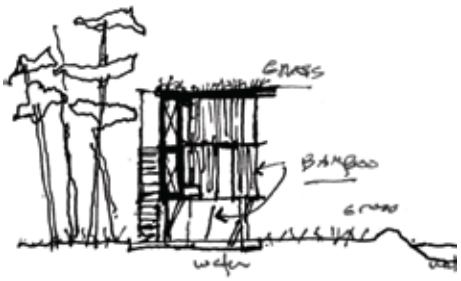
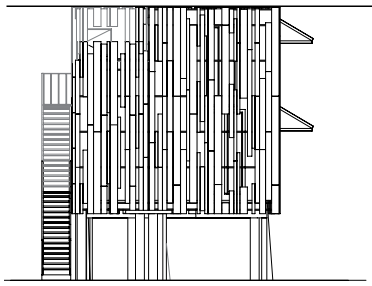
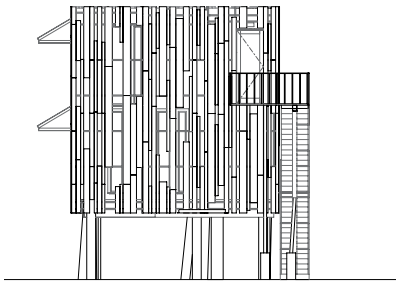
Loblolly House

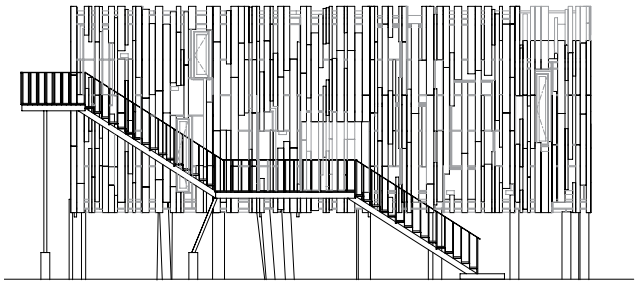
Elements of a New Architecture

Stephen Kieran
James Timberlake









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Preface by Barry Bergdoll
Introduction by Michael Stacey

Princeton Architectural Press

For Barbara, the best client an architect could ever desire

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Preface

Barry Bergdoll

For nearly two decades Stephen Kieran and James Timberlake have conducted their practice—today, numbering some fifty architects and collaborators in their Philadelphia office—as a sustained research project, delving into the very fundamentals of building. Although their position in architectural practice and thinking is generally aligned with the growing interest in prefabrication, each of their built projects defies categorization into the field's current typologies of flat pack, modular, or the numerous practices that hybridize the two. In their seminal book *Refabricating Architecture,* KieranTimberlake reframed the very question of prefabrication. In a holistic way they returned to the modernist tradition of reinventing the practice and language of architecture through off-site factory fabrication of building components. The issues they engaged extended well beyond deployable inventions and evolving fabrication systems to considerations of sustainability, site sensitivity, and to a philosophy of architecture and building.

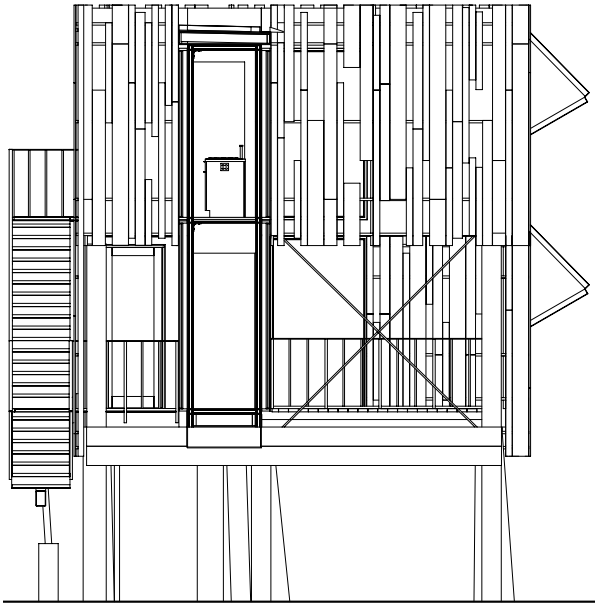
The fact that all of their projects look different, even as their analyses continue to gain subtlety, refinement, and large-scale applicability, demonstrates that to think in terms of prefabrication does not mean to create built diagrams. Although this beautifully documented book follows the conception, fabrication, and rapid assembly of Loblolly House, one might almost say that the installation of a singularly beautiful and refined prefabricated house on a fragile shoreline site is in itself exemplary of how their processes are capable of producing highly inflected, personalized, and subtle works of architecture. Loblolly House is a singular accomplishment precisely because it is at once site specific and paradigmatic. It takes its place among the accomplishments of modern house design for its architectural qualities of transparency, its expression of construction methods and materials, and its lightweight enclosure of volumes, as well as for its fulfillment of one of the key dreams of modernism: the production of a factory-built architecture that parallels, even rivals, modernity's other industrial products, from cars to airplanes and appliances. Loblolly House fulfills the aspiration of rethinking architecture in terms of new means of industrial production and organized communication within a digital environment. It reveals, too, that architecture, conceived as a product, can be

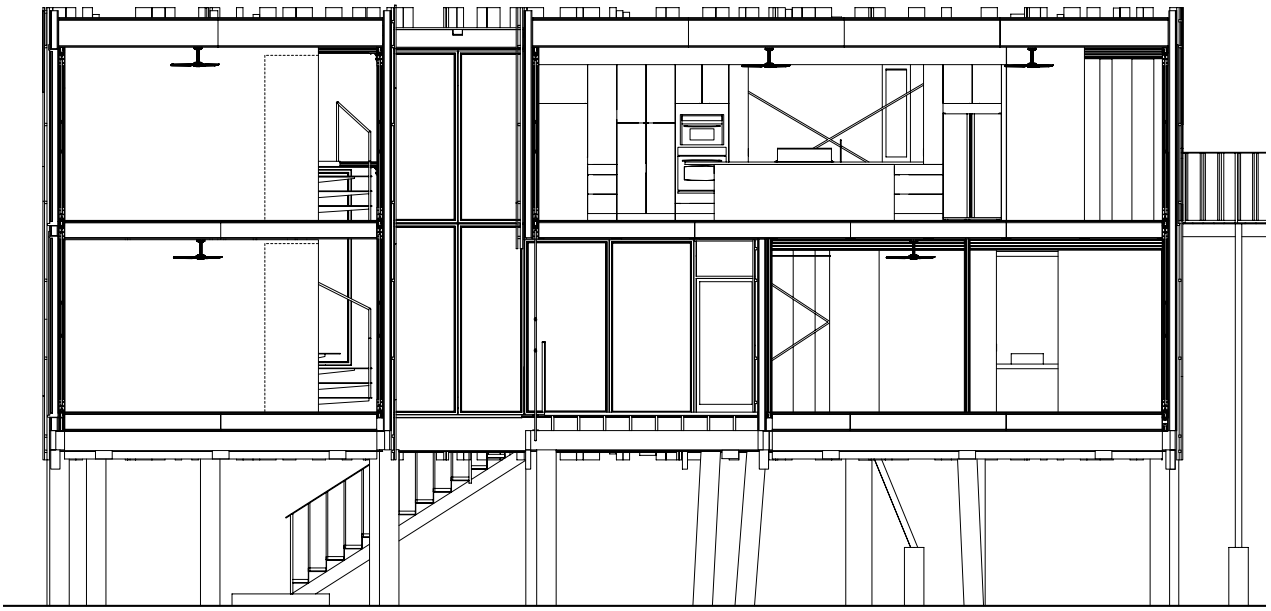
customized for an individual client and a specific site without compromising the clarity of its union of design and fabrication, thereby putting to rest two of the oldest anxieties about factory-made architecture.

The current explosion of interest in digital parametrics runs the risk of accentuating form for form's sake, leading to the architect's gradual abstraction into the algorithms of design rather than the logic of making. Central to KieranTimberlake's philosophy is the belief that digital parametrics hold the promise for a large-scale realignment of design and fabrication. Rather than distance the architect ever further from the actual making of things, digital tools have the possibility of creating a hand-to-glove relationship between design and fabrication, between the testing ground and the conditions of construction and natures of materials. In short, KieranTimberlake's questioning of the division of intellect and labor is characteristic of architecture's very rise as a profession, one that saw the designer progressively removed from the stone yard and timber mill.

In the new realm of computer-enabled mass customization, the architect's earliest conceptions begin with the possibilities of building and the nature of contemporary fabrication. This was a dream that Konrad Wachsmann and Walter Gropius pursued for decades, with notoriously disappointing results. Like Wachsmann, KieranTimberlake's research often leads to a concentration on the joint, a logical necessity of a system that seeks to eliminate wet assembly and extensive site work; but the comparison ends there. Just as the automotive and aviation industries have radically transformed in recent years, so might architectural fabrication move toward a system of subassemblies and greater coordination of just-in-time, robotic delivery of highly differentiated products ready for deft hand-assembly, be these cars, planes, or houses. If *prefabrication* once implied a radical simplification, so that within a Wachsmann house the same panel could be used in the horizontal and vertical planes as a wall, floor, or ceiling, KieranTimberlake's approach introduces the possibility for complex and diverse elements to be assembled into blocks or chunks prior to delivery on site. The combination of what they call "highly serviced blocks" with structural frames is a return to the old modernist separation of frame and infill, or served

and servant, as their distant mentor Louis Kahn defined it decades before Kieran and Timberlake arrived at the University of Pennsylvania and reconsidered that separation in terms of the organization of information and streams of assembly, as seen in other manufacturing sectors, today. The ideal might be the construction of a building the way BMW manufactures cars in its recently completed Leipzig plant designed by Zaha Hadid: each car is a distinct, customized object made up of complex sets of parts and subassemblies. But KieranTimberlake is not content to catch up with the car industry a century after Ford introduced the assembly line. Refusing the whole tradition of types in both classical architectural theory and in the logic of standardization, they hope that the age of information technology will provide the means by which the constructive language of architecture—realized by them in aluminum, glass, and polycarbonate, as well as traditional timber—will provide standardized and optimized elements for a continually renewed act of design. Certainly, the sober beauty and elegance of Loblolly House is a highly promising substantiation of that philosophy.





Introduction

Michael Stacey

Stephen Kieran and James Timberlake are two of the most thoughtful practitioners of architecture working in America today. In their lives they combine practice, research, and teaching. Following in the footsteps of Louis Kahn, they lead a final year research studio at the University of Pennsylvania School of Design. Their constructed projects display a depth of understanding of the art and craft of architecture. In their hands, theory and practice are a single realm, as was ably demonstrated in their 2002 book, *Manual*.

Their practice, KieranTimberlake Associates, is based in Philadelphia and at its core is an active engagement with the means and methods of construction and a committment to research, which they actively deploy in their architecture. From the layered facade of Levine Hall and the aluminum structure of the SmartWrap pavilion, their office has cultivated a strong component culture. The origins of Loblolly House can be traced to research undertaken for the Latrobe Prize, which lead to the publication of *Refabricating Architecture* in 2003.

Kieran and Timberlake's interest in prefabrication appears to have arisen from the careful craftsmanship exhibited in their earlier work, as well as from their pursuit of quality and refusal to accept the current norms of the North American construction industry. There is nothing rhetorical about their architecture; it demonstrates their commitment to solving the key issues that humankind faces in the twenty-first century.

After peeling back the layers of Loblolly House's west facade, you can sit in the living space and benefit from a totally unobstructed view of the Chesapeake Bay and distant sea and sky. Gasholders on the far shore remind you of civilization's impact on this land. Before 1000 BCE the fertile grounds that surround this estuary were farmed by Native Americans. With the establishment of the first New World settlement on the James River at the turn of the seventeenth century, the region was colonized by the British.

Looking west toward the setting sun and the nation's capital, the house is an eloquent critique of the United States' nonparticipation in the Kyoto Protocol and further evidence that we need not take to earth-sheltered bunkers to engage the pressing issue of climate change. The quality of the design of our homes, schools, and places

of work can provide a more sustainable ecology, as evidenced in Loblolly House.

When the adjustable west facade is in the open position, the section *is* the architecture. Each room not only has a view of the bay, it becomes part of the landscape, and this connectivity is further enhanced by the height of the inhabitable spaces. The potential to sleep or study under the stars links this house to precedents of the modern movement: Richard Neutra's Lovell Health House in Los Angeles and J. Duiker's Openluchtschool in Amsterdam.

As the largest estuary in the United States, the Chesapeake Bay retains significant biodiversity despite the consequences of human ingenuity, be these intended or not, from activities such as hunting and manufacturing. In 1639 Maryland established game laws to protect certain species of birds, including the great blue heron. Homeowners Stephen and Barbara clearly value the ecosystems of the bay. The polycarbonate screens on the west facade take inspiration from local duck blinds, without recourse to hunting. The use of prefabricated components to enclose the sophisticated building systems minimized the impact of construction on the site. Resting in this wooded landscape, the house itself seems to touch the ground only lightly, and the site below is already being reclaimed by indigenous species.

Even though Loblolly House is located in Taylors Island, Maryland, below the Mason Dixon Line, where summertime temperatures peak in excess of 100 degrees Fahrenheit with relative humidity averaging at 75 percent, it has been designed with minimal need for mechanical air-conditioning. This energy-hungry invention is one of the major reasons why America's carbon footprint is four times the world average. We need to uninvent this technology and learn to provide comfort without relying on petroleum-based energy sources. Loblolly House is a bold step on this journey. KieranTimberlake is monitoring the performance of its adjustable facade, which preheats the air in winter and provides shade and ventilation in summer. The budgets of many modern buildings are dominated by the costs of services, but creating comfort via the building fabric returns the investment to the visible architecture and reduces the demand for energy.

Loblolly House is not only a statement in favor of a more ecological approach, it is an essay in prefabrication

that exemplifies KieranTimberlake's engagement with craft, industry, and manufacturing. The new techniques they utilize, including scaffolding, blocks, and cartridges, are described in detail in this book. Loblolly House demonstrates that prefabrication has the greatest possibility of success when used in a hybrid manner, combining the advantages of highly serviced blocks with structural frames. The spaces created within a home should not be limited by the dimensions of production or the maximum sizes of transported goods. Nevertheless, prefabrication will evolve into an established construction method in the twenty-first century because it is an effective means for delivering quality while minimizing waste. Construction need not resemble trench warfare—it can be carried out in the controlled environment of a factory. For example, Loblolly relies on *floor* and *wall cartridges*. The floor cartridges, which contain prebuilt service systems, are considered "smart"—they were simply plugged in by the carpenters at Bensonwood Homes. It is an example of building services nearing the simplicity of an Apple computer: a plug-and-play architecture.

The timber piles that elevate the house are not the rhetorical *piloti* of the modern movement. Because the house is sited on the shore of a barrier island, they are essential for flood protection. The piles were driven into the ground at diverse angles, as is the norm in many jetties. If the architects had listened to the piles, they would be orthogonal, because as they were driven into the ground, many sought to become vertical. A kind of engineered timber called Kerto was then used to transfer structural loads between the rough-hewn piles and precise aluminum framing.

Loblolly House is a rare example of a multistory structure that utilizes aluminum as the primary material. Since the 1950s, aluminum has been the metal of choice for curtain wall substructures. In Europe, 52 percent of it is produced using hydroelectricity, significantly reducing its embodied energy, and 92 percent is recovered when buildings are demolished. Recycled aluminum uses only 5 percent of the energy traditionally needed to win it from bauxite. Used wisely, it can be a very sustainable metal.

Professor Colin Davies, author of *The Prefabricated Home*, might judge the success of Loblolly on whether

it remains a prototype or is made into a product that can be adapted to many locations. Stephen and James are working with LivingHomes to develop such a system. Market-driven architecture, especially housing, too often lapses into the lowest common denominator, but product-based architecture should remain thoughtful and offer new and well-considered opportunities to the North American housing market.

Upon entering Stephen and Barbara's shoreside residence I was struck by how delightful it is. In a world filled with so much banality—I had driven past miles of enormous detached houses, each with at least one SUV parked outside—the beauty of this site-specific home is satisfying in itself. It reminded me of John Winter's review, published in 1976, of Michael and Patty Hopkins' house in Hampstead, London, where he observed, "This is their home and not housing." The contribution of Barbara, as client, and the advice of Marguerite Rodgers on the interior design parallels the creative influence of Margaret and Frances Macdonald in the work of Charles Rennie Mackintosh.

Loblolly House gains its authenticity from the integration of space, structure, and adjustable environmental systems. Though crafted from aluminum, timber, glass, and polycarbonate, it shares a kinship with the arts-and-crafts homes of Greene and Greene in its exposed structural elements and in its acceptance of materials. Loblolly House is not a slick, super-product of surface architecture. The architects were searching for substance, not style.

The inventive facade combines two standard products, polycarbonate-clad hangar doors and double-glazed patio doors, both of which slide and fold, dematerializing the facade almost effortlessly. In comparison, the eighty-foot-wide retractable plate-glass window used by Mies van der Rohe in the Tugendhat House seems like an act of tectonic drama. Distinguishing these houses is an eighty-year period of dynamic technological development, which included the invention of polycarbonate in 1953.

Kieran and Timberlake have not fallen into the trap of formalism that has enmeshed so many contemporary architects. A 1:1000 scale model of the house reveals just how carefully they conceived the proportions and nuances, such as the cutout that facilitates access to the roof. The house was designed using a building information

model (BIM) to define the components, though it is the pixelated aesthetic of the timber rainscreen that is most suggestive of the use of computers. This cladding, which camouflages the house among the loblolly pines, truly reflects the tools and era in which it was designed.

Prior to founding their own studio, Stephen and James both worked at the office of Robert Venturi and Denise Scott Brown from the late 1970s to the early '80s, but after a visit to Loblolly House, a guest may well believe they had worked in the office of Charles and Ray Eames. One finds no trace of the quirkiness or graphic postmodern aesthetic of Venturi and Scott Brown, as in the Vanna Venturi House, built in 1962. If any connection can be made to architects of British origin, it is to be found in the influence of Louis Kahn on Richard Rogers, Norman Foster, and Michael Hopkins. Philosophically, the house appears to be informed more by Reyner Banham's *Architecture of the Well-tempered Environment* than by Venturi and Scott Brown's *Complexity and Contradiction in Architecture*. Nevertheless, Loblolly House risks being misunderstood in the same way that Charles and Ray Eames' 1949 Case Study House #8 has been misunderstood. Sure, it is assembled predominantly from components that anyone can find in a catalog, but like the Eames House, it is a wonderful demonstration of the architects' skill in crafting a family- and site-specific home.

In *Refabricating Architecture*, Kieran and Timberlake bemoaned the construction industry for being asleep for the last eighty years. Coincidentally, eighty years have also passed since the publication of Le Corbusier's *Towards a New Architecture*. While most industries have benefited from the technological inventiveness of the last century, construction enterprises have sleepwalked into a counterproductive state of mediocrity characterized by the American architect's active disengagement from the means and methods of building. Enshrined in the American Institute of Architects' standard Form of Appointment is language establishing the avoidance of risk, which essentially has translated into losses of opportunity and authorship. Kieran and Timberlake are proposing a way to deliver quality architecture at a reasonable cost and in less time, through the use of prefabricated building components.

Their last book ended with a call to arms: “We invite the world of construction to begin anew with these processes that can make everyone’s world and the architect’s work better.” The vision presented was rather corporate, with houses being built by a worldwide assembler, such as Boeing. Through Loblolly House, completed in 2006, Kieran and Timberlake have demonstrated their commitment to ecologically responsible architecture. Working closely with the fabricators and builders at Bensonwood Homes, they have delivered on the argument set forth in *Refabricating Architecture*, and the reality has proven more promising than the polemic. Unlike 1960s mass housing, the reality is no longer corporate. It’s personal, and it is delivered with authenticity.

Provocation

Stephen Kieran

The environment has co-opted sustainability. Just as concerning as the environment, less recognized, and even less acted upon are the escalating costs and declining quality of design and construction. By equating sustainability with the environment, we limit our ability to advance a truly robust plan of environmental reparation. The rising cost of construction (disproportionate to the rest of the economy), the ongoing decline in the craft and quality of architecture, and the daily damage our buildings inflict upon the environment represent a daunting confluence of forces for change. In this challenge, we see great opportunity. Unseen synergies between these factors—quality, affordability, and the environment—offer a broadly based agenda for a more sustainable way forward. And they formed the aspiration for the design, fabrication, and assembly of Loblolly House.

The profession of architecture is in the midst of a crisis of confidence, both in the capacity and the desire to realize much needed improvements in productivity and efficiency. If we continue to ignore the industry's needs, we do so at our own peril. With each passing year the affordability crisis worsens. Construction costs continue to outpace the general economy by a factor of two-, three-, and sometimes four-to-one, creating an inflationary spiral, year in and year out. With every 1 percent increase, more people are denied access to quality housing and home ownership. Underlying these economic realities is the fact that productivity throughout the design and construction industries has been on the decline for the last several decades. While other sectors of the nonfarm economy have experienced gains in productivity of more than 80 percent over the past forty years, ours has witnessed a 20 percent drop. Compared to the rest of the economy, this 100 percent swing—with other industries experiencing 80 percent growth and ours a 20 percent setback—is not only unacceptable, it's unsustainable.

Once synonymous with quality craftsmanship and symbolizing the highest levels of human achievement, our buildings are, more often than not, seen by the public as bastions of mediocrity. With each passing year, the litany of problems associated with incomplete, incorrect, or poor workmanship grows longer. In most cases, quality is applied after the fact, if at all. This method of

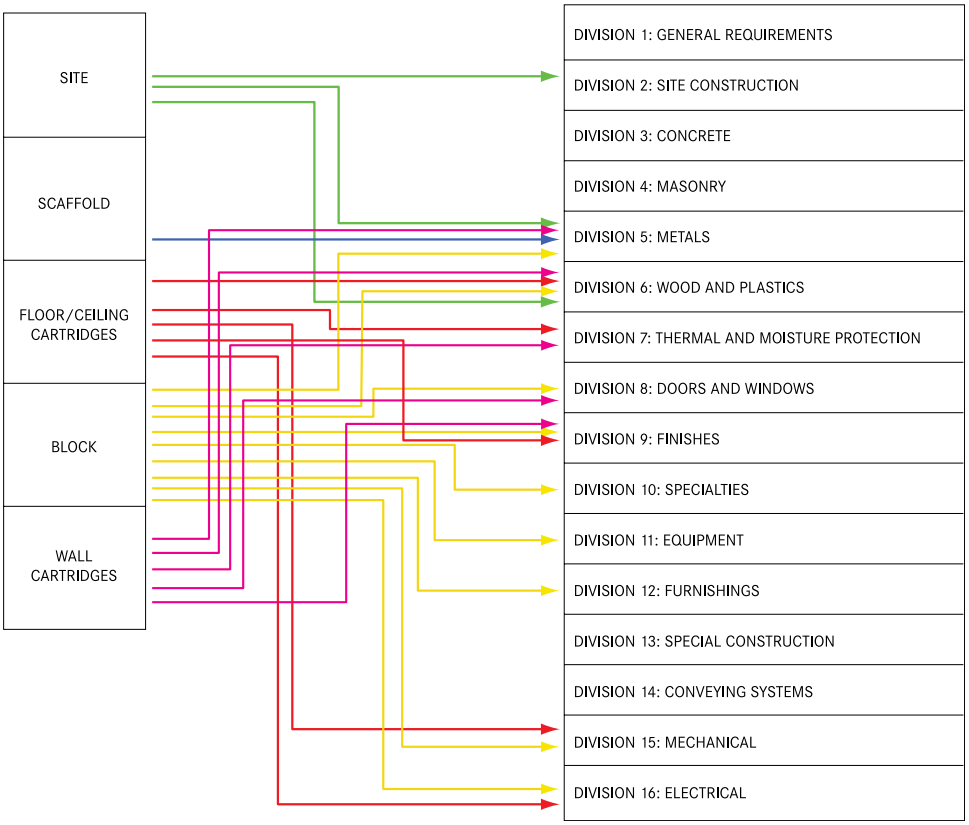
operation is built into the existing process, with a "fix it later" work ethic and a "talk the owner and designer into accepting the compromises, because we are behind schedule and over budget" approach to problem solving. Only occasionally is quality deeply and intelligently embedded within design and construction processes. The consequences of these inadequacies spill over, rather dramatically, into another realm: that of our responsibility to be stewards of the natural environment. For example, poorly designed and improperly installed cladding systems abound, leading to increased air infiltration and unmanageable moisture transfer through exterior walls. The result: additional and unnecessary energy expenditure and subquality indoor air. These problems are further compounded when substandard cladding systems are coupled with maximum horsepower building systems designed to compensate for the building envelope's unpredictable performance.

The ecological footprint that we leave on the natural world continues to deepen. If we proceed with business as usual, the consequences of this footprint will escalate. Growing worldwide populations will demand more of the world's natural resources, including water, energy, air, and raw materials. Mitigating the environmental impact associated with this rise in demand remains the focus of many environmental groups. While their efforts are beneficial, they do little more than offset the already enlarged footprint associated with our expanding population. In truth, our paradigms of consumption must change, if only to repair the damage exacted over the past few decades.

The mandate of sustainability is threefold: improve the productivity of design and construction, enhance affordability and quality, and do so in an ethical and aesthetically moving manner. This mandate is not optional. Increasingly, our clients demand it, and the people who use our architecture deserve it. The question for all engaged in design and construction is whether we have the desire, insight, and resourcefulness to seize the challenge that the current crisis affords. Sustainability's three main objectives—cost, quality, and the environment—are interdependent. Instead of prolonging our current paralysis, we must seek ways of understanding how these crises connect, rather than confound.

Since there are few models of efficiency in our own industry, we must look elsewhere for solutions. In the early 1990s the automotive industry faced a similar crisis of productivity and responded with a swift and expansive restructuring of its design and fabrication processes. By 1990 the 4,000 parts that evolved from the Model T to compose the contemporary automobile came together one by one at the factory. Over a remarkably short period of time, these production methodologies were reconstituted as subsets of fifteen or fewer integrated component assemblies, each fabricated by external suppliers who assisted in the design. For example, the more than 200 parts that made up a dashboard were collapsed into a single, integrated component with quick-couple connections for attachment at the point of final assembly. Instead of a single point of focus for the assembly of all 4,000 parts, the process was dispersed, allowing for multiple centers of focused design, innovation, and production. Each integrated component undergoes its own quality control prior to arriving at the main plant. Owing to the fact that substantially fewer joints were arriving at the final point of assembly, it became possible to enhance quality control for the few remaining connections. The results of this redesign process were higher productivity, lower cost, and improved quality. In lieu of the sequential, part-by-part weaving together of an automobile, the process is now conceived as a quilt of integrated components.

Toyota, of course, became the master of these new strategies. Underlying the design and production of their vehicles is a set of beliefs aligned with the current mandate of sustainability. At a time when most American automotive manufacturers are under competitive assault, Toyota is thriving precisely because it has comprehensively dealt with these challenges. Intrinsic to their practice is a relentless focus on the process itself. Individual outcomes (automobiles) are seen as stages within a neverending effort at self-improvement. Within their design philosophy the concept of a static type and the notion of perfection are irrelevant. Their culture insists upon ceaseless criticism and continual progress, driven by the ideals of better quality and enhanced design, delivered in less time and lower cost. More often, their processes are focused on environmental concerns, such as reducing



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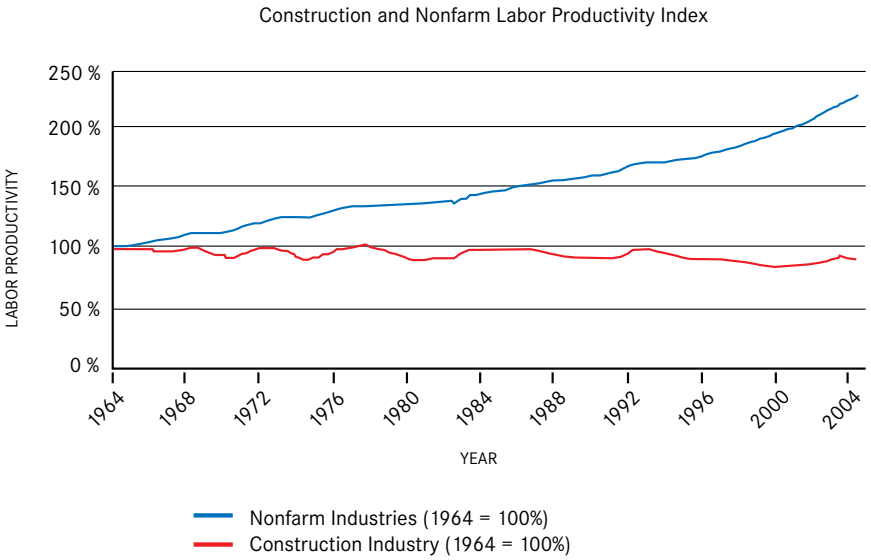
The 40,000 parts that make up the average American house collapse into five integrated construction elements



Reference: Paul Teicholz, PhD, Professor (Research) Emeritus, Dept of Civil and Environmental Engineering, Stanford University

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Productivity losses in the construction industry as compared to gains in other sectors of the nonfarm economy

carbon emissions and improving fuel efficiency. As a result, Toyota not only possesses significant cost and quality advantages, but they have simultaneously become the worldwide leader in hybrid technology. Every member of the company participates in this neverending effort guided by a singular ethic of improvement, with many of the design, production, and environmental process innovations, big and small alike, initiating with workers, not with management.

In contrast to the fields of industrial design and manufacturing, architecture and construction have been devoid of substantive change. Except for a few isolated gains in productivity, the overall trend has been downward, resulting in escalating cost and declining quality. Energy consumption continues to rise, with little regard for water and material conservation. In fact, according to the National Association of Homebuilders, a recent study revealed that the typical American house consists of more than 40,000 parts, most of which arrive one by one at the site for field erection, stick by stick.

If 80 percent of an automobile consists of integrated component assemblies built away from the point of final assembly, then the American house is its polar opposite, with more than 80 percent of its parts coming together at the site to which they are anchored. The time and costs associated with building a home increase as more systems are added. These expenditures stand in contrast to the productivity gains realized by other industries, where integrated, prefabricated assemblies are the norm. Meanwhile, with respect to quality, architecture and construction's failure to innovate is even worse. A study conducted in Florida found that more than 40 percent of new homes have "significant quality flaws."

It is widely known that average household energy use in the United States can be as much as four times that of other developed nations. According to a University of Michigan analysis, the conventional developer-built house will consume more than 15,000 gigajoules of energy over a life cycle of fifty years. This figure could be decreased *right now*, not five years from now, to 5,000 gigajoules, using existing design and fabrication strategies. The fragmented nature of the housing industry, however, works against any efforts to diffuse the skills, knowledge, and resources necessary to realize sizable

reductions in energy use. Judging by the integration strategies adopted by other industries, the means for acheiving higher productivity is through controlled implementations that reduce the overall environmental footprint.

Our objectives for the design, fabrication, and assembly of Loblolly House were as follows: create a house that evokes the extraordinary natural world that is its home; then redesign the process of design and construction, embedding within it an environmental ethic that privileges efficiency and quality. The central tool underlying our process was a parametric building information model (BIM), which provided the level of geometric certainty needed to shift the paradigm of design from a sequential, gravity-driven construction process to a simultaneous prefabrication process with integrated components and on-site assembly. Like automobiles, ships, and aircraft, Loblolly House was first built as a virtual artifact. This simulation was the mechanism that enabled simultaneity. The site no longer served as the factory, and nearly 70 percent of the effort shifted to off-site integration and fabrication. Our long-term objective, however is to altogether obliterate the Construction Specifications Institute's ever expanding system of nomenclature. Today, nearly fifty divisions of materials and equipment classify tens of thousands of products into a confusing and disjointed array of parts. In its place, we propose to simplify, merge, and unify these materials and environmental systems—structures, windows, doors, and finishes—into integrated assemblies, which we consider to be the *elements* of a new architecture.

Just as the site inspires an elemental house derived from nature, so does the process inspire a return to an elemental architecture, almost classical in its nomenclature: scaffold, cartridge, block, fixture, furnishing, and equipment. The 40,000 parts of the conventional American house—spanning fifty CSI divisions—collapse into several component types, ready for site assembly. With this new focus on integrated components, there are fewer joints. Quality, craftsmanship, and performance are greatly improved. While the existing on-site practices for home construction remain dispersed among thousands of small-scale builders (who lack knowledge of or access to best-practice environmental initiatives), a