THE DESIGN OBSERVER GROUP

Posted 10.11.12

http://places.designobserver.com/feature/what-we-learned-from-hurricane-katrina-new-orleans/36148/

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What the Nation's Best-Educated Amateur Planners Learned from Hurricane Isaac. And Gustav. And Rita and Katrina. And Cindy, Ivan, Lili, Isidore, and Georges.

Rebuilt levee at the site of the Hurricane Katrina breach in the Lower 9th Ward, New Orleans, 2007. [Photo by Everett Taasevigen]

Few regional societies have gained a more rigorous — if unwilling — place-based education in recent years than the inhabitants of greater New Orleans and the Louisiana coast. The past two decades have imparted, to nearly two million people, advanced lessons in geography, hydrology, climatology, engineering, civics, disaster recovery, sociology and urban planning. To be sure, the curriculum was tough, the tuition high, and the classes time-consuming; and all the while the students worked full-time jobs, maintained households, raised families — and did so in a poor region during difficult economic times.

By some measures the schooling began 20 years ago, with a professor named Andrew. But Hurricane Andrew, which wrecked southern Florida and disheveled south-central Louisiana on August 24-26, 1992, was a Category-5 exception to an otherwise placid year in the midst of a relatively quiet period of tropical activity. That ended in 1995, when the pace of storm development accelerated markedly; it has remained high ever since.

1998

The education began in earnest with Hurricane Georges, on September 28, 1998. By then, scientists had become convinced, and word had gotten out not only to policy-makers but also to citizens, that a century's worth of soil subsidence, coastal erosion and sea-level rise would bring storm surges dangerously close to levee-rimmed,

bowl-shaped New Orleans. As a result officials increasingly discouraged denizens of the rural coastal fringes from seeking refuge in the metropolis of New Orleans, and looked askance at New Orleanians sheltering themselves in sturdy neighborhood civic buildings, as they had done for generations (including during Betsy in 1965, the Hurricane of 1947, and many earlier storms). As it happened, a last-minute meteorological twitch pushed Georges toward Biloxi and mostly spared New Orleans, but not before tens of thousands of families had fled in the city's first large-scale evacuation — only to find themselves mired in horrendous and potentially dangerous traffic jams with no place to go. Thus began residents' early lessons in geography and disaster planning: Coastal wetlands buffer storm surges. If the wetlands erode — as they had been doing with an ever-quickening pace in recent decades — the waves come right up to the levees, and if they overtop them, gulf waters flood our bowl-shaped city. Ergo, evacuation would become the new order. But that would prove easier said than done.

Preparing for Hurricane Gustav, New Orleans, 2008. [Photo by Aaron Smith]

2002–2004

Higher-level coursework on these same themes came from Isidore (2002), Lili (2002), and Ivan (2004), the last of which triggered a full-scale metropolitan evacuation. By then — as part of the commitment to evacuation policy — authorities were deploying a new "contraflow" system that allowed outbound traffic to drive on inbound lanes, an unsettling experience requiring careful planning and inter-agency coordination. This lesson would take time to learn, and the Ivan evacuation proved to be even more tortuous than Georges. But Ivan, too, spared the city; and in retrospect the experience may have taught us a bad lesson: It made officials seem too cautious, too prone to crying wolf. It also made "hunkering down" at home, or utilizing municipal shelters-of-last-resort, seem like a wise recourse, especially for those without cars or cash for a week as refugees.

2005

Summer 2005 opened with a climatological pop quiz. A sloppy early July tropical storm named Cindy came ashore, the likes of which happen annually and barely raise an eyebrow. Cindy, however, nearly raised the roof. Under-predicted and under-reported, the storm caused extensive wind damage, blackened the electrical grid, left local meteorologists red-faced, and later matriculated in the record books as a Category-1 hurricane. The lesson: hurricanes are complex, multivariate phenomena defined by uncertainty; our categorization system oftentimes oversimplifies them, and as a consequence underreports hidden dangers and misleads the public. And with all this activity in early July, it seemed we were in for quite a summer.

Indeed it was — the busiest on record. The late summer of 2005 awarded residents of the region interdisciplinary baccalaureates — cum laude — courtesy of professors Katrina and Rita. On August 29 and then on September 23, the twosome taught crash courses so tough that many students never survived. Those of

us who did learned more than we ever wanted to. We learned ...

... that we had been worrying too much about the tolerable problem of levee overtopping, and too little about the unthinkable catastrophe of complete, total levee collapse.

... that our federal flood-protection system was a system in name only — piecemeal, disjointed, shoddily engineered, poorly maintained, sloppily inspected, underfunded and oversold.

Pumping water out of New Orleans after Hurricane Katrina, 2005. [Photo by U.S. Coast Guard]

... that the Army Corps of Engineers, the Federal Emergency Management Agency and other departments at the federal, state and local levels bore responsibility for various elements of the fiasco.

... that the deltaic terrain had subsided more deeply, and the sea had risen higher, than engineers had foreseen, yet no adjustments had been made to the defense system.

... that a century of navigation, of oil and gas drilling, and of drainage canal excavation, plus the leveeing of the Mississippi River, had turned nearly 2,000 square miles of coastal marshes into scored and scarred watery surfaces offering minimal friction against storm-pushed waters gliding and funneling inland.

... that the absence of closeable gates at the mouths of outfall canals, a result of inter-agency disputes, meant outside water could penetrate the heart of the metropolis but for the floodwalls — which failed.

... that it was a mistake (circa 1895) to locate the lift pumps of the municipal drainage system in the interior of the basins they drained, because subsequent soil subsidence would require that the pumps lift water above people’s homes via elevated outfall canals lined with floodwalls — which collapsed.

... that a deluge respects no jurisdictional boundaries, and a breach on one side of the parish line may well flood folks on the other.

... that topographic elevation matters, and that while living on higher ground may not guarantee against flooding, it will ensure shallower flood depths, usually substantially.


Failed floodwall and levee at 17th Street Outfall Canal, Lakeview, New Orleans, after Hurricane Katrina. [Photo by Richard Campanella]

... that the Army Corps of Engineers is not legally responsible for flooding caused by the failure of federal flood-control devices, but rather only when navigation projects lead to flooding.

... that evacuation only works if you have a car — and even then, it's costly, difficult and potentially dangerous.

... that municipally approved shelters of last resort are a good idea only if the municipality is able to keep said places safe and fit for human occupancy.

... that nursing homes and hospitals with elders or the infirm need their own power and provisions, else will turn into death traps.

... that emergency responders need to be on-site and on the offensive *before* the storm, not arriving afterwards and playing defense. And they need to be on the same wavelengths — literally, radio frequencies.

... that a calamity of this nature brings out the best in most people, but the worst in some.

... that a metropolitan-scale deluge wrecks *all* urban systems: electricity, gas, water and sewerage treatment and distribution, telephony and communications, transportation ingresses and egresses, refuse collection and disposal, all forms of health care, schooling, policing, incarceration, and most ominously, fire suppression. It also stews together the gasoline and oil of hundreds of thousands of vehicles, and the toxins of local industries and hundreds of thousands of households. It damages asphalt, taints soils, deposits sediment, kills animals, and poisons vegetation. And did we mention the mold?

One of hundreds of thousands of hazardous refrigerators left behind after the evacuation of New Orleans in 2005. [Photo by Richard Campanella]

Professors Katrina and Rita were not without a sense of humor, though the humor was often dark. They taught us, for instance, that an evacuated metropolis will leave behind, oh, 200,000 refrigerators loaded with putrid pot-pies and rancid red meat. Who would have guessed. And that each toxic refrigerator had to be duct-taped, wobbled out to the curb, hauled off by specialized HAZ-MAT teams, drained of fluorocarbons, and discarded along with a roughly equal number of destroyed cars and millions of tons of ruined household interiors.

2006–2007

For the next few years, post-Katrina and post-Rita, residents of greater New Orleans and southern Louisiana did graduate work in disaster recovery and urban planning. In marathon civic sessions and innumerable neighborhood meetings, we learned how to rebuild a city: houses, neighborhoods, businesses, schools, cultural events — everything. We came to understand that cultural memory and economic inequality informs peoples' interpretations of why both the floodwaters and the recovery resources were not evenly distributed, spawning suspicions, conspiracy theories, and race-, class-, and place-based resentment and competition. We also learned that people tend to resist proposals for change after a disaster, and crave instead normalcy. We learned that it's easier and less controversial to let people resettle wherever they were and wherever they wanted, rather than redraw the urban footprint in light of the recent geographical lessons. Indeed, in the years following Katrina, some students seem to *unlearn* these lessons. Others became bona fide amateur experts in everything from citizen participation in planning; to public health; to running a nonprofit; to starting a business; to dealing with FEMA, the Road Home Program and the Army Corps of Engineers, not to mention law, policy and city government. Having lectured and interacted with members of the public on a wide range of geographical topics before, during and after Katrina, I can personally attest to the dramatically heightened level of knowledge and understanding of the average citizen on these topics. Hurricanes, like wars, are great geography teachers.

Top: Soldiers arrive in New Orleans before Hurricane Gustav, 2008. [Photo by Richard Campanella] Bottom: Louisiana National Guard soldier supervises the mandatory evacuation of New Orleans residents, 2008. [Photo by U.S. Army]

2008

Hurricane Gustav provided an opportunity for us to earn continuing education units. Coming within a few days of the third anniversary of Katrina — school usually begins around September 1 — Professor Gustav began with a test of what we learned so far. We did well. The storm was powerful (though certainly not a Katrina) yet the levees and floodwalls (undergoing upgrades at the time) prevented a repeat of 2005. The contraflow evacuation passed too, in part because authorities had been inculcating the public about preparing for such a scenario. A new system of public buses ensured that those without cars did not get left behind, and it too worked well. There were no more shelters of last resort; nearly everyone evacuated — and this time, we all

knew to empty the fridge. Officials scored high marks for securing the city *before* the strike and guarding against looting during and after Gustav's assault on the emptied city. They allowed people to take their pets on evacuation buses, a wise and humane new policy that prevented a repeat of the heart-wrenching dramas of 2005, often involving children. And they let evacuees return as soon as humanly possible so they could bring the stilled city back to life.

On that note, we also gained some new insights in thinking back on the past decade. We realized that while evacuations can save thousands of lives if a catastrophe like Katrina happens, they can also be terribly expensive, disruptive and even fatal for some folks if no catastrophe (Gustav, Ivan and Georges) happens. I myself began to wonder: can a modern metropolis survive while living one-fifth of every year under the constant threat of massive interruption to all systems of civic life? Or would this major competitive disadvantage drive away families, businesses, institutions and investors and eventually winnow the population down to that of a Venice-like boutique city?


Left: Bonnet Carre Spillway opened by the U.S. Army Corps of Engineers to divert excess river water into Lake Pontchartrain during the 2011 Mississippi River Flood. Right: Floodwaters at the base of the loess bluffs in St. Francisville, Louisiana, 2011. [Photos by Richard Campanella]

2010–2011

Additional CEUs were earned from a 2010 guest lecturer from England, who gave the entire world a lesson in the risks of deep-sea drilling and what happens when a blowout preventer fails in its eponymous task. From the BP Deepwater Horizon disaster, we learned first-hand lessons on topics such as surface slicks, tar balls, containment booms, dispersants, oil-eating microbes, and the relationships among ecology, culture and economics. A year later, we learned a very different lesson, this time a comforting one: that while the Army Corps of Engineers is relatively new to handling hurricane storm surges, it has 200 years of experience in managing the Mississippi River, and ranks as the best in the world at such a Herculean task. Following the heavy Midwestern rains of early 2011, exceedingly high water flowed down the Mississippi River system from April through July, and the intricate network of spillways, floodways, easements, levees, weirs, control structures and armoring installed after the Great Flood of 1927 worked flawlessly in keeping the number of flood victims to a minimum.

2012

The 2012 school year opened exactly seven years after Katrina and nearly four years since Gustav. Hurricane Isaac imparted our latest batch of tests and classes. Some we flubbed; others we aced. As Cindy (should have) taught us in July 2005, we re-learned from Isaac that storm categorizations can be deceptive and simplistic, especially after the 2009 elimination of storm surge estimations from the Saffir-Simpson scale. We made the mistake of pooh-poohing Isaac's Category-1 status, and thus we were startled by its strong surge driven in on a 45-degree-angle track, with metro New Orleans positioned in the dreaded northeastern quadrant.

We also came to appreciate the relevance of a storm's forward momentum. Isaac slowed to nary a jog as it approached the birdfoot delta of the Mississippi River and meandered erratically westward of New Orleans for the better part of two days. A slowed system means more time for surge, wind and rain (totaling 20 inches for the duration of the event, more than Katrina and Gustav combined) to do their damage. Mercifully, the rain was fairly well distributed, spatially and temporally, but the winds pulled down thousands of poles and wires and left nearly the entire region without power for three to six days. The same had happened in earlier storms, but because most people had evacuated for them, few suffered the full extent of the outages.

Construction of Inner Harbor Navigation Canal Surge Barrier, Lake Borgne, Louisiana, 2009. [Photos by U.S. Army Corps of Engineers]

This time was different. Enraged customers cursed Entergy for the interminable wait night after sweltering night. Their discomfort was undeniable and their frustration inevitable, but their accusations of incompetence and foot-dragging were, on technical grounds, faulty and unreasonable. A problem of this nature is enormous, dangerous and logistically complex, and by most qualified assessments, Entergy exceeded expectations. The U.S. Department of Energy, which grades utilities on power restoration and is more than eager to flunk a laggard, gave Entergy an "A+" for its Isaac work. Nevertheless, we learned that that the burying of electrical utilities, which protects lines from winds and falling trees, deserves a thorough cost/benefit analysis. Nearly 10 times in the past 15 years, this region has suffered widespread storm-related blackouts; at what point do these burdensome interruptions and ongoing costs become more expensive than the one-time investment of burying utilities?

We also learned some good news. The Army Corps of Engineers' ten-billion-dollar levee-upgrading project worked perfectly. No longer called a "flood-protection" system but rather the Risk Reduction System (now there's a lesson), the effort fast-tracked 30 years of deferred work — heightened levees, strengthened floodwalls, Dutch-style surge barriers, closeable canal gates with bypass pumps, and the world's largest pumping station — in six years. The new system promises the New Orleans area protection against a storm that has a one percent chance of occurring in any given year. Actually, the metropolis needs and deserves a *higher* level of protection; Katrina was measured as a 0.25 percent storm and therefore would have partially penetrated the upgraded defenses. Nevertheless, considering the system's performance during Isaac and following the

Army Corps' perfectly executed control of the Mississippi River Flood of 2011, I would suggest that New Orleanians should start re-learning how to respect and trust these talented engineers, and recognize how vastly improved the department has become since the shocking lessons of Katrina.

It was the completed Risk Reduction System that persuaded authorities in New Orleans not to order a mandatory evacuation ahead of Hurricane Isaac. This, to me, deserves another leadership kudos. Whereas Katrina and Gustav warranted mandatory evacuations, Isaac did not, and I am buoyed by the fact that authorities resisted the litigiously tempting instinct to "err on the side of caution" and pull the get-out trigger. For all the discomfort and damage of Isaac, it would have been much worse if a million people were forced out needlessly onto the road. The ten billion taxpayer dollars spent on risk reduction ought to pay more dividends that just keeping out the water. Too many unnecessary evacuations may hobble this metropolis even if another Katrina does not.

But the non-evacuation scenario also changes place-based planning. It means that people sheltering at home will likely lose power and suffer in subtropical heat — no trivial matter for elders — and may need cooling centers and other sanctioned spaces with provisions, medicine, communications and climate control. It means hospitals and nursing homes must have their own generators. It means homeless people need shelters. And it means that while authorities may discourage people from circulating beyond their homes during non-evacuations, they cannot arrest them for so doing, as during a mandatory evacuation.

Top: Construction of New Orleans floodwall tying the Lake Borgne Surge Barrier to the risk reduction system in St. Bernard Parish, 2010. [Photo by U.S. Army Corps of Engineers] Bottom: LaPlace, Louisiana, after Hurricane Isaac, 2012. [Photo by U.S. Customs and Border Protection]

Similarly, the Risk Reduction System changed the physics of storm surge — that is, how much gulf water went where and for what reason. Investigations are ongoing, but this much is clear: surge inundations during Isaac occurred in places that rarely if ever flooded previously, in communities like Braithwaite, located on the relatively high natural levee of the Mississippi River in Plaquemines Parish, and in Laplace in St. John Parish, relatively far from open Gulf waters. Did the successful protection of areas *inside* the improved federal levees send waves reverberating into adjacent areas that were weakly guarded by inadequate parish levees? Or did Isaac's wicked 45-degree track and maddeningly slow shuffle account for the difference? If and when these questions are answered empirically, I ponder what might be the lesson. Surely no one is suggesting that the Risk Reduction System, which protects over a million people inside, ought to be compromised for the sake of a few thousand outside. And extending that federal system — in this era of limited public budgets — would only pass the reverberations onto the next perimeter of communities.

Finally, Isaac iterated a lesson delivered repeatedly since the 1990s: that while structural engineering may extend the life of this metropolis for another few generations, genuine long-term sustainability will come only when we figure out how to rebuild the sinking, eroding coastal wetlands at a pace faster than the level of the sea is rising. Given the low supply of sediment in the Mississippi River and the costly, legally complex and economically disruptive challenge of diverting sediment and freshwater onto the coastal marshes, the time window in which we can reverse the course of this battle is closing fast. If we take home one additional lesson from the graduate school of experience of the past two decades, may it be that the Army Corps' success in fast-tracking massive structural engineering projects during 2006–2012 must be replicated for nonstructural coastal restoration during the 2010s and 2020s.

Else we might not survive our doctorate.

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