

Resilience by Design: how designers can make a difference

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Hurricane Sandy: a wicked problem

Some of the most pressing challenges of our time are wicked problems. Climate change and extreme weather events are clear examples. Characterized by **novelty** - they are not readily understood or have a clear solution; **unprecedented scale** - so pushing us beyond our normal capacities to respond and **complexity**- essentially with complicated interdependencies, so posing a combination of issues and events to grapple with.

These intractable problems challenge our normal capacities, processes and routines and demand more innovative ways of problem solving. What may work in an everyday, business-as-usual, situation may not work when multiple factors come into play.

In the wake of Hurricane Sandy, the unprecedented damage hammered home to all affected the vulnerability of US coastal cities and towns and the real threat of more frequent extreme weather events. Given the financial costs, over \$65 billion, and the excessive human toll, with 117 people dead and more than 200,000 displaced from their homes, it was clear from the outset of the recovery process that rebuilding what existed before was not a viable option. The good news is that out of disasters come opportunities and an imperative for innovation.

All levels of government—federal, state, and city—clearly articulated the imperative to build greater resilience in the Sandy-affected areas of New York, New Jersey, and Connecticut. To ensure the region fares better next time around, it was acknowledged that it had to build differently. As every \$1 spent on mitigation and preparation can save \$4 downstream on post-disaster rebuilding, government agencies tried a range of new initiatives, including competitions—such as *Rebuild by Design* to promote resilience through innovative planning and design.

Design is seen as key tool for dealing with such complex problems¹ with the potential to reframe questions and develop new paradigms to challenge the status quo. Designers as collaborators, visualizers and synthesizers can unpack issues and put together scenarios in new and different ways. As such *Rebuild by Design* was envisaged as an opportunity to innovate and develop more integrated strategies that could build resilience, sustainability and livability.

Rebuild by Design (RBD) came out of the Hurricane Sandy Rebuilding Task Force and the US Department of Housing and Urban Development (HUD). It aimed to address structural and environmental vulnerabilities that Hurricane Sandy exposed across the region and to develop solutions that could give better protection from future climate events. The competition also aimed to strengthen understanding of regional interdependencies, fostering coordination and resilience both at the local level and across the US².

Acknowledging the need to think outside the box and because of the scale and open-endedness of this challenge, the *Rebuild by Design* competition was a different kind of competition process.

How is Rebuild by Design different?

The competition design was innovative in a number of ways. The standard model for federal design competitions is to define an existing problem, develop a brief and solicit solutions from the best in the field. But a problem of such unprecedented scale and complexity as Sandy could not easily be defined until it was understood in all its dimensions. Such uncharted territory suggested an open-ended question and an interdisciplinary, cross-jurisdictional approach.

First, a diverse pool of talent was engaged. Rather than limiting the field, teams of interdisciplinary collaborative thinkers were sought. The selection of teams, with a broad range of disciplines and integrated team structure, was devised to facilitate a multiplicity of ideas and approaches as well as more holistic strategies.

Second, the process was different. It was fast paced. 10 months in total. Short, sharp and focused. The process involved research *and* design to interrogate the issues and maximize the breadth and range of ideas through open innovation paradigms. The process was research led; open source and collaborative, to better refine the nature and scope of the complex regional challenges and so develop comprehensive design solutions.

1 How Design Thinking Tools Help To Solve Wicked Problems, Julia von Thienen, Christoph Meinel, Claudia Nicolai, Springer

2 Hurricane Sandy Rebuilding Strategy p4 <http://portal.hud.gov/hudportal/documents/huddoc?id=HSRebuildingStrategy.pdf>

Third, there was funding and commitment to implementation. RBD represented a policy innovation by having set aside HUD Community Development Block Grants (CDBG-DR) funding (\$920 million) specifically to help implement winning projects and proposals. Typically, grantees (governments) are required to develop action plans only after receiving these funds. RBD informally changed this procedure by fostering innovative proposals before awarding the money to execute them. Federal dollars thus became a catalyst for innovation as well as a mechanism to facilitate implementation. Teams were also encouraged to secure their own funding for additional design development as well, fueling the extension of their outreach and the project's scope.

Finally, RBD aimed to rethink existing governance structures, systems, regulations and funding mechanisms by engaging with project partners, communities, not-for-profits, government agencies and local, state, and federal leaders at every stage to build new coalitions of support and capacity in tandem with each design proposal.

This poses a number of questions.

How effective has the *Rebuild by Design* competition been as a vehicle for driving innovation and delivering resilience across the region? And what are the key possibilities and challenges of such a design led process?

We will not know for some time if RBD will ultimately deliver innovations that better prepare and adapt the region to a changing climate or whether the projects can be successfully implemented. However, it is possible to identify where the competition has demonstrated innovation and potential impact over and above more standard processes.

The *Rebuild by Design* process

HUD in collaboration with NYU's Institute for Public Knowledge (IPK), the Municipal Art Society (MAS), Regional Plan Association (RPA), Van Alen Institute (VAI) and with financial support from the Rockefeller Foundation and other major Foundations developed the 3-stage competition. The involvement of these project partners was critical in establishing credibility, robust public outreach and in securing other sources of funding and program support.

Stage 1 began with a call to designers around the world to participate. From a huge field of submissions 10 multidisciplinary design teams³ were selected.

The consortia from the United States and Europe were led by notables such as BIG, WXY/West8, OMA, HR&A with Cooper, Robertson & Partners as well as smaller firms such as Interboro, SCAPE/LANDSCAPE ARCHITECTURE and unabridged Architecture with Waggoner and Ball. Significantly, a number of teams were bolstered by university affiliations such as the MIT CAU + ZUS + URBANISTEN team, PennDesign/OLIN, WXY/West 8 and the Stevens Institute and Sasaki with Rutgers University and ARUP.

From the outset of Stage 2 in August 2013 the teams were immersed in design based research, targeted discussions and field trips to Sandy affected areas to help to understand the enormity of the challenge.

The research phase was led by the Institute for Public Knowledge as a way of addressing a broad range of issues and involved local community input and fieldwork. The IPK research identified vulnerabilities and risk, for which the design teams could then propose better, more resilient alternatives as part of the research process.

Teams undertook extensive precedent studies, examined global best practice and met with community members to get input on what might be most effective in local contexts. Moreover, in the spirit of open innovation, the process facilitated the sharing of research and ideas across teams.

This multifaceted research phase differentiated this design competition process from the start. This

³ The 10 teams included representatives from the following consortia **BIG** (Bjarke Ingels Group) with One Architecture, Starr Whitehouse, James Lima Planning + Development, Project Projects, Green Shield Ecology, AEA Consulting, Level Agency for Infrastructure, and the Parsons School of Constructed Environments // **HR&A Advisors, Inc. with Cooper, Robertson & Partners**; Grimshaw Architects; Alamo Architects; Langan Engineering; W Architecture; Hargreaves Associates; and Urban Green Council // **Interboro** Partners with Apex; Bosch Slabbers; Center for Urban Pedagogy; David Rusk; Deltares; H+N+S Landscape Architects; IMG Rebel; NJIT Infrastructure Planning Program; Palmbout Urban Landscapes; Project Projects; and TU Delft // **MIT CAU + ZUS + URBANISTEN** with Deltares; 75B; and Volker Infra Design // **OMA** with Royal HaskoningDHV; Balmori Associates; and HR&A Advisors // **PennDesign/OLIN** with PennPraxis; HR&A Advisors; and eDesign Dynamics // **Sasaki Associates with Rutgers** University and ARUP // **SCAPE/LANDSCAPE ARCHITECTURE** with Parsons Brinckerhoff, Dr. Philip Orton // Stevens Institute of Technology, Ocean & Coastal Consultants, SeArc Ecological Consulting, LOT-EK, MTWTF, The Harbor School and Paul Greenberg // **Waggoner and Ball, unabridged Architecture**, and the Gulf Coast Community Design Studio, Yale's Urban Ecology and Design Laboratory and ARCADIS, Long Island Sound and the Northeast Atlantic region // **WXY/West 8** Alan Blumberg, Davidson Laboratory, Stevens Institute; ARCADIS; Maxine Griffith; Kei Hayashi, BJH Advisors; Kate John Alder, Rutgers University; Yeju Choi, Nowhere Office; William Morrish, Parsons the New School for Design; Verisk Insurance Solutions; In dialogue with: Robert Young, Program for the Study of Developed Shorelines, Western Carolina University; Orrin Pilkey, Duke University; Mary Edna Fraser

enabled the project teams to identify, understand and respond to core problems by using design techniques to analyze data and develop an evidence base that helped define opportunities and create scenarios.

Teams identified new and emerging practices that have demonstrated promise in other contexts and that could be adapted in the Sandy-affected region. For example, new approaches to coastal protection, finance, policy, land-use planning, and communication were explored.

Visual tools were central to the exploration. Scenarios were tested using GIS mapping tools to collate, interrogate, synthesize and communicate complex data, and 3D visualizations helped to convey various options and engage stakeholders.

The power of design led propositions cannot be underestimated as a means to translate intangible problems into tangible solutions that stakeholders can relate to and discuss in meaningful ways.

This expedited interrogation of more than 40 design opportunities and selection of a shortlist of the 10 most compelling projects for development in the next design phase. These represented a cross-section of ideas across the region.

In Stage 3, working closely with MAS, RPA and VAI each team focused on transforming their design opportunities into projects across the region that can be implemented, funded and have political, community and agency buy-in. Because of the regional approach of these far reaching projects the role of the partner organizations was pivotal in bringing together local networks of often vastly different interests.

Developing coalitions of support was seen as an essential strategy to ensure the approach was not only comprehensive but also inclusive. Even more important was the grassroots support for implementation. This will be key to create the necessary momentum to deliver projects in the longer term, as inevitably there will be some rolled out over time as funds become available.

Another innovation in the community outreach has been the use of open-source frameworks for creating online engagement that is both informing the process and educational. This enabled the teams to tap into a much broader range of users than traditionally attend community meetings.

For example, *CrowdGauge for Rebuild*, developed by Sasaki was used at Asbury Park, New Jersey. It first asked users to rank a set of priorities and then demonstrated how a series of actions and policies might impact those priorities. Finally it gave users a limited number of coins, asking them to put that money towards the actions they support most.

The Proposals: Key themes

The overarching logic in the proposals is that the greatest benefit and value is created when investment addresses not just flood or storm risk, rather the combined effects of extreme weather events, environmental degradation, social vulnerability and vital network protection, by restoring ecosystems and creating recreational and economic opportunities. As a consequence sustainability, livability and resilience are all enhanced. Here the differentiating role of a design led approach is clear.

Layered approaches to building protection and resilience that incorporate green, blue and grey infrastructure prevailed, along with proposals for new more regionally based governance models as well as online tools and educational initiatives that build capacity within communities. Many demonstrated place-based solutions that also had wider application. While some had inventive strategies to facilitate implementation. This is particularly important when venturing into new territory and breaking new ground. All highlighted interdependencies, fostering coordination and inclusion.

Big infrastructure solutions that incorporate large scale storm mitigation measures *plus* ecology, energy, recreational opportunities were explored by 3 teams- BIG (the Big U), WXY/West (Blue Dunes) and SCAPE/Landscape Architecture (Living Breakwaters). Each of these ambitious projects proposed a storm surge barrier with a difference.

Other teams, perhaps recognizing the feasibility and logistical challenges of such ambitious projects adopted a more granular suite of (sometimes disparate) interventions brought together through a strong public domain across the catchment. In a number of cases, when all the layers are put in place, these strategies could be scaled up and result in systemic transformation and benefits.

Multiple teams demonstrated this *kit-of-parts* approach albeit with slightly different twists, such as the strategy for Nassau County by the Interboro Team, Penn/Olin's proposals for Hunts Point, Sasaki/Rutgers/Arups's strategy for the Jersey shore, The HR&A/Cooper Robertson team Redhook initiatives, and Resilient Bridgeport. Social and economic development initiatives, how-to toolkits and urban improvement projects were all mechanisms used in various combinations to achieve resiliency objectives.

Effective approaches to managing climate risk and building resilience involve many initiatives by many

players acting across a range of issues. Such granular approaches can facilitate phased implementation and with funding can be immediately actionable, impactful, and scalable.

Among the 6 winning projects, announced by HUD Secretary Shaun Donovan in June 2014, there are a number of key innovations that are worth noting.

SCAPE/Landscape Architecture's *Living Breakwaters* could have far-reaching application if the engineered protective oyster reefs are successful. Although the proposal faces some challenges—in-water permitting and potential broader environmental effects that need to be worked through—it has the potential to be piloted and tested on a much smaller scale with the buy-in of local communities and champions such as the New York Harbor School, to iron out teething problems early. If feasible, it has the added benefit of self-sustaining biological systems that keep replenishing themselves. The ingenuity of this scheme is the use of a pilot project to challenge the policy and regulatory framework with a radical rethink of the possibilities. Regulatory hurdles are often a significant barrier to innovation, so a small-scale trial is a low-risk investment. If it fails, there is little downside; if it succeeds, it will have circumvented major policy hurdles, paving the way for other new approaches to more ecologically based storm protection.

Another equally innovative approach to implementation was developed by MIT+ ZUS + URBANSTEIN in their *Meadowband* proposal. Green infrastructure— in the form of thick multifunctional landscaped berms along the water's edge that act as flood barrier but also allow occupation— is characteristic of many schemes. The *Meadowband* proposal for the Meadowlands is the most striking example of this approach.

A productive regional park is proposed. Berms and wetlands ring the waterway to buffer property and infrastructure from floods, rebuild biodiversity and host recreational and social programs as well as a mix of new development to take advantage of the park's amenity.

Coupled with this proposal is the compelling opportunity of a regionally based governance model to facilitate the implementation of this vision. The New Jersey Meadowlands Commission with existing land use zoning over 14 municipalities is a case study in inter-municipal collaboration with latent powers that positions it well for a coalition-building effort over this regional landscape. With some re-engineering could it become an ecological and economic development agency? There are many regulatory hurdles embedded in this proposal that a strong governance body such as this could potentially streamline. The regional scale of many of the proposals means that they cross jurisdictional boundaries. This poses complications in implementation. By identifying the untapped potential of this existing governance framework this team has unlocked a major roadblock to delivering the vision. It begs the question, what other mechanisms could be harnessed to catalyze and deliver more integrated strategies across regions? Regional Catchment Authorities, Municipal Planning Organizations are other examples that may have broader capacities.

BIGs' Big U is a compartmentalized, multipurpose barrier designed to protect vulnerable precincts in lower Manhattan from floods and storm surge. The team focused on the Lower East Side. The project integrates green space, social programs, and, in the longer term, much-needed transit. While it aims to redress the lack of recreational open space in the neighborhood, it falls short of addressing many systemic shortcomings, such as the disadvantage of the low-income community in the area and the potential gentrification this project could accelerate.

In Nassau County, the Interboro Team sought to enhance the region's quality of everyday life in nonemergency times while addressing flood risk. Taken as a whole, the initiatives present a collection of relatively low-risk propositions that can be readily implemented and that sow seeds for a more strategic and resilient future. Over the long-term, improvements would include denser housing close to mass transit and a new community land trust.

At Hunts Point in the Bronx, Penn/OLIN's Lifelines' proposal focused on social and economic resilience. While the team considered environmental vulnerabilities, its chief concern was the critical role of the Hunts Point Market to the local community and the regional food chain. The team worked with the community and industrial property owners to develop site-specific designs for integrated storm protection and green infrastructure that offers high quality social space using components that can be manufactured locally and built cooperatively. The project demonstrated the potential of hybrid port protection and ecology throughout the estuary.

OMA's comprehensive strategy for Hoboken—Resist, Delay, Store, Discharge—represents a catalogue of interventions that incorporates extensive green/blue infrastructure as well as a protective barrier of critical transport infrastructure. While sharing many similarities with the Hoboken Sustainable Communities project, its strength is the comprehensive approach achieved through a series of key initiatives that brought Hoboken and Jersey City to the table with more than 40 stakeholders who will be essential to implementation.

Risks and rewards

These projects have many common threads. On the upside, they are overwhelmingly innovative, multifaceted, collaborative and regional in approach. But would these proposals been developed through other more business as usual processes?

Interdisciplinary professional teams with robust public engagement guide many planning processes. *Rebuild by Design* proposals, in the main, complement existing strategies but add other dimensions. However, the design led process in RBD has crystallized the role of designers as agents of change.

The urgency of the problem and the fast pace of the RBD competition provided a level of intensity, drive, and momentum that yielded some extraordinary results in a very short time frame. This did not hinder propositions that were openly aspirational. With a clarity of vision and purpose they also embodied beauty and delight. It was the sheer quantum, richness of ideas and depth of resolution and cleverness of approach of many of the schemes that is a defining difference of this process. The focus was not just on recovery and risk reduction (flood and storm mitigation) but long-term resilience and sustainability. All propositions deliver social, economic, environmental benefits such as, improved amenity, ecology, education capacity building,

On the other hand, because of the compressed timeframe and constrained resources – activities that typically take two years, took ten months - this inevitably resulted in a focus on projects that address the immediate impacts of the disaster rather than systemic vulnerabilities that were exacerbated by the disaster, such as chronic social housing and critical infrastructure in low lying flood prone land. The timeframe also inadvertently favored larger teams with greater capacity and resources to commit time and resources to the challenge.

Finding the sweet spot between the visionary and the pragmatic will be the key to effective implementation.

While the real and potential innovations are many there were also risks, uncertainty and challenges to overcome as in any groundbreaking process.

The carrot for the competition winners was the possibility of building these projects with disaster recovery grants from HUD and other sources of public and private-sector funding. An implementation strategy that demonstrated feasibility, support of local grantees, phasing, short term deliverables that could be delivered with CDBG-DR funding as well as ongoing revenue streams for later stages, was a key component of the winning schemes.

Even if RBD fostered the innovation necessary for a new level of resilience, it risked producing proposals incompatible with existing systems, regulations and funding mechanisms. To date the nature of funding regulations and protocols for the eventual award of these projects has proven to be a challenge. Procurement requirements for major projects in different jurisdictions have meant that open tender processes for the implementation has seen new consultants coming in and some existing teams marginalised in the process. To date, the might of the big engineering companies seems likely to prevail. So despite RBD attempts to challenge existing systems and processes some existing governance frameworks have demonstrated a lack of flexibility in procurement and implementation. Fragmented governance between different states, counties and cities, could also potentially hinder more strategic complete solutions. A real risk is that the RBD roll out could be caught in the middle of long term negotiations between HUD and recipient jurisdictions, thus losing momentum and the support of communities eager for resolution.

Recognizing these risks and so working through these challenges is essential but already the impact to date has been catalytic. RBD has not only generated a range of innovations but has also broadened the conversation from disaster recovery to resilience by design.

Albeit the real measure of success is in the implementation, a robust and innovative process is required to provoke cultural change in practice.

There are still many challenges to work through, but if the work so far is anything to go by there should be numerous exemplar projects that demonstrate that a design-led approach can deliver multiple benefits as well as new paradigms for integration, resilience and livability. The United States Federal Government has already been able to leverage this process on a national scale, to benefit other disaster affected regions. In learning from the successes and the challenges of RBD, the model was adapted, scaled up and in June 2014 a \$1 billion National Disaster Resilience Competition was launched. If successful, the model has lessons and opportunities for communities at risk globally. Let's watch this space.

Abstract

In the wake of Hurricane Sandy, with more frequent extreme weather events and rising sea level in progress, the vulnerability of coastal cities and towns has become a matter of urgency. But out of disasters can come opportunities for innovation. Post-Sandy, a range of new initiatives, tools, policies, governance frameworks and incentives are being tested, including competitions like *Rebuild by Design*. Design is seen as a key tool for dealing with complex problems by creating integrated strategies to build resilience, sustainability and livability.

Using the *Rebuild by Design* process as a case study, this article considers the potential of such a process to drive innovation and deliver resiliency projects and strategies that can be implemented and leveraged to have a catalytic impact on a broader scale.

Biography

Helen Lochhead is an Australian architect, urban and landscape designer, and 2014 Lincoln/Loeb Fellow at the Graduate School of Design at Harvard University and the Lincoln Institute of Land Policy. Before taking up the fellowship, she was the Executive Director of Place Development at Sydney Harbour Foreshore Authority. She is currently an adjunct professor at Sydney University and Deputy Government Architect working in Sydney Australia on strategic design projects.