includes:

- Placing in-wall batt insulation above flood elevation and using rigid insulation below flood elevation.
- Placing a gap in the drywall at the design flood elevation to prevent water from wicking into the drywall above and limiting drywall damage.
- Elevating all electrical outlets and switches above design flood level.
- Installing removable wainscots and water-resistant flooring.

If the lower portion of the drywall becomes inundated, it can be removed to allow the interior of the wall and the rigid insulation to dry out before installing replacement drywall. Other water tolerant materials include non-paper-faced gypsum board, treated lumber, and closed-cell extruded polystyrene insulation, all of which can be disinfected, dried, and placed into service much sooner than if the wall was rebuilt from the studs.

Dry flood-proofing requires making the building as watertight as possible by using impermeable materials and flood barriers. A space below the flood line can be sealed to prevent the entry of water into the area. Some utilities can then be located there such as a fuel tank for a roof-top generator. An entire basement can be sealed in the same manner, but the building design must include a way to anchor the building to the bedrock to keep it from floating.

Wet and dry flood-proofing are both components of resilient design, which relies on certain building techniques to prevent or mitigate damage to the structure and making it easier to repair. Buildings constructed with resilient design can be repaired and returned to service quickly with a minimum of demolition and reconstruction.

Decreasing Run-off

Much of the flooding in Houston was caused by water running off concrete surfaces and inundating the bayous. Sponge-like concrete has been developed that absorbs water much as the soil would, and prevents so much water from reaching overtopped stormwater systems.

Retention and detention ponds built with each new development can also help slow the deluge by holding floodwater and releasing it slowly so the bayous and rivers have time to absorb it. Other emergency reservoirs, such as public parks, serve the same purpose.

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All of these remedies are more costly than traditional construction but compared to the expense of recovery after a major flood the cost is minuscule. An added advantage to resilient design is the reduced psychological impact that is felt when disaster strikes. A home will not be completely lost; it can be resurrected to its former function at less cost and effort. Commercial buildings can keep their power and water running in the midst of outages caused by flooding and storms.

We cannot fight Mother Nature, but we can build so that when she unleashes her fury, she doesn't leave complete destruction behind. We cannot control the weather, but we can plan for the worst the world can throw at us.

Rebuilding after Harvey Pt 3: Keeping inexperienced workers safe