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Resilient and Regenerative Design in New Orleans: The Case of the Make It Right Project

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Surveys

Resilient and regenerative design in New Orleans: the case of the Make It Right project.

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Abstract

According to Swiss Re, there are currently approximately 180 urban disasters globally per year. Hurricane Katrina demonstrated the vulnerability of cities and the ability of humans to exacerbate the magnitude and intensity of man-made and/or natural hazards. The changes produced after a disaster can imply multiple adverse impacts including health risks, disruption to energy and water supply, and ecological imbalances. Post-disaster reconstruction, in this context, provides not only the necessity for a community to return to its pre-disaster state, but as Burby states, a "window of opportunity" to enhance resilience, and, in essence, to 'regenerate'. These 'windows of opportunity' allow exploration to plan more globally, assess community social viability, foster adaptation and examine the technical issues of flooding, retrofits, location, and building energy efficiency. The multiple dimensions of resilience in urban settings are paramount to preserving community stability, as well as long-term sustainability.

The concept of resilient design and planning uses both technical and social strategies to increase a community's resilience. Post-disaster environments must address structural-technical issues (such as sea levels, proximity to major infrastructure, and quality of infrastructure) and social issues (such as community participation, policy and integrated design processes) that are vital for a community's long-term survival. In this instance, community participation is vital both during the planning process and at the level of the individual project. Drawing from post-disaster reconstruction New Orleans, and in particular the Make It Right project, this paper evaluates the ways in which resilient design and planning are put into action. This article will consider the links between regenerative design and resilience at the three scales of building, neighborhood, and city, focusing on the process of the design approach, and impacts on resilience, "regeneration," and on collective action. In addition, it examines how design for a built environment that has ecological, social and infrastructural resiliencies contributes positively to human and natural systems, and reduces vulnerability. This paper concludes with a comprehensive set of criteria that can be used to evaluate whether a built environment supports resilience and "regeneration" in both the short- and long-term. As the issues of short and long-term resilience will expand, so will the need to revise the criteria from which sustainability will continue to emerge.

Keywords: Resilience, Vulnerability, Hurricane Katrina, Sustainable Development, Regenerative Design, Make It Right, Community Development.

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1. INTRODUCTION: REGENERATIVE AND RESILIENT PLANNING IN POST-DISASTER CONTEXTS

According to Swiss Re, there are approximately 180 urban disasters globally per year (Bevere *et al.*, 2012). Until 2012, the most deadly and costly contemporary natural disaster effects were from Hurricane Katrina in the Gulf Coast of the United States. The example of the devastation caused by Hurricane Katrina demonstrates the vulnerability of contemporary cities to both human and natural hazards, and the ability of humans to exacerbate the magnitude and intensity of natural hazards. Arguably, changes to ecosystem states are increasingly the consequence of human action, which reduce the resilience of these ecosystems (Adger, 2000; Gunderson & Holling, 2002; Folke *et al.*, 2002). At the global level, the cost of flood risk is expected to reach 100 billion euros per year by the end of the century (EEA, 2008), with the large majority of the damage occurring in cities (COST22 in Serre *et al.*, 2011). All cities are vulnerable, and the phase of resilience planning in which they engage is influenced by a complex interplay of factors. As Pelling (2003) notes, resilience can be found in hazard-resistant buildings, or equally in adaptive social systems and natural ecosystems. The long-term viability of a system depends on its intrinsic resilience, or in other words, its ability to self-organize, facilitate learning, and the diversity of its elements and links (Dauphiné & Provitolo, 2007).

Understanding the multiple dimensions of resilience in urban settings is paramount to preserving community stability and long-term sustainability. Health hazards after a disaster may disrupt energy and water supply, as well as create ecological imbalances. In addition, urban heat islands may cause environmental changes that amplify the impact of climate change. Post-disaster reconstruction, in this context, provides not only the necessity for a community to return to its pre-disaster state, but an opportunity to enhance resilience, address vulnerable infrastructure, urban heat islands, and to regenerate. As DuPlessis (2012) notes, "To make full use of the opportunity offered to rearrange the released potential into a better, more sustainable world, a more active and directed approach such as that offered by regenerative development is required" (p. 17). Put differently, post-disaster contexts provide a significant "window of opportunity" (Burby *et al.*, 2000: 104) wherein the "collapse of a rigid system releases potential and opportunity that can be used to design new development trajectories." (DuPlessis, 2012: 17) 'Windows of opportunity' may represent ways to explore planning more globally, assess community social viability, and examine the technical issues of flooding, building retrofits, building location, and building energy efficiency. Understanding pre-disaster resilience and preparedness levels is equally important and may interrupt potential adverse impacts based upon historic post-disaster effects. As Figure 1 suggests, the 'window of opportunity' for a community to reorganize may result in either a 'regenerative' (more viable), 'sustainable', or 'degenerative' (less viable) state. Here, a regenerative system is defined as one that restores ecosystems, gives new life, and creates social and natural capital. A sustainable system is one that maintains social or ecological balances. A degenerative system is an unviable system that declines in value or worth (Plaut *et al.*, 2012; Lyle, 1994). Of particular interest to this paper is *regenerative reconstruction*.

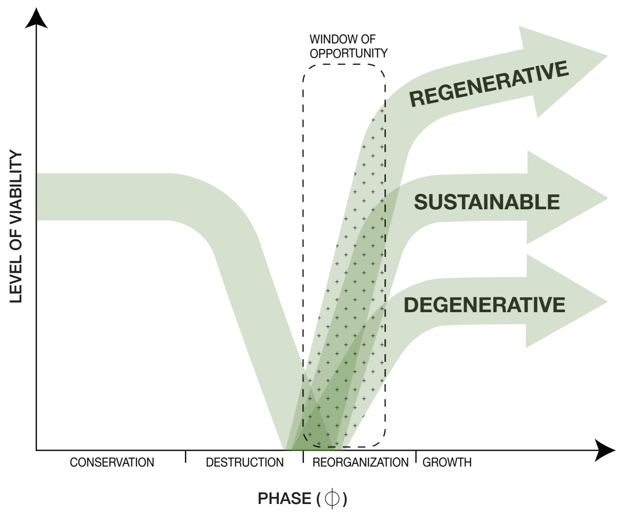


Figure 1: Window of opportunity for reorganization and new trajectories. Source: Authors.

This paper focuses on regenerative design, social and technical resilience, and the relationship between the two. The concept of resilient design uses both technical and social strategies to increase a community's resilience. This paper therefore asks:

how can we design for a built environment that is ecologically and socially resilient, that contributes positively to human and natural systems, and that is ultimately less vulnerable to disasters? The paper is structured in three parts. It begins with a literature review, drawing parallels between green design, regenerative design – an emerging paradigm that promises more than conventional green building practices – and resilience. Next, it proposes a framework for evaluation regenerative reconstruction, using a hybrid of resilient design and regenerative design criteria. Finally, drawing from post-disaster reconstruction in New Orleans, it assesses the outcomes of the Make It Right project according to the framework for regenerative reconstruction. The primary objective of the paper therefore is to evaluate the case study's design outcomes. The paper concludes with some lessons learned and comments on the efficacy of the framework used.

2. RESILIENCE: CONCEPTUAL UNDERPINNINGS

2.1 WHAT DEFINITION OF RESILIENCE IS APPROPRIATE?

While resilience is a term used commonly in various disciplines, its direct applications to the built environment have not been investigated, except within the domain of disaster management (DuPlessis, 2012: 17). Moreover, its relationship to green design and regenerative design has yet to be made explicit. In physics, resilience designates the resistance of a material to shock, or its ability to return to its original state after a shock. In the field of ecology, it gained recognition following Holling's seminal work (1973), *Resilience and stability of ecological systems.* Here, the authors defined resilience as the degree of shock an ecosystem can absorb before returning to a stable state or changing to a different stable state. Many authors, however, argue that resilience was originally studied in the fields of psychology and psychiatry and concerned resilience in the individual (Manyena, 2006), which related to acknowledging an individual's trauma as a means to recovering from depression. We argue that resilience does not necessarily mean returning to an original state but may in fact mean moving towards a more viable state.

In recent times in the United States (2009), resilience has become a mandated policy goal within the National Security Council of the White House. The US Federal Government signed the "Robert T. Stafford Disaster Relief and Emergency Assistance Act" into Law on November 23, 1988 including amendments to the Disaster Relief Act of 1974 (Schwab, 2010). In 2000, the *Disaster Mitigation Act* required state and local governments to prepare and adopt plans approved by the Federal Emergency Management Agency (FEMA) in order to receive hazard mitigation funding. FEMA required that the approved 'local hazard mitigation plans' (LHMPs) are a means to evaluate resilience as part of the comprehensive planning process. While resilience is currently being included as a policy agenda issue at several levels of government, related research has begun to grow in the field. According to the Resilience Alliance[1], an interdisciplinary research organization based in the United States, "resilience" has three defining characteristics:

- the amount of change the system can undergo while retaining the same controls on function and structure (resistance);
- the degree to which the system is capable of self-organization;
- the ability to build and increase the capacity for learning and adaptation.

Folke *et al.* (2002) add two further characteristics: learning to live with change and uncertainty, and nurturing diversity for resilience. The identification of metrics and standards for measuring resilience remains very much a challenge.

2.2 DIFFERENT TIME SCALES FOR RESILIENCE

It is important to take into consideration the different time scales under which resilience operates. Maret and Cadoul (2008) outline three important time horizons in post-disaster reconstruction: short-term resilience and the rebuilding infrastructure and networks; medium term resilience focusing on economic revitalization and the provision of housing; and finally, long term resilience promoting socio-cultural development and enhancing informal social networks.

For short-term resilience, cities are vulnerable because their inhabitants rely on complex technological and infrastructural networks over which they have no control (*ibid.*: 115). Such networks include roads, railways, telecommunications, garbage collections, and sewage. These networks serve the vital needs of inhabitants and in the context of a disaster, must be reconstructed expediently and efficiently – a challenge, given their complexity. In repairing these technical systems and networks, it is important to improve their maintenance and to find synergies between different systems; for instance, combining a defense strategy with an environmental one, or developing blue and green corridors that simultaneously deal with flooding, urban heat islands, and increasing quality of life. In the short time scales, *robustness* and resilience may be more or less corresponding concepts. Here, robustness implies the capacity of a system to continue to function given fixed external shocks over a fixed time period (Martin-Breen & Anderies, 2011: 14).

For medium term resilience – five to ten years – communities must focus on the issues of economic revitalization and providing housing (Maret & Cadoul, 2008: 116). This may include building temporary housing, repairing and retrofitting damaged buildings, relocating some buildings and infrastructure to less vulnerable areas, and preparing emergency preparedness and disaster plans. These strategies will often favor homeowners over landlords or renters in the least affected, most affluent areas.

1 http://www.resalliance.org/index.php/resilience

		Green Design	Regenerative Design	Resilience
PHILOSOPHICAL UNDERPINNINGS	Worldview	Anthropocentric view with an emphasis on managing the environment (nature is a resource).	Fosters a co-creative, coevolutionary process between human and natural systems (nature is a living system).	Universal view with an emphasis on adapting the built environment to withstand shocks.
	Approach	Fragmented, reductive approach.	Whole/living systems approach.	Whole systems and sometimes complex systems approaches.
	Foundation & logic	Based on belief in knowing certainty of future performance and outcomes; Relies on incremental change.	Operate within the uncertainty of complex, dynamic systems; Promotes fundamental values shift and reassessment.	Based on mitigation, prevention and adaptation of natural and manmade disasters; Promotes co-learning and augmenting adaptive capacity.
	Social & natural capital	Reduces social and natural capital.	Builds social and natural capital.	Restores social and natural capital.
	Primary factors	Sustainability, net-zero, triple bottom line.	Evolution, regeneration, net-positive, education, co-evolution.	Diversity, self-organization, learning, amount of change a system can undergo (Walker et al., 2002; Carpenter et al., 2001; Dauphiné & Provitolo, 2007); robustness, redundancies and resourcefulness (Howell, 2012).

Table 1: The attributes of green design, regenerative design, and resilience.
Source: Authors. This table is partially adapted from Cole (2012).

Finally, in the long term, and as evidence of a sustainable reconstruction, resilience must focus on the social and cultural realms of a community, aiming to improve quality of life, social equality, education and health, and enhancing informal social networks (*ibid.*: 117). Cultural resilience needs to be a central focus in post-disaster reconstruction, as it is the most fragile, the least tangible, and the slowest to be rebuilt (*ibid.*: 123).

2.3 SPATIAL SCALES FOR RESILIENCE

Resilience not only operates across multiple time horizons, but also at different spatial scales. Nelson *et al.* (2007: 24) outline three interrelated scales at which rebuilding occurs: 1—the individual/ household level, 2—the neighborhood level, and 3—the citywide level. At the individual/household level, it is important for citizens to become educated about disaster preparedness and how to maintain their building. At the neighborhood level, communities and groups may participate in cleaning and rebuilding, advocate, and encourage nearby institutions and businesses to rebuild (*ibid*.: 25). Decisions about infrastructure, public building repairs, community facilities, and service priorities are then made at the citywide scale.

2.4 HOW DOES RESILIENCE RELATE TO GREEN DESIGN AND REGENERATIVE DESIGN?

In contemporary literature, the term resilience has been used in relation to sustainable development (Toubin *et al.*, 2012; Lallau, 2011; Gunderson & Holling, 2002; Walker & Salt, 2006; Brand & Jax, 2007; Brock *et al.*, 2002). Analyzing the two concepts from an operational and from a technical point of view, Toubin *et al.* (2012) provide a definitional review and a framework for comparison. While the objective timeline horizon for implementing a sustainability plan is long-term, resilience operates on a short- and long-term basis. Toubin *et al.* conceptualize that resilience is a means, while sustainable development is an end. Similarly, Lallau (2011) also writes about the links between risk management and sustainable development, arguing that resilience and adaptive capacity are not always clearly defined. He writes:

> "Sustainability will certainly include some elements of resilience (shocks and associated irreversibilities), but also will depend on the human capacity for adaptation and possibilities of transformation, that is to say major changes in the relationships between human society and ecosystems in a given space and time frame"[2] (p. 172).

This suggests that sustainability and risk management are equally multi-faceted concepts and their links are not easily tangible.

In addition to drawing parallels between resilience and sustainable development, one may also draw parallels with the emerging notion of *regeneration*. Regeneration promises much more than green design, and it is of particular interest to this paper. Over the past decade or so, the notion of regeneration has been emerging as an alternative paradigm to the conventional green building discourse (Cole, 2012). Lyle (1994) emphasizes that regenerative design aggregates, while modern cities tend to be disaggregated with few links between their parts. In a recent special issue of *Building Research and Information,* Cole *et al.* (2012), Mang & Reed (2012), DuPlessis (2012) and others present the key attributes of regenerative design and development. In contrast to conventional green building practices, these promote "a co-evolutionary, partnered relationship between socio-cultural and ecological systems rather than a managerial one. In doing so, this

2 Translated from Lallau (2011): "La durabilité pourra certes comporter certains éléments de résilience (face aux chocs et aux irréversibilités liées), mais dépendra aussi des capacités humaines d'adaptation et des possibilités de transformation, c'est-à- dire de changements majeurs dans les relations liant, sur un espace et un pas de temps donnés, la société humaine et les écosystèmes."

suggests a relationship that builds, rather than diminishes, social and natural capitals." (Cole *et al.*, 2013: 2) Furthermore, and as Mang and Reed explain, regenerative projects stress the fact that built projects, stakeholder processes and inhabitation "are collectively focused on enhancing life in all its manifestations – human, other species, and ecological systems – through an *enduring* responsibility of stewardship" (Cole *et al.*, 2013: 2). Therefore, green building practices in sustainable design alone will not constitute a regenerative project.

Currently green building practice is based on short-term quantifiable performance targets, certainty of outcomes, with its actions, consequences and benefits operating on a longer time horizon. The immediate assessment is based upon rating systems and building performance and assessment tools such as LEED, LEED ND, and BREAM. The metrics used to determine the ratings are based upon materials that increase efficiency, reduce toxins generated from the building, minimize reliance on off-site energy sources and exceeds standards for product life cycles. These tools merely promote a "less harm" approach to architecture and planning, however, and do not promote "quantum change" (Pearl & Oliver, 2013). Regenerative design, by contrast, shifts the emphasis towards systems thinking – the practice of understanding how parts influence one another within a whole (Meadows, 2002). Above all, regenerative design calls for radically re-thinking the multiple scales that operate in a project simultaneously. A fundamental reconsideration of a building's role and impact by actively engaging the much larger context of a project or community (and the synergies within that context) must be considered. Further, the regenerative approach engages with current pressing environmental issues such as climate change and loss of biodiversity. In this context, it becomes possible to draw important parallels with post-disaster reconstruction and enhancing a community's resilience.

Building on the work of Cole (2012), Table 1 compares green design, regenerative design, and resilience. Several parallels between resilience and regenerative design can be made. Notions of social learning, adaptation, and co-management are central to both paradigms. In earlier definitions, the focus has been on technical issues with limited focus on social interaction or community engagement. Hoxie *et al.* (2012) emphasize how regenerative design encourages finding 'common ground' with diverse stakeholders. Community dialogue is imagined to create feedback loops and enhance resilience. Social learning – the iterative feedback between a person and his/her environment (Moench *et al.*, 2011; Berkes, 2007) – is central to the regenerative approach and to social resilience, which Adger (2000) defines as "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (p. 347). Thus, community participation, governance, policy and integrated design processes are vital for a community's long-term survival (Mertenat & Thomas-Maret, 2009). Resilience is also based on the concept of adaptation or adaptive capacity, which is mainly based on a community's social component (Lallau, 2011) or "the capacity of actors in the system to affect resilience…" (Walker *et al.*, 2004). Adaptation of a community is transformed into a proactive, integrated and systemic vision that affects urban structures, behaviors, and practices. Mang and Reed (2011) suggest that regenerative development includes "putting in place, during the design and development process, what's required to ensure that the ongoing regenerative capacity of the project, and the people who inhabit and manage it, is sustained through time" (p. 34). How evidence of this paradigm shift may be manifested in the built environment has yet to receive significant attention. In other words, what makes a building "regenerative" — and moreover, resilient — deserves much more attention and will be the focus of the remainder of this paper.

3. DEFINING RESILIENT DESIGN AND THE REGENERATIVE RECONSTRUCTION FRAMEWORK

Based on the literature review discussed in Section 2, we define regenerative reconstruction as a set of reconstruction practices that incorporate a mixture of resilient design and regenerative design criteria. While resilient design is not a new concept in the engineering disciplines, it is much less discussed in the arenas of urban planning and architecture. Typically in engineering and physics, resilient design refers to a design (or material) that is able to withstand shocks and return to its original form without changing its inherent structure. Here, however, the definition must be broadened to include multiple spatial and temporal scales. Resilient design may be seen in contrast to fracture-critical design, a concept used by Fisher (2012) to connote "design in which structures and systems have so little redundancy and so much interconnectedness and misguided efficiency that they fail completely if one part does not perform as intended" (inside cover). The levee system in New Orleans in 2005 is an example of a fracture-critical design because the failure created catastrophic failures in multiple systems that were not directly tied to it. The design of post-disaster environments must address structural-technical issues (such as sea levels, proximity to major infrastructure, quality of infrastructure, etc.) and social issues (informal social networks, insurance, income levels, etc.), as well as mitigative, preventative and adaptive measures. On the technical side, strategies of buffering, redundancy, rapid feedback, decentralization, integrating ecosystem services and taking into consideration a site's path of least resistance are effective design tools to increase resilience (Watson & Adams, 2010). In essence, technical strategies aim to enhance resilience via less connectedness and efficiency since "[c]reating disconnected and discrete parts within a system remains one of the best ways to ensure the survivability of the whole" (Fisher, 2012). On the social side, community participation, policy and integrated design processes are vital for a community's long-term survival (Mertenat & Thomas-Maret, 2009). Community participation is vital both during the planning and implementation processes and at scales of the building, neighborhood, and city. At the same time, resilient design and planning may be coupled with regenerative strategies in order to increase ecological resilience.

Table 2: Regenerative Reconstruction Framework

<table>
<tr><th></th><th>BUILDING SCALE</th><th>NEIGHBORHOOD SCALE</th></tr>
<tr><td rowspan="3">1. BUILD CAPACITY</td><td>support research that creates knowledge</td><td>integrate decision-making via good governance</td></tr>
<tr><td colspan="2">educate the population</td></tr>
<tr><td colspan="2">create innovative financing mechanisms</td></tr>
<tr><td rowspan="4">2. SITE APPROPR-IATELY</td><td colspan="2">use land appropriately</td></tr>
<tr><td colspan="2">develop land appropriately</td></tr>
<tr><td colspan="2">avoid building in high risk areas</td></tr>
<tr><td colspan="2">adapt for climate change</td></tr>
<tr><td rowspan="8">3. PASSIVE SURVIVA-BILITY</td><td>use seismic criteria</td><td></td></tr>
<tr><td>use passive design strategies</td><td></td></tr>
<tr><td>reduce absorptive materials</td><td></td></tr>
<tr><td colspan="2">survive a disaster with limited external support</td></tr>
<tr><td colspan="2">employ stormwater runoff regulations</td></tr>
<tr><td colspan="2">mitigate urban heat islands</td></tr>
<tr><td colspan="2">use conservative design strategies</td></tr>
<tr><td colspan="2">use native, drought resistant plants</td></tr>
<tr><td rowspan="5">4. ACTIVE RESILIENT SYSTEMS</td><td rowspan="2">create buildings that can safe fail with less damage</td><td>create community infra-structure (water, energy)</td></tr>
<tr><td>create resilient infra-structure w redundancy</td></tr>
<tr><td colspan="2">plan multiple energy and water sources</td></tr>
<tr><td colspan="2">design + adapt systems for future climate conditions</td></tr>
<tr><td colspan="2">avoid cascading disasters</td></tr>
<tr><td rowspan="12">5. BUILD-INGS THAT ADAPT</td><td colspan="2">avoid practices that cause erosion</td></tr>
<tr><td colspan="2">design controlled points of failure</td></tr>
<tr><td colspan="2">retrofit and/or upgrade existing stock</td></tr>
<tr><td>design good “bones”</td><td>retrofit urban space</td></tr>
<tr><td>design for disassembly and reuse</td><td>decentralize energy</td></tr>
<tr><td>design to withstand appropriate wind loads</td><td></td></tr>
<tr><td>consider material resistance to salt water, corrosion, etc.</td><td></td></tr>
<tr><td>reduce wastewater</td><td></td></tr>
<tr><td>install locally appropriate, flood resistant systems</td><td></td></tr>
<tr><td>elevate mechanical systems (heating, cooling, ventilation)</td><td></td></tr>
<tr><td>elevate structure above BFE</td><td></td></tr>
<tr><td>use easily adaptable building components</td><td></td></tr>
<tr><td rowspan="4">6. REGEN-ERATE</td><td colspan="2">celebrate diversity</td></tr>
<tr><td colspan="2">rely on renewable energy</td></tr>
<tr><td colspan="2">let waste equal food</td></tr>
<tr><td colspan="2">anticipate future design evolution</td></tr>
</table>

Source: Authors. Adapted from the Urban Resilience Framework proposed by McGregor et al. (2012).

This paper outlines a Regenerative Reconstruction Framework (illustrated in Table 2) that is based on the first five principles of the Urban Resilience Framework proposed by McGregor et al. (2012) and the “cradle to cradle” criteria developed by McDonough & Braungart (as described in Feireiss & Pitt, 2009). The Urban Resilience Framework is a six-phase adaptation approach that pertains to the built environment. Its sixth principle, “managed retreat”, is not appropriate for evaluating a design project, so is omitted from our adaptation. Furthermore, the Urban Resilience Framework does not adequately address the costs of development (including land) and building maintenance nor short- and long-term community infrastructure. The sixth principle, “Regenerate,” uses the following criteria (Feireiss & Pitt, 2009):

- *Waste equals food*: design material sand systems that will be cycled repeatedly in biological and/or technical metabolisms; in natural systems, waste equals food.
- *Rely on renewable energy*: the quality of energy matters; use renewable energy sources that protect human and environmental health.
- *Celebrate diversity*: natural systems thrive on complexity; technical systems thrive on coherence.
- *Anticipate design evolution*: design to accommodate changing uses over time.

Table 2 summarizes the six key elements of the *Regenerative Reconstruction Framework*, expanding each element into sub-criteria focusing on building and neighborhood or community scales. Using this framework, there are clear differences between how the elements can be applied at the varying scales, but also some similarities.

4. RESILIENCE IN THE BUILT ENVIRONMENT: THE CASE OF THE MAKE IT RIGHT PROJECT

4.1 LONGSTANDING VULNERABILITIES IN THE LOWER NINTH WARD

One of the neighborhoods hardest hit in New Orleans by Hurricane Katrina in 2005 was the Lower Ninth Ward, an area comprised of both the ‘Lower Ninth Ward’ and ‘Holy Cross’ (see Figure 3 below)[3]. This neighborhood is defined by its east-west boundaries from the St. Parish border roughly one mile to the Industrial Canal boundary, and by its north-west boundaries from the river 1.5 miles north to Florida Avenue. It was primarily swampland until the early 1900s and remains “particularly flood prone” (Landphair, 1999) due to its location at the sharp bend in the Mississippi River, as well as a large “dip” topographically; hence, in the wake of Katrina, the current easily eroded the levees and the floodwaters remained for weeks, with devastating consequences. According to UNOP (2006). Katrina affected 77% of the population of New Orleans; however, it disproportionately affected vulnerable populations, including the residents of the Lower Ninth Ward. More than 100,000 residential structures were completely flooded, and damage to public infrastructure, including many schools, was catastrophic. In contrast, the neighborhoods alongside Lake Pontchartrain suffered much less damage. In fact, some residents of the Lower Ninth Ward believed that

3 For the purposes of this paper, the neighborhoods of the Lower 9th Ward and Holy Cross will be referred to as the Lower 9th Ward.

the levees were deliberately breached along the Industrial Canal to protect parts of the city at the expense of others, thus impacting confidence of these Lower Ninth Ward residents in the local government (Nelson *et al.*, 2007).

Figure 2: The Lower Ninth Ward & the improved levee.
Source: Thomas (2007).

The Lower Ninth Ward's territorial vulnerabilities were exacerbated by some infrastrucutral and planning choices. The area was chosen as the site for construction of the Industrial Canal from 1918-1923. The canal, which runs for 5.5 miles through the Lower Ninth Ward, only reinforces its geographic detachment from the rest of New Orleans – as did the pre-Katrina construction of the I-10 Twin Span Bridge and the significant reduction of public transportation. Finally, socio-economic vulnerability has also characterized the Lower Ninth Ward from the early 1900s, when poor settlers were forced to move to "flood-prone backswamps" (*ibid.*: 839). While a relative degree of racial harmony (Landphair, 2007: 839) existed earlier on in the 1900s, this harmony quickly dissipated during the fights for public school desegregation, where from 1960 to 1970, the Ninth Ward lost 77% of its white population (Landphair, 1999: 29). What is more, by 1970, 28% lived below the poverty line (*ibid.*).

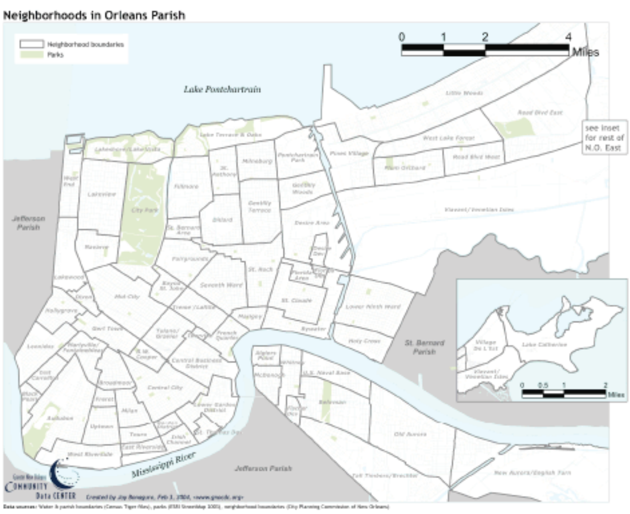


Figure 3: The Neighborhoods of Orleans Parish.
Source: Greater New Orleans Community Data Center (2013).

Paradoxically, it was the very marginalization of the Lower Ninth Ward residents that assured its social cohesion: "[T]he Lower Ninth Ward's literal and figurative isolation from central and uptown New Orleans bred a fierce loyalty among residents to their neighborhoods" (*ibid.*: 840). The Lower Ninth Ward's isolation from the rest of New Orleans – both in terms of distance and social inclusion – cultivated a culture of community-based groups such as benevolent associations (Landphair, 1999: 40). The Lower Ninth Ward was the 'murder capital of the murder capital', but it was also ironically a "ladder of upward mobility" (Landphair, 2007: 843), where from the 1940s until the 1960s, many modest-income families were able to buy homes. Many of these homes were passed down from generations and helped provide families with a foundation and sense of identity (Feireiss & Feireiss, 2009: 118) For these reasons, Lower Ninth residents felt strongly about having their neighborhood rebuilt.

4.2 REBUILDING PROGRAMS AFTER HURRICANE KATRINA AND THEIR LIMITATIONS

Not only did the Hurricane affect neighborhoods differently, but so did planning proposals in the aftermath of the storm. Some observers outside the city questioned the value of rebuilding New Orleans at all, citing its vulnerable location, declining population, and relative poverty (Nelson *et al.*, 2007). Rebuilding was hampered by "the failure of local officials to designate a single, accountable agency to oversee recovery planning" (Nelson *et al.*, 2007: 26) with the result that there was no clear, citywide rebuilding strategy. In the first few years after Hurricane Katrina, the city of New Orleans developed five different recovery planning schemes, and a sixth scheme was developed by a community-university-municipal consortium. The key elements of the planning schemes are summarized here. The complete plan goals, implementation and status can be found on the City of New Orleans website[4] and local media.

- The Bring New Orleans Back (BNOB) Commission was a top-down process, with limited resident input, driven by architects and planners. It resulted in a citywide plan that prioritized where to allocate resources for rebuilding.
- The New Orleans Neighborhood Rebuilding Plan (NONRP) assumed that all neighborhoods would be rebuilt and emphasized the need for bet*ter di*saster preparedness throughout the entire city (including higher-risk areas) "instead of emphasizing safe rebuilding practices to reduce relative risk within the city" (Nelson *et al.*, 2007: 31).
- The Unified New Orleans Plan (UNOP) was a philanthropic-funded process that produced thirteen neighborhood plans and one citywide plan, focusing mainly on urban design and land use solutions, such as elevating homes. A key component of the UNOP was to prioritize community engagement throughout the planning process; indeed, the City Council required that the Master Plan incorporate community engagement with the "force of law"[5]. UNOP also approved two community-led plans.
- The Office of Recovery Management, established in early 2007, was formed to develop a recovery strategy, given all the different plans that were produced. In June 2007, the city adopted the BNOB, NONRP and UNOP plans. In 2013, OCD and the New Orleans Redevelopment Authority

4 City of New Orleans Comprehensive Plan: http://www.nola.gov/city-planning/master-plan/
5 See City of New Orleans Comprehensive Plan: http://www.nola.gov/city-planning/master-plan/

developed a program that provided funding for affordable housing development, soft second mortgages and purchase of Louisiana Land Trust (LLT) properties at 10% of the fair market value.

- The *Raise Up the Lower 9th Ward* (RUL9W)[6] was initiated by US Senator Mary Landrieu in 2011 to evaluate the integrated plans and move ahead with implementation strategies.
- The Lower 9th Ward Neighborhood Empowerment Network Association Housing counseling and housing development uses a community land trust (CLT) model and Lowernine.org, a non-profit that works with volunteer labor to rebuild about 60 homes in the Lower 9th Ward. Figure 4 displays the 'green' parcels on the map which indicate lots that previously held dwellings but (as of 2012) remain vacant and in some cases abandoned and/or blighted.

Figure 4: Lower 9th Ward Property Condition Survey. Source: www.whodata.org, 2012. http://www.whodata.net/pages/maps.html.

4.3 THE MAKE IT RIGHT PROJECT: A REGENERATIVE AND RESILIENT COMMUNITY?

4.3.1 WHY WAS IT INTRODUCED?

In December 2006, Brad Pitt founded the Make It Right Foundation to help build 150 prototypical green and affordable homes for residents of the Lower 9th Ward. Pitt and his collaborators saw the aftermath of Katrina as an opportunity to create cradle-to-cradle designs (a term coined by William McDonough and Michael Braungart) that could serve as models elsewhere. The partners of Make It Right argued that providing solutions that did not go beyond providing proper sanitation and shelter were "merely adequate" (Feireiss & Feireiss, 2009: 117) Pitt argued that on the contary, cities can produce more than they consume and can eliminate waste (*ibid.*). Many of the homes from Make It Right have in fact been putting energy back on the grid. While the Make It Right Foundation's primary goal was to resurrect a section of the Lower 9th Ward community, it also aimed to create homes that were culturally appropriate, affordable, and one may argue, *resilient* and *regenerative.* The collaborators of the Foundation saw preserving neighborhood cohesion as vital in promoting long-term social empowerment (*ibid.*: 45). This would involve engaging multiple actors in multiple spheres in order to enhance resilience.

6 http://www.rul9w.org/

Figure 5 : The Make It Right project's pink houses. Source: Thomas (2006).

Figure 6: The Make It Right project in the works. Source: Thomas (2011).

4.3.2 HOW WAS IT IMPLEMENTED?

The architecture firm GRAFT contributed to the initial design criteria aimed at enhancing technical resilience and which met the LEED Platinum certification: raising houses five to eight feet, engineering to withstand hurricanes, employing materials to resist water damage and components resistant to hurricanes; creating rooftops that operate as raised patios in the event of a flood. With a budget of $200 per square foot for a prototype and $130 per square foot for replicable models, esteemed architecture firms from around the world were invited to submit proposals. All initial design presentations were open to community groups and homeowners for feedback (Feireiss & Feireiss, 2009: 125). Make It Right sells their homes for around $150,000 and homeowners use a combination of insurance payouts and moneyfrom the Road Home Program to purchase the homes. Make It Right also offers mortgages to make up any discrepancies. John Williams serves as the Executive Architect for the Make It Right project and maintains the design standards of the first 86 out of 150 dwellings proposed for constuction.

Figure 7. Examples of the Make It Right houses.
Source: Brittany Arceneaux/www.whoData.org, July 1, 2013.

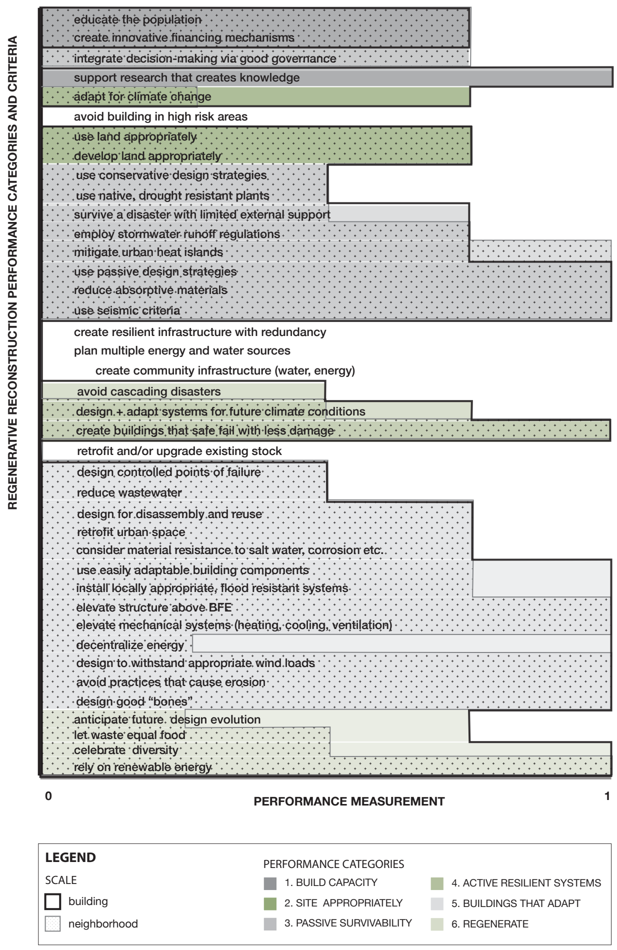
4.4 HOW RESILIENT IS THE MAKE IT RIGHT PROJECT?

It is possible to evaluate the Make It Right project based on what extent it satisfies resilience and regenerative design criteria. Table 3 summarizes how the Make It Right project performs given the Regenerative Reconstruction Framework outlined in Section 3. A ranking on a sliding scale from 'not successful' or 'not met' (=0) to 'successful' or 'met' (=1) was used. In other words, on the left hand side are areas where the Make it Right project does not perform so well, and on the right hand side are areas where it performs very well. The graphic aims to evaluate the Make It Right project at two scales: the scale of the individual building or home, and the scale of the neighborhood. Here, the neighborhood scale is not limited to the 90 Make It Right homes built in the Lower 9th Ward, but refers to the Lower 9th Ward as a whole. It is important to note that some criteria are more applicable to one scale than the other (for instance, the criterion "create community infrastructure" is clearly more targeted to the scale of the neighborhood, rather than the building). The neighborhood scale is indicated by a horizontal line pattern and light outline and the building scale with a vertical line pattern and dark outline. The criteria have been weighted subjectively by the authors based on their experience and knowledge of New Orleans. This represents a first step in applying the framework; however, in the future, the criteria used and their weighting could be determined by local community members, and as such, have stronger foundations and consequences.

In terms of the category 'Build Capacity', the Make It Right project performed well in those areas where integrated decision-making and co-learning occurred. The rating for 'Siting Appropriately' focuses most on appropriate siting and zoning conformance, and it does not meet the criterion of avoiding development in high-risk areas. The category 'Passive Survivability' depends on the specific design elements that are included. For example, for the 'reduce absorptive materials' criterion, the rating would be 1=reduced or 0=not reduced. The category 'Active Resilient Systems' considers whether there are redundant/alternative systems when the primary system fails. The Make It Right project performs well in creating buildings that safe fail with less damage, but does not meet the criteria of creating community infrastructure and using multiple water and energy sources. The category 'Buildings That Adapt' focuses on design interventions such as 'design controlled points of failure', a criterion that the case study meets both at the building and neighborhood scale. In this category, the Make it Right project generally performs the same at both scales, except for the 'decentralize energy' criterion, where the project performs better at the scale of the building than the scale of the neighborhood. Evaluating elements in the 'Regenerate' category is rated according to whether the building and community of buildings consider the McDonough & Braungart criteria, ranging from 0=does not meet to 1=meets. While the Make It Right project does rely on renewable energy, it performs less well when it comes to celebrating diversity and anticipating future design evolution at the community scale.

In summary, the Make It Right project performs very well in the 'Passive Survivability' and 'Buildings That Adapt' categories, both at the building and community scales. The project's weaknesses are visibly in certain criteria at the neighborhood scale, especially in the 'Regenerate' and 'Active Resilient Systems' categories. The differences in performance between the building scale and the neighborhood scale allow for new typologies to emerge. While some categories, such as 'Building Capacity' and 'Passive Survivability' are strong-strong, others such as 'Site Appropriately' and 'Active Resilient Systems' may be said to be weak-weak. The 'Regenerate' and 'Buildings That Adapt' categories are strong-weak, meaning they perform better at the building scale than the neighborhood scale. No categories are weak-strong, meaning that none perform better at the neighborhood scale than at the building scale. The Regenerative Reconstruction Framework is thus not only useful to evaluate the Make It Right project, but also to highlight scalar conflicts or differences, and to emphasize those criteria that have not been met, in order for improvements to be made in the future.

Table 3: Performance of the Make It Right using the Regenerative Reconstruction Framework.



Source: Authors.

4.5 FURTHER CONSIDERATIONS

While it is possible to evaluate the Make It right project based on the Regenerative Reconstruction framework, several other questions nevertheless emerge. First, the category 'Siting Appropriately' is much more complex than it appears in the framework. Though the Lower 9th Ward is geographically vulnerable, it is also has a rich cultural history and sense of collective identity. As one researcher notes, "When you're here, and you talk to people, you're like, this is generations of families. This is more than bricks and mortar. You look at the Lower Nine and say 'why'. And now I say 'why not?'" (M. Thompson, quoted in Depillis, 2013). Still, when decisions to come back are made, one can see an opportunity to rebuild in a more sustainable way, not only at the building scale, but also at the neighborhood scale and at the urban scale. In this matter, efforts still need to be made to improve the connectivity between this neighborhood to the rest of the city as well as basic services. Hence, diversity and connectivity, it would seem, should also be criteria to take into consideration when 'siting appropriately'. It would be important to see, for example, how projects like the Make It Right project could be linked with other efforts, either from the official authorities like the Road Home Program or from the local non-profit organizations (CHDO – community housing development organizations). Projects like Make It Right would benefit from being incorporated into the urban plan developed by the city. Potential designs could include mixed-use buildings linked with public transportation, for instance. The questions of scale and connectivity are essential to enhance resilience. More generally speaking, it is important to integrate performance of the global structure and strategy of the city.

The question of scale is equally important when addressing the sixth principle in the Regenerative Reconstruction Framework. To illustrate, while "waste equals food" is clearly a guiding principle when it comes to material finishes in individual homes, it is less clear how building components and materials are designed to be repeatedly cycled in biological and technical metabolisms. How do the homes incorporate waste materials from other systems? How does their own waste nurture other systems? Similarly, one can question diversity: diversity of what, and at what scale? At the scale of the house, residents were able to choose out of 21 different designs and choose their interior finishes as well as interior and exterior paints. This leads to a certain aesthetic diversity in the neighborhood. However, if referring to diversity of uses and the neighborhood scale, it is evident that diversity has decreased. There are very few services (grocery stores, restaurants, hair salons, *etc.*) that cater to residents of the Lower 9th Ward. In terms of biodiversity, the foundation originally was conscious of landscaping, but cut back this part of their program. Social diversity also did not increase. And finally, the question of adaptability is clearer at the scale of the home than the scale of the neighborhood. The Hot Links design, submitted by Atelier Hitoshi Abe from Japan, for instance, proposed a contemporary version of two shotgun houses with 'soft boundaries' in order to adapt to the changing needs of a family over time. It is also possible to imagine various uses underneath the houses (parking, storage, a play area for children, and so on) that are adaptable and can evolve over time. However, one may still be inclined to ask, how can the Make It Right homes and the community as a whole get better over time, as new systems become available and families evolve?

Furthermore, it is important to emphasize redundancy at multiple scales. While the Make It Right homes are designed for less failure during future disasters, the project does not incorporate enough redundancy in its designs. The designs do not plan for multiple energy and water sources. Though they are powered by solar energy, the panels are hooked up to the municipal grid, meaning that in a power outage, the homes would be out of electricity for long stretches as well. Moreover, it is unclear whether the designs take into consideration future environmental conditions (elevated temperatures, flood lines, humidity levels and so on) and the possibility for future expansions, such as to the mechanical and plumbing systems. Finally, one may argue that at a district scale – with a goal of 150 homes to be built – it would have been possible to build in some community infrastructure such as community-based heating and water cooling systems. This would increase the

Lower 9th Ward's resilience in a city-scale disaster.

At the scale of the building, we may conclude indeed that the homes have a net positive impact – particularly in terms of feeding energy to the municipal grid. Furthermore, the choice of cradle-to-cradle materials, easily modifiable building components, and spatial flexibility incorporated into some of the designs move towards design that is 'regenerative'. On the other hand, and at the scale of the community or city, until the City of New Orleans allows underground cisterns for greater water independence, and provides incentives for biodiversity, drought resistant landscapes, and programs to bring much needed services and amenities to the neighborhood, it is difficult for the Make It Right project to perform as regenerative and resilient across all six main categories.

4.6 LIMITATIONS/ FUTURE RESEARCH

The paper examines the scale of building and community when considering resilience and regenerative design. Additional research at the regional and/or national scale is still needed. Issues of environmental justice, community engagement, demographic shifts post-shock, and community-based definitions of regenerative design must be further explored. There are numerous cost/benefit analyses that should be considered in future research. The cost of elevating new/rehabilitated dwellings and the long-term impact of increased expenses for flood insurance should be explored further. Leading the fight to oppose the FEMA flood map rating revisions is US Senator Mary Landrieu from Louisiana. There are a number of planning studies, Livable Claiborne Communities[7] and the Crescent City Community Land Trust[8] economic impact study along St. Claude Avenue that will begin to influence resilience citywide in 2013/2014.

Furthermore, additional efforts need to be made in terms of acquiring pertinent data. The whodata.org is an example of the type of dataset necessary for researchers in resilience planning. Without the data and knowledge of the changes that occur on the ground, it is difficult for researchers and policymakers to make the choices necessary for enhancing resilience and regeneration. In addition to these data sets, additional research is required on choosing the criteria for resilient, but especially, regenerative design. The Regenerative Reconstruction Framework has served as a strong basis from which to draw resilience criteria. It does not, however, address the issue of design style, which could be pertinent in the Make it Right project: in particular, how the new houses are received, and whether or not they fit into the existing context. The next step logically would be to engage local community stakeholders to choose the pertinent criteria and weightings in order to evaluate a project. In particular, the homeowners in the Make It Right houses could be interviewed to describe their experience pre-Katrina and post-rebuilding to evaluate the social and building issues that are key to building long-term resilience.

7 http://www.livableclaiborne.com/
8 http://www.ccclt.org/

5. CONCLUSIONS

This paper considers a contemporary use and definition of resilience and regenerative design that has not typically been considered in the areas of design and planning. Resilience has previously focused on the social and economic responses to man-made or natural disasters and the process for how to return to homeostasis after 'shock'. This paper has reviewed the literature that extends the use of resilience and the resulting model for evaluation, also taking into consideration issues of different temporal and spatial scales and the nuances in performance at each of these scales; and it has studied vulnerability and the factors that influence the ability of an individual, neighborhood or larger community to respond, revive and renew after a catastrophic event.

Hurricane Katrina was a natural disaster with significant adverse impacts on all levels and scales of the social-physical-economic systems. This paper has evaluated the Make It Right project according to the Regenerative Reconstruction Framework. This case study was used to better understand the link between resilient and regenerative designs, highlighting the compatible agendas of integrating various scales and time frames, engaging the community, and enhancing adaptive capacity on the one hand, and exposing the tensions between redundancy, self-sufficiency, and integrated systems on the other. As part of this evaluation, a tool that considers both social, political and physical-technical issues are considered, with a systemic approach. The Make It Right project is an important project and has gone a long way in furthering the discussion of a type of resilience that does not simply result in returning to a pre-disaster state. On the contrary, the Make It Right project has shown that communities may strive for a more sustainable, if not regenerative, reorganization. While the Make It Right project has been criticized for only completing 90 homes in six years, it has reached its goal of helping several Lower 9th Ward residents return to their neighborhood and into affordable, sustainable homes. Moreover, it has elevated the standards for post-disaster reconstruction in New Orleans, and arguably for post-disaster reconstruction efforts on a more global scale. This project demonstrates that post-disaster reconstruction indeed represents a 'window of opportunity' – to echo Burby et al. (2000) – to rebuild better than what was there before. Resilience may thus include a dimension of 'renewal' and not necessarily just 'recovery' (Donovan, 2013: 45).

The project nevertheless also highlights some issues that deserve more attention within architecture and planning communities. Regenerative reconstruction must balance regenerative design criteria with enough redundancy to withstand future shocks, for example by getting energy and water from multiple sources. Second, we must question how regenerative design and resilience criteria is measured across the three scales of building, neighborhood, and city. What will the Make It Right project look like fifteen years from now, and who will pay for the maintenance? Finally, the mechanisms and processes that can make a project like the

Make It Right project better integrated with city programs and plans must be questioned. Further collaboration with other programs, especially city programs, could yield several benefits: changing regulations to foster greater biodiversity and water independence; augmenting resilience and 'regeneration' at the neighborhood scale by integrating community infrastructure, services, and amenities; involving neighborhood groups and promoting transparency and participation; and further developing a global education component to augment adaptive capacity and teach residents about long-term maintenance and stewardship of their neighborhood. The recovery and renewal of the Lower 9th Ward continues to be a closely watched story in long-term resilience. Cities impacted by natural disasters such as Hurricane Sandy or those influenced by natural disasters such as the blighted properties in the City of Detroit can consider this new model for how to consider a new definition of resilience that considers the parts and the whole.

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