

STRESS TEST

Infrastructure as a Synthetic Surface

By Roger Hubeli and Julie Larsen

“If the goal of designing the urban surface is to increase its capacity to support and diversify activities in time - even activities that cannot be determined in advance - then a primary design strategy is to extend its continuity while diversifying its range of services. This is less design as passive ameliorant and more as active accelerant, staging and setting up new conditions for uncertain futures.” - Alex Wall, Programming the Urban Surface, in Recovering Landscape

Recent times have been marked by the crisis of multiple systems that were formerly considered stable and secure infrastructures - such as financial institutions and real estate markets - built on an idea of efficiency, production and monetary value. The answer to the financial system's recent distress comes from the idea of resilience; and banks were put under a STRESS TEST to measure their resilience. According to C. S. Holling, “resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.” The source of the financial system's recent distress stems from a lack of resilience, and it is all too clear how badly the global financial system failed this test. What has not occurred, however, but is perhaps suggested in the growing environmental crisis, is a concurrent ‘testing’ of our urban developments to measure their own resilience and longevity. If a stress test determines the stability of a given system through its capabilities to go beyond normal operational capacity, how can one begin to use new knowledge to push a given system beyond its current capacities in a productive way?

In a country where urban development is primarily driven by private entities, the infrastructure that stems from these developments offers one of the last possibilities to reclaim territory and direct current development towards more productive and spatial necessities.

STRESS TEST utilizes urban development as a testing ground for infrastructural interventions that reconfigure common urban spaces which otherwise would lie beyond the reach of an architectural discourse. The infrastructural conditions researched are not only in need of major overhauls but many of them, such as the energy system or waste management, are undergoing widespread critique as to their basic ability to function adequately. And, most importantly, there is a detrimental relationship to the environment that if given more focus, has the potential to reinforce a new kind of resilience our current system is lacking. Recent policies such as the United States Federal Recovery and Reinvestment Act underline the desperate need for updates to these infrastructural systems for both economic and environmental concerns.

The projects set forth attempt to address various current, critical

conditions as urban speculations of poly-centric sprawl that proliferates for better or worse across the American landscape. These developments are currently supported by an ever-increasing infrastructural network of roads, power lines, storm and sanitary sewer pipes, and the local, state, and federal bureaucracy that is required to administer and maintain such massive undertakings. But despite their projective heritage and the staggering amount of physical and monetary capital that goes into maintaining sprawl developments each year, today's outlying urban developments are not usually seen as productive environments for architectural experimentation. As Paul Andersen reveals in his essay, *The Economy of Excess*, "today, the suburbs are not commonly viewed as fertile territory for experimenting with untested urban ideas-as a place to invest a culture's excess energy- but as a set of known problems that require practical solutions." The disciplines with potentially the most to gain - urban design, architecture, landscape architecture - sit ineffectually on the sidelines having failed to develop a campaign to end sprawl's profligate waste or capitalize on the same through a process of projecting alternatives.

SURVEYING the history of infrastructural interventions and their architectural strategies embedded within them, one sees a major shift over the last 100 years that can be subdivided into three broad categories: 1. Stylistic Expression 2. Framing the Machine and 3. Architectural Disregard

Early on, architecture endowed the technology of infrastructure with an expression of perceived permanence. While disguising the actual technology itself, neo-classic temple fronts or neo-gothic fortified facades ensured the beholder of great achievement because the facades represented power and the architectural expression was commonly associated with wealth and triumph. Many of the infrastructural projects were also hidden or disguised to reflect permanence, stability and reliability. In cases, such as the Louisville, Kentucky Water Tower (1856) the architect Theodore R. Scowden not only hid the technology of the facility behind the shells of a monumental, classical, Greek temple facade but envisioned the grounds of the plant as a public picnic area where people could participate in the 'public' space beyond the building. In a broader, more far reaching sense, the water tower became a stand-in for communal space. This is an early example of a multi-functional infrastructure that attempted to leverage architectural expression and function for a useful public space.

This notion of technology stands in stark contrast to the modernist approach for the expression of the machine as the infrastructural system itself. Here, the architecture seemingly resides in the background and frames the technology. The expression of the machine becomes the expression of the architecture. The example of the recently destroyed power plant, on the campus of the Michael Rees Hospital, by Walter Gropius suggests this relationship was not limited

to representing the technology but that the architectural expression itself took its aesthetics from the functional order of the technology housed in it.

Later, this relationship was replaced and misunderstood with a position that technology stood in for architecture, which in turn, became anti-architecture. In this case, infrastructural elements were built without any consideration to their context or expression. Electrical substations appear as poorly constructed grey metal sheds, waste or recycling posts are built in a random manner or hidden behind metal fences and wooden planks. Or as Michael Jakob states in *Architecture and Energy or the History of an Invisible Presence*, “Today, the vast majority of these structures attract no attention at all. They are hidden beneath the density of a no less anonymous anti-architecture, or behind the total insignificance of their buildings, which have nothing more to day.”

This lack of presence hints at our expectation that these systems should support our lifestyle without appearing in it. Many of these anti-architectural objects are mono-functional and terminate as ruins once the technology is outdated. Instead, infrastructure has the potential to become more plastic if seen as a new testing ground for redefining needed urban programs. Instead of obsolete ruins, resilient systems can live beyond their capacities through a new ecological slant that tests the potential for new urban spaces.

EXHIBIT

The first half of the exhibition revisits five iconic infrastructural categories: Water, Energy, Mobility, Waste and Ecology. Each of the five categories features a series of twenty projects, a hundred in all, that either reach an architectural expression or oppose it. Each of the five categories are studied through an architectural lens of ten criteria to compare and contrast projects: Monumentality, Ornament, Public Access, Habitability, Exposed Technology, Scale, ‘Looks like a Building’, Context, Hybrid Programming, and Adaptability. All one hundred projects are then reshuffled once more to compare projects in all five infrastructural categories.

The second half of the exhibition recomposes three common surface conditions - ground, wall, and roof - into six common urban conditions that speculate on the future of infrastructural projects as leverage for architectural proposals. Each of the projects capitalizes on future potentials in new ecological and technology-based infrastructure that could reconfigure the urban environment. Harnessing ecological necessities, such as storm water run-off, waste to energy, and contamination, the projects take advantage of these programs for new hybrid uses to reconfigure urban space.

New architectural, infrastructural and ecological necessities have the potential to alter urban territory through a more public focus - what was previously disregarded as a necessity in many bedroom communities.

The projects are formed around the notion that many small-scale infrastructural systems can and will become outdated or even obsolete. With the introduction of various ecological possibilities embedded within each project, the structures have the potential to live beyond their use.

Each of the six projects focus on a particular need that fuses new program, public capacities, and ecological potential. These new infrastructural networks provide a synthetic landscape of ecologies for needed habitats and public space for people. These hovering, shifting, and floating landscapes are ecologically and experientially performative. They provide micro-habitats for species most at risk from the processes of urbanization, industrial agriculture, and climate change while at the same time providing potential for public interaction for human species most at risk from the process of sprawl strip-malling. The urban ground, wall and canopy evolve beyond a predetermined aesthetic to today's infrastructural and ecological realities.

Individual Project Descriptions:

Waste to Energy Residential

R.WTE 8.0

Nearly eighty percent of all waste is landfilled nationwide and growing into an infrastructural problem - literally. The global market for waste-to-energy systems is expected to rise from \$3.7 to \$13.6 billion in 5 years. IST Energy's 48 foot long Green Energy Machine, or "GEM" system is about the size of a garbage dumpster and can go to where the waste is: small towns. The \$1.1 million system processes up to 3 tons a day of mixed waste which would produce 75 kilowatts of net electricity and 180 kilowatts of heat daily. A typical 1500 square foot house uses an average of 50 Kilowatts per day. The GEM would produce enough energy to keep 5 houses running daily.

Abandoned or foreclosed lots are periodically bought by the city. On open lots, a GEM system is installed that is run by the waste produced in the individual households. The produced energy is stored in batteries and fed back into the individual houses on demand. The GEM module is housed in a WTE (waste to energy) structure that shields neighbors from noise and smells generated from the system. The thickness needed to buffer noise and smell are taken on by a multi-layer wall construction that inhabits part of the infrastructure. The WTE also allows for the habitation of local species by providing a porous facade that serves to provide substrate for growth.

Reed Beds, Barges, and Bridges

R.RBB 4.0

Untreated storm water run-off commonly culminates in retention ponds and brings with it debris, chemicals, dirt, and other pollutants into the storm sewer system and eventually lakes, rivers, wetbeds, and coastal waters. According to the EPA (the United States Environmental Protection Agency), anything that enters a storm sewer system is discharged untreated into the water bodies we use for swimming, fishing and even drinking water. Slim barges and bridges form the base structure to house reed media. These reed barges work as micro sewage-treatment plants controlling the amount of nutrients in the water as well as binding pollutants, a process called bioretention. The seasonal and daily trimming of reed allows the nutrients and pollutants to be removed from the ecosystem of the pond, thus cleaning the water bodies before the water flows further. Water is restored to the capacity of becoming a healthy environment for human recreation and for animal habitats to thrive. Reed bridges merge with barges and connect residential backyard porches. Human inhabitation is shifted to primarily bridges to keep reed beds and barges dedicated for animal habitats. Animals are free to cross under bridges and form mini-habitats hidden between the reed beds of the geocell structure. The reeds, which grow densely in the geocells of the structure, act as a barrier to support wildlife.

Storm Water Run-off Urban Canopy

R.SWR 4.0

The storm water run-off (SWR) urban canopy proposes the re-figuration of commercial street systems to increase infrastructural resilience to climate change. Major increases in precipitation are a result of climate change. Currently, storm events across the country are greater than 2 inches per day cause aging storm-water infrastructure to merge with sanitary sewers. Subsequently, raw sewage flows into natural lakes and rivers. The expected increase of storm events suggests a need for a new approach to storm-water management in many cities.

The SWR detains and cleanses storm-water runoff, provides critical habitat to displaced species, and offers programmatic and experiential qualities of public space to residents. A small town or residential area can use the SWR for multiple infrastructural needs, such as resident car parks, DIY car washes, hydrogen pump and energy rechargers, and neighborhood bus stops. The strategy combines tactics such as bio-swales and detention basins in addition to an above-ground filter and retention system. This method retains rainwater from above and provides extra storage for the existing storm-water system below. The canopy also provides micro-habitats for species most at risk from the processes of urbanization, industrial agriculture, and climate change.

Waste Commercial

C.WTE 7.0

Nearly eighty percent of all waste is landfilled nationwide and growing into an infrastructural problem - literally. The global market for waste-to-energy systems is expected to rise from \$3.7 to \$13.6 billion in 5 years. IST Energy's 48 foot long Green Energy Machine, or "GEM" system is about the size of a garbage dumpster and can go to where the waste is: colleges, hospitals, factories, strip malls, or big box retail. The \$1.1 million system processes up to 3 tons a day of mixed waste which would produce 75 kilowatts of net electricity and 180 kilowatts of heat daily. A typical 150,000 SQFT big box store uses an average of 25 Kilowatt/hours (kWh) of energy per SQFT/year. With only five GEMs needed, all major retailers could save over 10% in energy from just the waste they produce on a daily basis.

Abandoned or foreclosed lots are periodically bought by the city. On open lots, a GEM system is installed that is run by the waste produced in the individual households. The produced energy is stored in batteries and fed back into the individual houses on demand. The GEM module is housed in a WEW (waste to energy wall) structure that shields neighbors from noise and smells generated from the system. The thickness needed to buffer noise and smell are taken on by a multi-layer wall construction that inhabits part of the infrastructure. The WEW also allows for the habitation of local species by providing a porous facade that serves to provide substrate for growth.

Reed Beds, Barges, and Bridges

C.RBB 11.0

Untreated storm water run-off commonly culminates in retention ponds and brings with it debris, chemicals, dirt, and other pollutants into the storm sewer system and eventually lakes, rivers, wetbeds, and coastal waters. According to the EPA (the United States Environmental Protection Agency), anything that enters a storm sewer system is discharged untreated into the water bodies we use for swimming, fishing and even drinking water. Small beds and barges form the base structure to house reed media. These reed beds and barges work as micro sewage-treatment plants controlling the amount of nutrients in the water as well as binding pollutants, a process called bioretention.

The seasonal and daily trimming of reed allows the nutrients and pollutants to be removed from the ecosystem of the pond, thus cleaning the water bodies before the water flows further. Water is restored to the capacity of becoming a healthy environment for human recreation and for animal habitats to thrive. The reeds, which grow densely in the geocells of the structure, act as a barrier to support wildlife. Ducks, geese, etc. are able to live simultaneously side-by-side humans in the pockets between reed geocells. Reed beds form along the periphery of a water basin, while reed barges form islands in the middle of the basin. Animals predominantly make habitats in the reed beds, while humans

interact on the barges for fishing, swimming, and picnicking.

Storm Water Run-off Urban Canopy

C.SWC 9.0

The urban canopy proposes the re-figuration of street systems to increase infrastructural resilience to climate change. Major increases in precipitation are a result of climate change. Currently, storm events across the country are greater than 2 inches per day cause aging storm-water infrastructure to merge with sanitary sewers. Subsequently, raw sewage flows into natural lakes and rivers. The expected increase of storm events suggests a need for a new approach to storm-water management in many cities.

The storm water run-off urban canopy (SWC) detains and cleanses storm-water runoff, provides critical habitat to displaced species, and offers programmatic and experiential qualities of public space to residents. The city is able to use the SWC for multiple infrastructural needs, such as hydrogen pump stations, bus stops, and operated car washes. The strategy combines tactics such as bio-swales and detention basins in addition to an above-ground filter and retention system. This method retains rainwater from above and provides extra storage for the existing storm-water system below. The canopy also provides micro-habitats for species most at risk from the processes of urbanization, industrial agriculture, and climate change.