

Loq•kit — A More-Affordable Housing Technology

Loq•kit is a system of mass-produced and inter-related house parts. It is an industrialized housing strategy that introduces a new methodology for connecting parts, coordinating component sizes, and regulating connection locations. The strategy utilizes modern manufacturing processes, like metal roll-forming and bending, and “plastics” extrusion — and new materials such as non-petroleum-based foams and natural fiber reinforced resins (rather than petroleum-based plastics) for the majority of building shell components. The new technology does not employ nails, glues, or screws. Instead, it utilizes snap-lock connections so that house parts may be released and reconfigured. For example, window and door locations may be reconfigured or their sizes enlarged or made smaller, or home additions may be added or subtracted. Part sizes and connection locations are governed by an innovative regulating grid, enabling them to be interchanged between other Loq•kit houses. The parts may be reused over and over again.

The development of Loq•kit has been a personal mission of mine for the past five years. Long before becoming an architect, and owner of PAF Architecture, LLC, I had become a skilled mechanic. Mechanical components, their connections to each other, and operations, have always fascinated me. There is an intuitive connective relationship between well-designed parts in nearly every industry — except housing. The housing industry is rooted in its crafts-based traditions, where each part is prepared (manufactured) and assembled by a carpenter. It is an assembly process that is time-consuming and expensive. In light of the growing demand for affordable housing worldwide, I believe a technology-based house assembly system must be realized.

Growing Need

Housing affordability is declining. It is a worldwide trend affecting even the richest countries. Growing housing costs are a symptom of falling economic conditions for families in nearly every country across the globe. Many countries are experiencing a middle-class in decline. Those of us who live in the U.S. have experienced these global trends. Median household income has declined by over \$1,500 since 2000, reports Congressman George Miller. Although increasingly cost-burdened, American families of middle- to low-income will continue to spend more on

housing than is considered affordable. In fact, in my own state, according to *The Next Decade of Housing in Minnesota*, low income households will comprise more than one-half of new households in the state between 2000 and 2010. Into this arena of falling economic power, will arrive many more families in need of affordable housing. World's population reached 6 billion near the beginning of 2000. In their report, *The World at Six Billion*, the United Nations projected that world population will “cross the 7 billion mark in 2013; the 8 billion mark in 2028; (and) the 9 billion mark in 2054.” In turn, The World House Project estimates: “By the year 2030, three billion people in the developing world will need housing — that's 96,150 housing units per day.”

An affordable mass-produced housing technology could have enormous potential for easing economic stress on families around the globe. The technology is needed, and the demand is large, and growing. In consideration of such great demand, mass-production is an appropriate solution. Because a house is an expression of homeowner individuality, Loq•kit will introduce a mass-produced system of parts that may be assembled into an unprecedented number of interior layouts and exterior designs — with each design a unique arrangement of parts selected by the homeowner. Components will make use of green technology, such as solar power and rainwater harvesting, and can be shipped to a world market. Loq•kit is unlike any home building technology currently in use — and is vastly different from technologies of the past.

The Power of a Prototype

A successful industrialized housing strategy will have enormous potential for influencing change. The Loq•kit house parts were developed according to the belief that a successful industrialized housing strategy (a prototype) is not the creation of a single building, but the creation of a **system for producing housing individuality at an affordable price**. A system such as this could potentially fill the great need at the low end of the housing market. A viable strategy for producing high-quality, unique, and affordable houses — that incorporate new technology — could flourish, bringing needed attention to the low end of the housing market. Private industry invests very little effort in realizing creative and affordable home options for consumers because the marketplace is largely unestablished, and a successful direction is unclear. A successful industrialized housing strategy could open up that market.

Loq•kit House Parts

There are three types of Loq•kit building components: sequence-defined structure, sequence-defined infill, and sequence-defined snap-cladding. All but a few of the components utilize snap-lock connections. All component sizes are regulated geometrically by an alternating-sequence grid. Loq•kit's A,B,A,B rhythm (alternating sequence) regulating grid is applied in three dimensions (The regulating grid has received patent pending status). The B module establishes a **regular connection size** between components. The A module establishes a **regular distance between adjacent connection locations**. Loq•kit modular dimensions are determined by selecting any two coplanar connection locations (B modules), and adding the total distance between them – made up of both the A and B modules. This method of standardization produces modular component sizes of A, 2A+1B, 3A+2B, 4A+3B, 5A+4B, etc. Because component sizes are regulated by an over-arching connection methodology, many connections – or only a few, can be made between standardized parts, and overall system dimensions remain modular. The **modular coordination between connection size and connection location** of the Loq•kit grid produces a system of parts standardization capable of producing unprecedented flexibility — resulting in near limitless number of achievable final configurations.

Because the Loq•kit house parts utilize snap-lock connections (releasable only from the interior of a home, to ensure security) and are interchangeable between houses, they can be removed undamaged, and reused again and again. Because parts remain undamaged after use, and are coordinated geometrically for use in other homes, an economically sustainable system of component reuse can result. This potential earned a Loq•kit house second place in 2005 in the international C2C Home competition. Also in 2005, the business plan to implement this strategy was recognized as a semi-finalist in the First Annual Minnesota Cup Breakthrough Ideas Competition. The Loq•kit 6-way connector (used to connect and release infill — image 4) has been featured in the Illinois Institute of Technology paper “House of the Future.” And Loq•kit's C2C Home is slated to be featured in the World House Project's book *100 Houses*. The Loq•kit component system received patent pending status on January 12, 2007.

Next Steps

The Loq•kit Web site www.loq-kit.com is near completion and will be live mid-November. The spirit of the site is aimed at sharing openly a strategy for continued development of the technology. The Web site will address “the what, why, and how” in detail while preserving through intellectual property rights, as much as possible, in order to attract capital. The site will enable access and understanding of the technology, including the patent specification and drawings. The open sharing of ideas is very important to this strategy. The creation of an entirely new technology is risky. The shared ideas and concepts will need to capture attention and spark the imagination of the public. The Web site will initiate a grass-roots effort of rallying interest and spurring innovation in the development of a market viable, technology-based alternative to high home construction costs. At this time, most of the components have been modeled using parametric modeling software. Virtual testing of component physical properties can be performed by a skilled technician using this software. A shortlist of possible component manufacturers has been compiled.

Because technology is a product of the mind, whereas crafts are the product of labor, individually applied creativity and reason can generate the effect of a multitude of workers. Because of this, it is possible for one person to lead by example, and affect great impact in an industry still clinging (with few exceptions) to 160-year-old technology. Loq•kit’s technology is a trim tab. Furthermore, the internet affords the widespread sharing of ideas to begin from a single point. Dialog, input, feedback — and ultimately, support, can occur rapidly today. Through the Web site, Loq•kit technology will “exert the subtlest of pressure” on the housing industry “in the proper place”, in an effort to make a lasting contribution to humanity.