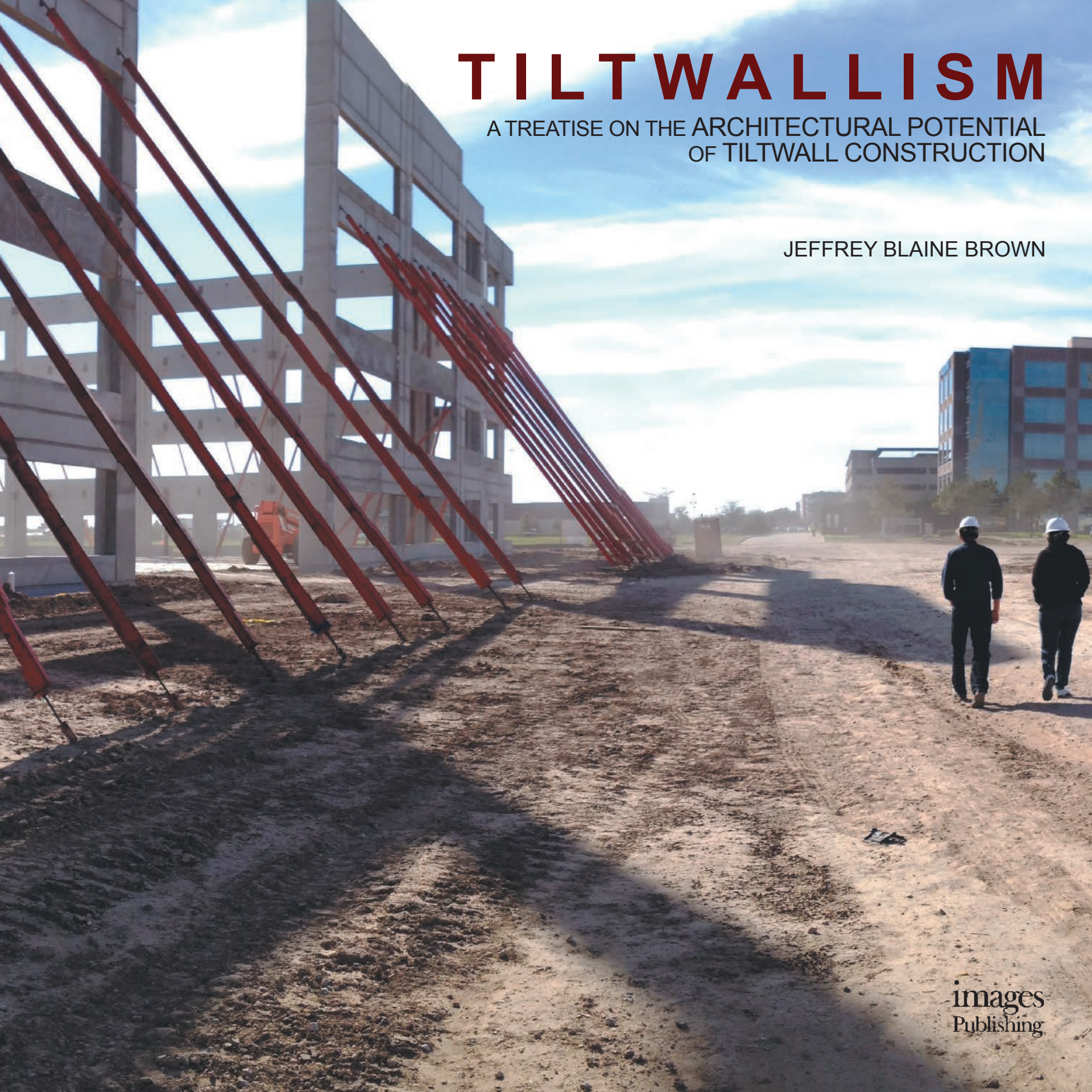


# TILTWALLISM

## A TREATISE ON THE ARCHITECTURAL POTENTIAL OF TILTWALL CONSTRUCTION

JEFFREY BLAINE BROWN

images Publishing

# INTRODUCTION

Architectural education and its relationship to architectural practice have changed a great deal across the last 50 years. Design theories have come and gone, and while the design studio remains the international pedagogical anchor for most architectural curricula, a direct connection between the design studio and architectural practice, perhaps even between the studio and *making architecture*, has waned. Architectural education has become a discipline unto itself, apart from the practice of architecture.

Several factors have fueled this shift. Guidelines for faculty members' advancement have often been standardized across the many disciplines represented within today's large public universities. For evidence of achievement in academia, tenure and promotion guidelines now often favor more traditional forms of faculty-member scholarships compared to more discipline-specific activities such as writing poetry, making art, or producing architecture. Because of the ever-present, heightened contemporary threat of litigation, university committees and administrators seek university-wide objectivity with clear, irrefutable consistency in evaluating faculty members' scholarships.

Meanwhile more "peer reviewed" venues for presenting and publishing papers (such as the conferences organized by the Association of Collegiate Schools of Architecture) have developed and grown. Thus, instead of producing buildings, today more and more architects teaching in architecture schools write papers on focused research topics to satisfy the "publish or perish" requirements for advancement in academia. Simultaneously, practitioners increasingly view architects in academia and their scholarship as being products of ivory towers and as being irrelevant to the daily challenges encountered in architectural practice.

This book is written by an anomaly to this trend. Here is an architectural teacher who runs a practice and makes architecture, and who is perhaps even more unusual because he is simultaneously exceptionally well versed in architectural history and theory, even among academics. Perhaps rarer still, Jeffrey Brown also sees no implicit conflict between the goal of making architecture imbued with our highest goals and our concurrent adherence to the constraints produced by the realities of typical American commercial enterprise!

When I think of where we are now regarding the relationship between architectural education and architectural practice and how we got here, I find this a very hopeful book. Jeffrey senses a current trend of a heightened interest in re-engaging the actual materiality and processes of making buildings. He also sees the possibility of new architectural theory arising at the cusp of this renewed interest and our making architectural form, and he proposes that theory should be produced from within the disciplines of design, architecture, and engineering through questions arising from actions, and processes related to making buildings. *TILTWALLISM* encourages teacher and practitioner alike to look inside architecture for meaningful research and theory topics rather than (or at least in addition to) outside architecture. Here design theory could spring from designing and making buildings rather than being imported and overlaid from "outside" architecture. Jeffrey also sees the possibility of architectural theory being a continuum, with testing. Unlike some more esoteric forms of architectural theory popular in the last century, *TILTWALLISM* explores the potential for architectural theory to be proven through its application (as in other disciplines), but importantly, what is "tested" in this instance is a synthetic, whole building design rather than a small isolated piece of a building as is often the case in much academic research today.

*TILTWALLISM* champions Tilt Wall construction as a particularly rich territory for this research and for formal invention. In Jeffrey's view Tilt Wall is a new form of "global vernacular" that enables a response to the ubiquitous need for cheap, direct, and fast construction. But *TILTWALLISM* also sees the architectural value of Tilt Wall as not implicitly constraining its efficiency as a construction process or its economy, and conversely, the economy and efficiency of Tilt Wall construction is not seen here as diminishing its architectural potential. Because it operates at architecture's base level of construction and structure, the system is seen as capable of fostering clarification and refinement within architectural proposals. Here Tilt Wall, as a way and means of making, is viewed as primarily structure; and when structure (here the Tilt Wall system) is coupled to program and design skill, elegance is possible. Historically a similar formulation for elegance can be found in many works—particularly in the direct and efficient structure and beautiful design elegance of Robert Maillart's work. *TILTWALLISM* shows that with Tilt Wall, function, construction, and meaning are inextricably linked. I am reminded here of a quote from the Pritzker Prize and RIBA Royal Gold Medal winning architect Rafael Moneo, who spoke of architecture "arriving" at the point "when our thoughts about it acquire the real condition that only materials provide".





# Tilt Wall — A Brief History
01

***"Well, one thinks about the lawyer with a whole library bound in blue morocco behind him. This is the inventory of cases bearing upon the specific case that he is requires to judge. So simply to pronounce a legal innovation, to discriminate the new, our jurist is obliged to consult the old and the existing; and it is only by reference to these that genuine innovation can be proclaimed. For are not precedent and invention the opposite sides of the same coin? I think a better topic might have been: How does the new invade the old and how does the old invade the new?"***

***Colin Rowe, Letter to the Editor,***
**The Harvard Architecture Review, Vol. 5.**

The history of Tilt Wall construction has to be teased out, like a beneficial genetic mutation, from the seam between the pre-modern formative period and that of late Industrial Revolution hubris in the early 20th century. Imbricated in construction history, Tilt Wall construction has concomitantly been retarded as an independent architecturally important development. Steel frame construction, the elevator and poured-in-place concrete methods, as didactic independent building techniques, have architectural influence on aesthetic design potential up to the current day. Tilt Wall construction, invented at the same time as these methods and techniques, has also persevered and, indeed in many markets, has become a globally dominant approach to building; yet it has never received intense investigation regarding its architectural design potential, let alone its unique developmental history. As the Tilt Wall method became dominant as a commercial and increasingly popular architectural method, its history is all the more important to understand. Many of its methodological siblings like those described above have been radically modified, totally integrated into synthesized hybrid approaches, or have become outdated, yet the proposition of Tilt Wall construction as a particularly potent architectural approach to conceiving of form has never been stronger.

Several conditions illustrate the conundrum as to why it has not been more celebrated even as it has become a dominant method: 1) It lacks the pedigree or purity of material developments such as concrete, with which it is both dependent upon and developmentally intertwined; 2) Similar approaches to construction systems and strategies such as "Chicago frame" or the residential adaptation of "balloon frame" construction technologies are far more integrated with architectural history and thus influence, and finally, 3) Tilt Wall construction has more in common with parochial methods of cultural procedures such as barn raising, at least considered as a commercial manifestation of technique rather than any kind of communal activity. Tilt Wall, at least, has in common with barn raising its conception as a unitized system of efficient building. In some ways, the fact that Tilt Wall has persisted to become so prevalent as a building method without the support of nearly any scholarship speaks to a deeply-embedded media / historical narrative that repeatedly privileges cultural activities like barn raising over commercially applied vernacular techniques like Tilt Wall. Thus, a surprisingly small number of sources record scant information regarding detailed development of Tilt Wall construction as a method.[1] Rather, it has evolved to its current state organically along several parallel vectors into a uniquely American approach to construction.



## Origins

Tilt Wall's known history begins in the early 1900s with Colonel Robert H. Aiken, at one point an army engineer, pioneering the technique of pouring concrete slabs and tilting them into place as rifle range target abutments. Aiken, given the patents he filed in relation to ferroconcrete reinforcing techniques and tilting devices appears to have been possessed of a degree of assiduity in his adopted field of construction. Several articles spanning from 1908 to 1917 in trade publications of the day such as *Keith's Magazine on Home Building*, *Concrete Era*, *Concrete Engineering* and *Cassier*, cover Aiken's efforts in the building of structures using Tilt Wall as well. Much of what is known of Aiken is found in a paper titled, "Monolithic Concrete Wall Buildings—Methods, Construction and Cost" which he produced for presentation at the Fifth Convention of the American Concrete Institute (ACI) held in Cleveland, Ohio, on 13 January 1909. The summary of proceedings show he was not in attendance and a W.S. Abbott presented the work in his absence. Given that Aiken pioneered the method and that this short paper constitutes the known origin of its history, a brief overview is in order.

The first few paragraphs set up the introduction to what Aiken describes as a "new mechanical method of erecting buildings with concrete", supported by facts and statistics indicating the increased availability of concrete in the states from 1885 to 1906. To provide context to his declarations, it is worth noting Kenneth Frampton has recorded, in relation to a description of the American pioneer of reinforced ferroconcrete Ernest L. Ransome (author of *Reinforced Concrete Building*, 1912), that after 1895 the use of concrete in the United States becomes less dependent upon the importation of European cement, and thus establishes hegemonic status as a construction material nearly overnight. Aiken, prone to perspicacity, secures the brief introduction with the declaration of "a New Age of Concrete". This is evidence of the intoxicating times during which he practiced: that seam between the last vestiges of the Industrial Revolution and the rapid technology infusion of the pre-modern one taking its place. He gives a brief description of what will have to suffice as the invention of Tilt Wall construction that involved the pouring of five-foot-tall panels lying on the ground then raised to the vertical via a "derrick" (he anecdotally annotates as "horse drawn") onto an existing foundation then secured with pre-placed reinforcing bars. The function of this "tilted up" retaining

Colonel R. H. Aiken

Irving Gill

La Jolla Women's Club and Clubhouse under construction

La Jolla Women's Club and Clubhouse

## Integration into Modernism

Beyond Aiken, early significant practitioners of the Tilt Wall technique were limited, but as a matter of rearguard action it must be noted that while Thomas Edison created a cluster of reinforced concrete houses in 1908 at Union Village, New Jersey that still exist today,[v] they were form cast and not, as is often claimed, Tilt Wall construction. Interestingly, Thomas Fellows advocated a similar interest in tilting walls into place and in or around 1910 utilized a variation on Aiken's method for a low-cost demonstration house. His method, described in an article in *Southern Contractor and Manufacturer* magazine, used an eyebolt system in which rods tied the panels together at the vertical joints, later to be grouted. Interestingly the article describes a crane that lifted the panels into place, a precursor of the perfection of the method many years later. As to whether Fellows had knowledge of Aiken's system, we can only speculate. It may, for example, be a case of what physicist Freeman Dyson has termed "complementarity". Roughly defined, it is the simultaneous unconnected invention of similar theories. But that Aiken's system was known on the West Coast, we know to be a fact.

Tilt Wall construction briefly interested California regionalist architect Irving Gill, who experimented with it in several projects and as a business. Gill was inveterately interested in innovation and materiality in his work. He combined this with a passion for the craft and making of his buildings, often creating integrally cast doorframes for his early cast-in-place houses, along with developing shop-fabricated wall panel systems and approaches to heating / cooling system approaches. Frank Lloyd Wright's son, Lloyd Wright, worked for Gill, as did Gill's nephew, Louis Gill, at a time in San Diego in which contractors built all but the public buildings and larger residences.[vi] Irving Gill was unique in his interest in overcoming the exclusion of architects from everyday building types; the symmetry with current or contemporary trends is stunning. With the purpose of building more economically and more quickly in order to compete with the then dominant contractors, Gill purchased the rights in 1912 to the by-then bankrupt Aiken Reinforced Concrete Company.[vii] Gill first used it on the Banning House in 1913 to the amazement of neighbors, according to Sunset magazine at the time.[viii] In 1914, Gill partnered with Louis to create the Concrete Building and Investment Company in order to build low-cost housing. There is, of course, a parallel in that Aiken also utilized the method for low-cost (in his case barracks) housing and that both men saw in Tilt Wall construction the intersection of architecture and business. In some ways, they were early John Portman-types, with Gill exhibiting a modern developer sensibility. Gill has been accepted into architectural history more for his early adaptation of Modernism in regionally inflected work, significant in his opus the La Jolla Woman's Club for which he utilized the Tilt Wall method to conceive of and construct just prior to forming the building company. The company ultimately failed at great cost to Gill. Suffice to say, it has been the Tilt Wall industry that has revived research into Gill on this subject, not Gill who pushed it forward in history.

Irving Gill also gave Tilt Wall one additional dimension to its pedigree in high Modernism by introducing Rudolph Schindler to the method. While Gill had the aesthetic implications of Modernism in mind with construction playing a secondary role in his work, Schindler's work is defined and characterized by his search for the moral depths of Modernism; the relationship to form and craft were important areas of his investigation. Lloyd Wright, with whom Schindler had worked during his time at Taliesin in Frank Lloyd Wright's employ, introduced Schindler to Gill and his work. In fact Schindler recorded some of Gill's Mission Revival style work while on a tour in California in the early 1920s and also visited Gill in his office. It is there that Schindler presumably became aware of the Tilt Wall method. He employed it in the design of his home and studio at Kings Road, directly across the street from one of Gill's most significant residential projects, the Walter L. Dodge House in Los Angeles. Schindler's use of the method in the Kings Road house was, at best, secondary, but still innovative. He poured one-story walls—that would contain the main rooms of the connector between wings of the house—on the slab and utilized a block and pulley system to tilt them into place vertically. The edge of each wall, at the joint between panels, was left as a gap into which a thin glass "connector" articulated each panel joint.

## Lacunae—contemporary diaspora

After Tilt Wall's flirtation with high Modernism, it sank into anonymity for several decades as the war retarded the commercial construction industry. However World War II and its economic aftermath sponsored a need to build quickly and economically. Surviving the war as a technique but shedding its high modern pedigree, Tilt Wall was revived as the way to

Rudolph Schindler

Kings Road House under construction

Kings Road House

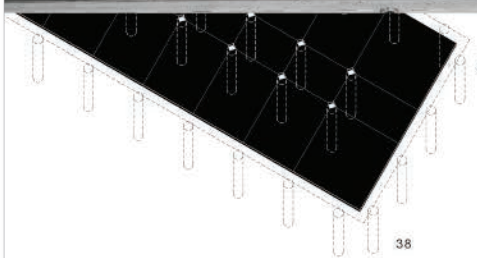




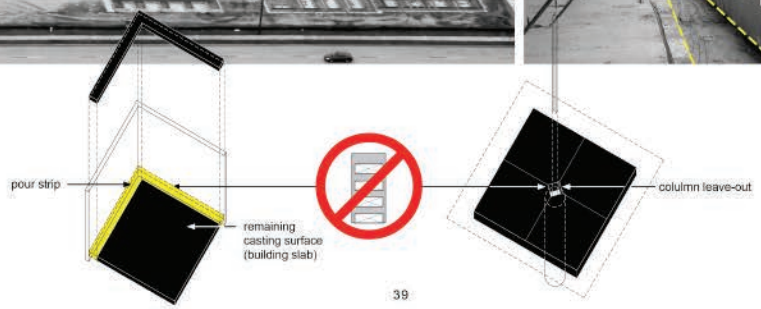
# CASTING SURFACE

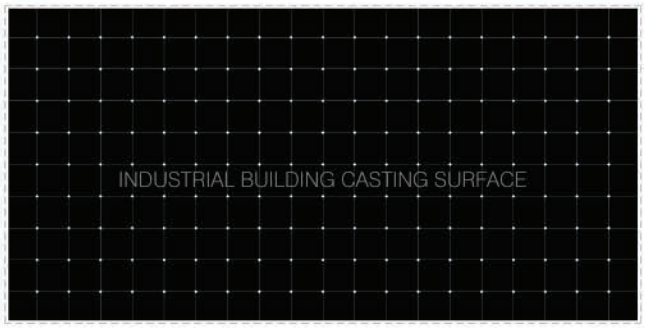
(engineer) **flat** casting surface (minimal ponding water after rain) with hard-trowel finish

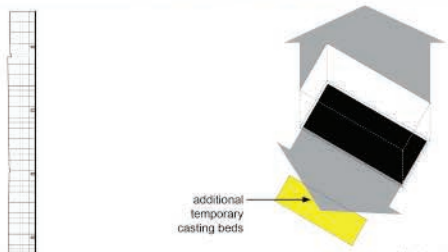


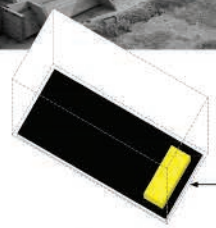


(contractor) **grade prep** is extremely important in both industrial and multi-story applications due to **increased loading** on the slab, whether it be cranes, concrete trucks, pump trucks, or even bracing

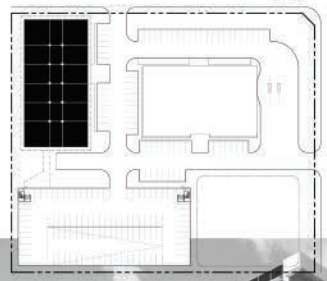


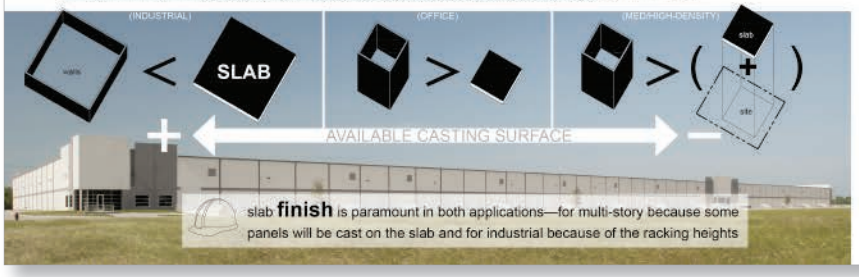



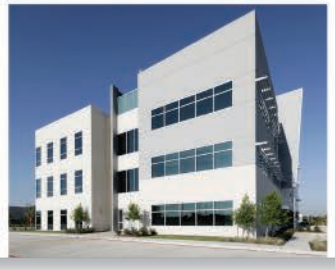









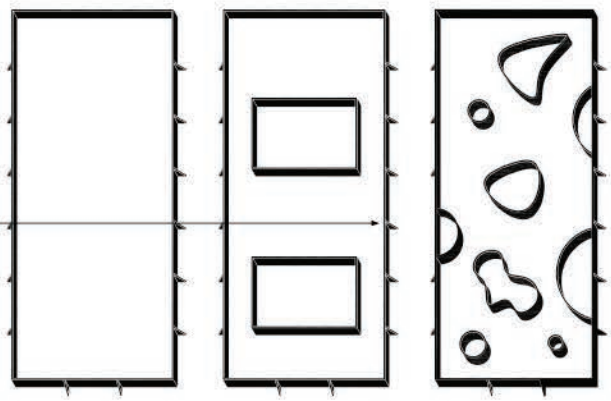



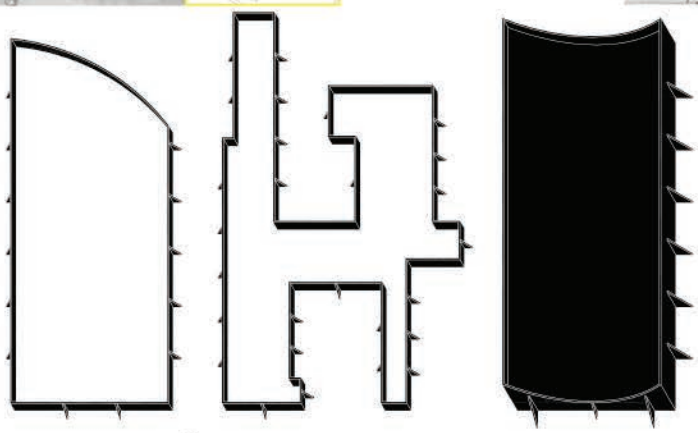
# FORMS

ensure compatibility of **bond breaker** with curing compound

chamfered **edges** to avoid 90-degree corners in concrete

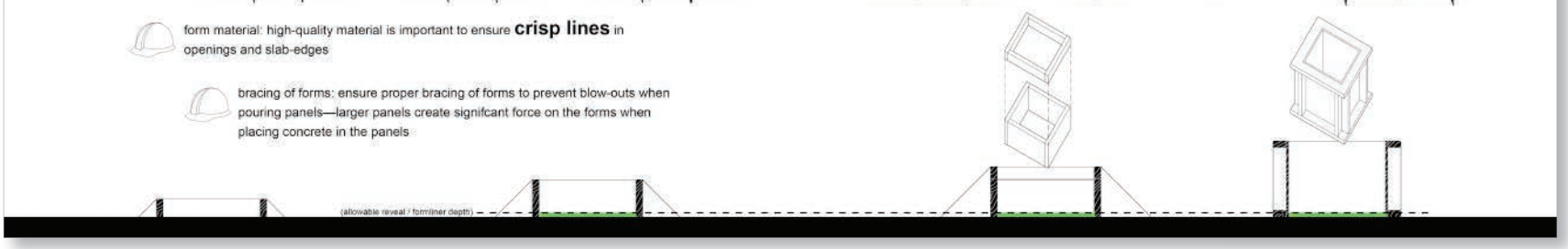
strong enough / **braced** enough to not move at concrete placement





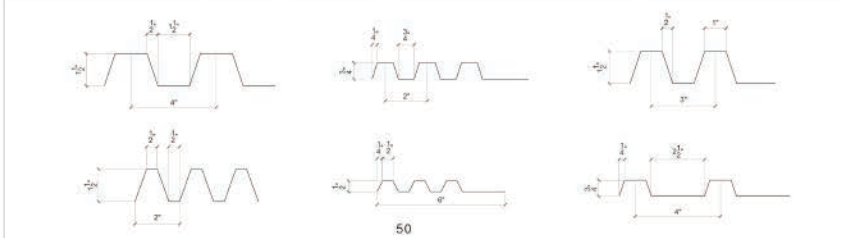
form material: high-quality material is important to ensure **crisp lines** in openings and slab-edges

bracing of forms: ensure proper bracing of forms to prevent blow-outs when pouring panels—larger panels create signifcant force on the forms when placing concrete in the panels



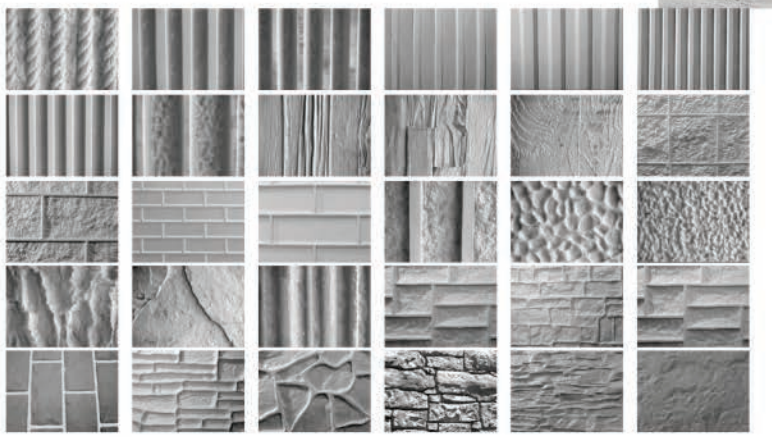
**aligned** from panel to panel

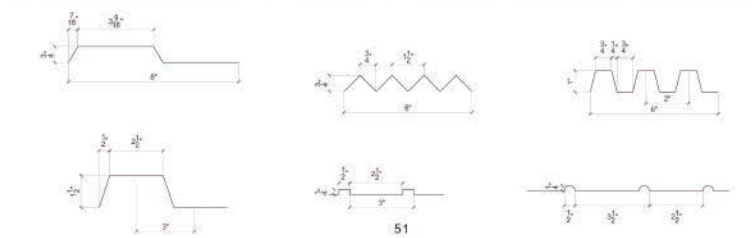
**caulked / sealed** to avoid concrete-paste bleed-through





reveal material: should be **high-quality** material to **prevent weather damage** while stored onsite or in place





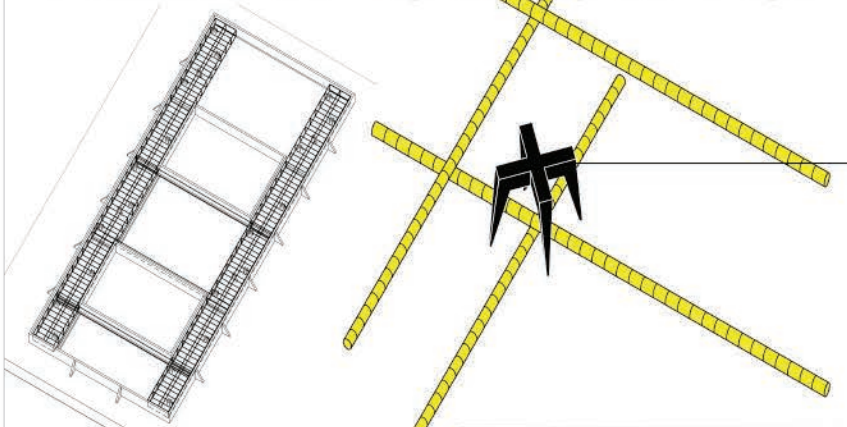


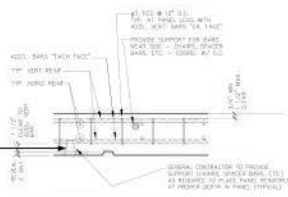
# REINFORCING

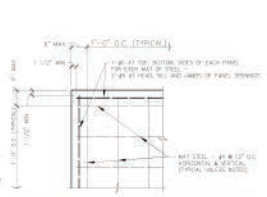
minimal rust and free of bondbreaker / chemicals / oils

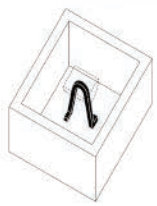
diagonal bars at re-entrant corners

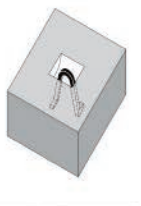
enough **support chairs** so mat does not settle / deflect / displace when concrete is placed







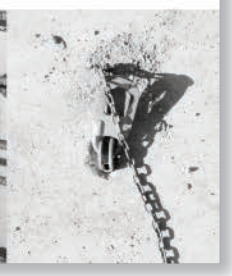
reinforcing **too close to the surface,** or any other material at the surface, will result in imperfections in the panel finish or rust spots at the least

care should be taken to ensure that the reinforcing steel is in the **proper location** within the panel, as the greatest load on the panel occurs in the lifting process

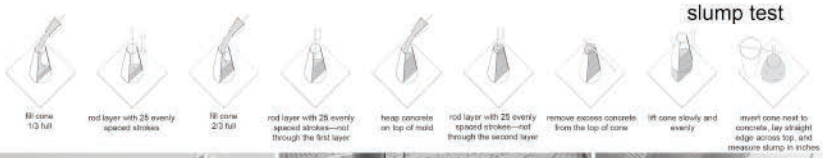


additional reinforcing should be, and often is, considered in the panels by the lifting engineer, not only at the lifting hardware, but around the openings and in the panel legs

lifting inserts must be designed by the **lifting engineer**



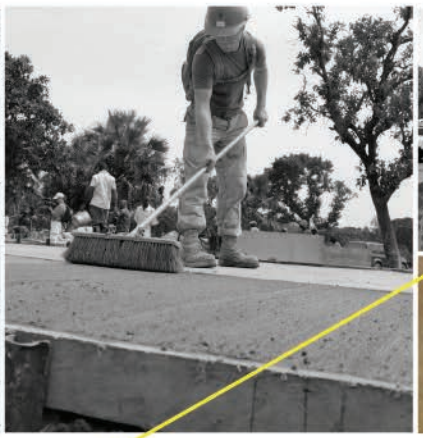
## slump test

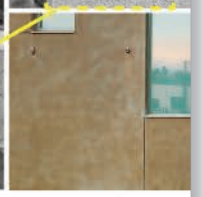



technician **onsite testing** quality and taking **samples** for laboratory **testing**

**no cold** joints within panels

special care is taken for **cold- or hot-weather applications**

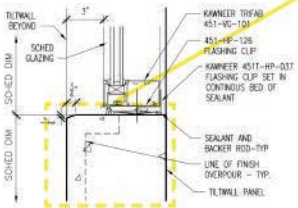




good vibration **VS.** bad vibration

**vibrated** as concrete is placed to **ensure consolidation** around embeds and reinforcement to **minimize voids**

**limit** the use of **fly ash** on panel mixes to ensure **quick curing** and clouding in the finish




- applied **before casting:** integral color, formliner mold, exposed aggregate, precast overpour, thin brick
- applied **after casting:** broom, trowel, screed, float, stipple
- locally sourced / batch-plant sourced, thus varying characteristics per batch / delivery, resulting in an inconsistent natural finish

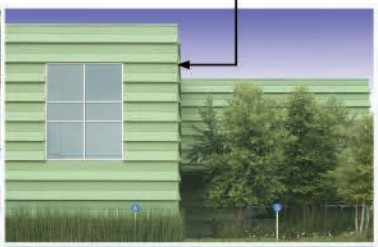
consider **aggregate type** for any **surface finish**—sand beds, "bush-hammering", etc



medium-textured paint

formliner + paint

bush-hammered



brick veneer + natural metals

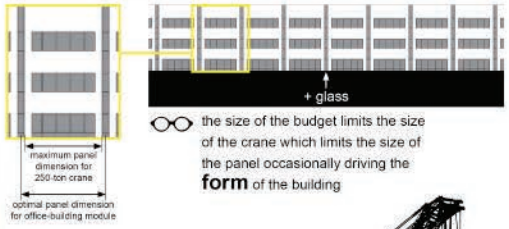
text

stained

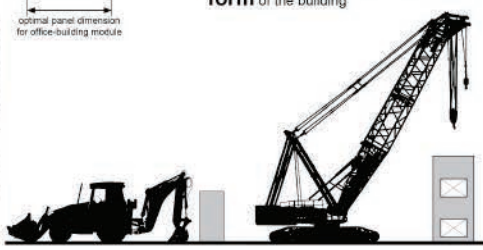
aluminum cladding

stone

# THE LIFT

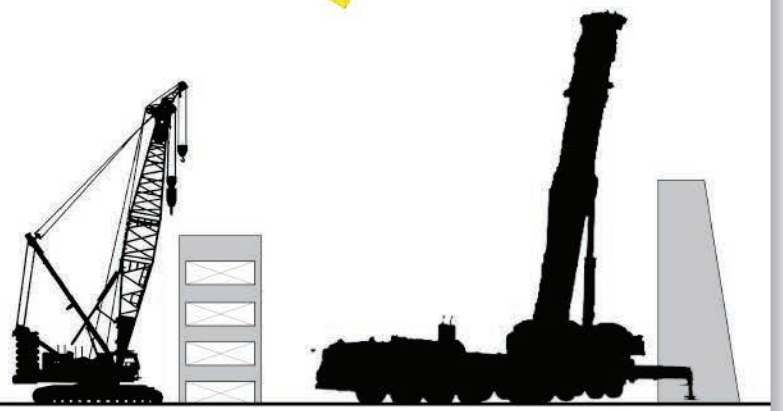



the size of the budget limits the size of the crane which limits the size of the panel occasionally driving the **form** of the building



adequate **cribbing and blocking** to avoid damaging slab-on-ground or other structural elements

verify capacity at the maximum reach



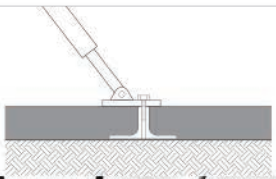
whether picking from the slab or from a crane-road, ensure that the integrity of the **lifting surface** is measured and considered by the rigging engineer to ensure appropriate load distribution

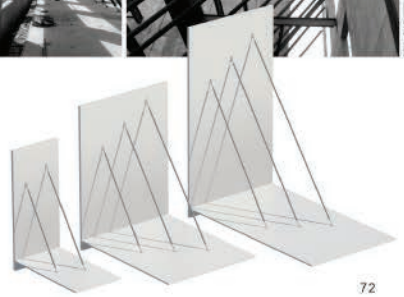
the crane is the most expensive part of the panel erection process—manage the **panel size** as much as possible to limit the **crane size**





# BRACING

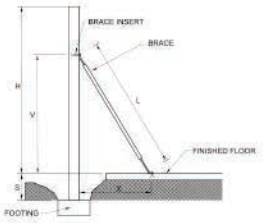


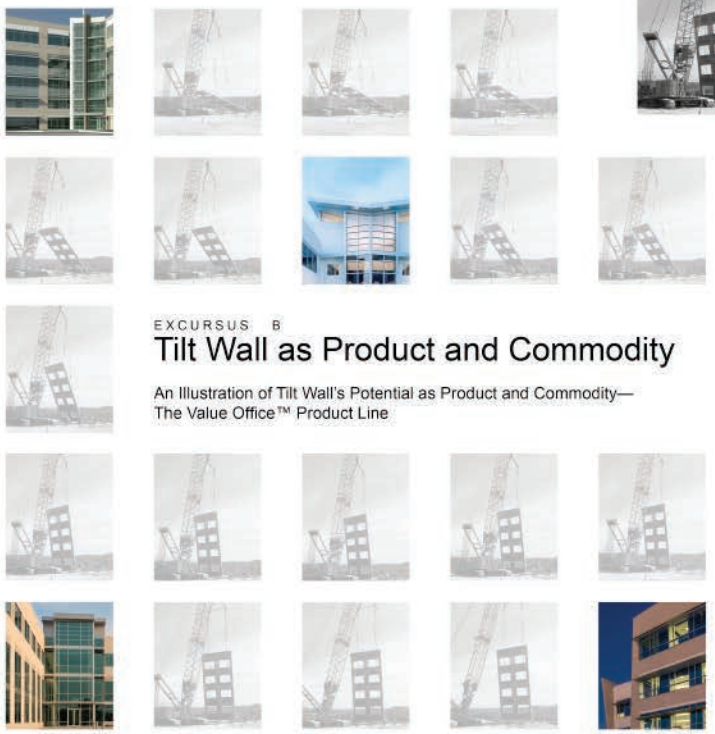


for **multi-story** projects, it's always best for the overall schedule to **brace** the **outside**

not used to crank the panels in or out during steel erection

**left in place** until a certain amount of the interior **structure is placed**





EXCURSUS B

# Tilt Wall as Product and Commodity

An Illustration of Tilt Wall's Potential as Product and Commodity—
The Value Office™ Product Line

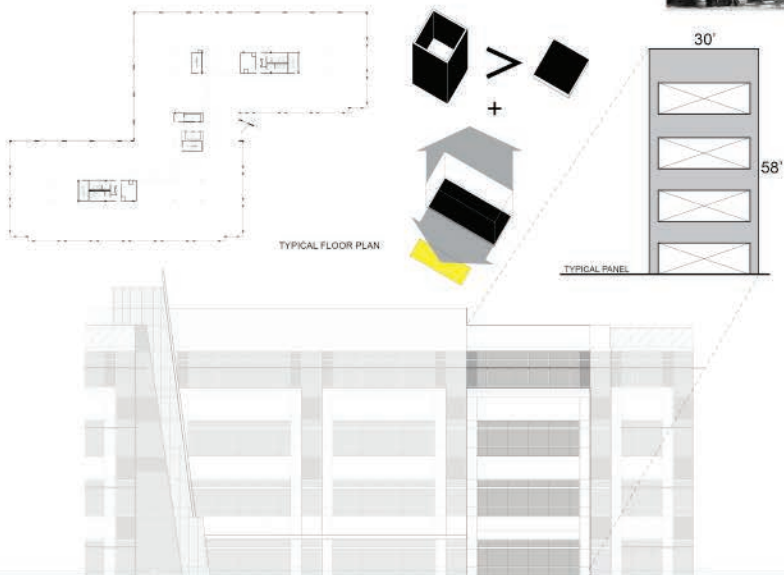




## VALUE OFFICE 4.1

240,000 SF: Office Building




| FLOORPLATE SIZE | PANEL | | | GLASS / WALL | SKIN AREA / FLOOR AREA |
|---|---|---|---|---|---|
| 60,000 SF | 115,500 lbs WEIGHT | 30 ft X 58 ft DIMENSION | 11 in THICKNESS | 57% / 43% | 74,240 sf / 240,000 sf |

# Tilt Wall as a Potential Carrier of Meaning
05

*"For Heidegger, technology is problematic not in regards to benefit it brings but rather to its emergence as an autonomous force ... "*

***Kenneth Frampton*, Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture.**

*"We continue to hear the fiction that what is important is how a technology is used ... but hardly ever do we mediate on wider implications: on what a given technology, or group of technologies ... actually does to us"*

***Sanford Kwinter*, Far from Equilibrium: Essays on Technology and Design Culture.**

## Carrier of meaning = theory = research

The goal of this section is to establish the relationship between architecture as an embodiment of, or carrier of meaning, and how it does so, namely relating to the concept of tectonics. In particular, this section is an exploration of the latent content in the Tilt Wall construction methodology. How form is made either contributes to a larger argument for content and meaning in a formal proposition, or it doesn't. There appears to be no middle ground. The relationship between process and content in Tilt Wall construction must reside in its being a tectonic method and thus a potential contributor to subjective intention, rather than its categorization as technology, and thus a neutral objective technique. The connection between construction methodology and formal meaning necessarily travels through the discipline of architectural theory. As to why Tilt Wall would present a special case under this rubric, *Learning from Las Vegas* serves as a good model. Venturi, writing as an architect and not a theorist, exposed a previously unseen urban prototype lying on the desert floor. He, along with Denise Scott Brown, Steven Izenour and their Yale students, teased the latent content out of the (at that point) non-architecture of the Vegas strip: They threw into sharp critical relief buildings by unimportant architect's containing previously non-existent programs, which were running as an independent, bypassing system of meaning relative to conventional architectural culture. Tilt Wall construction is comparable.

Tilt Wall is simply a method of building and thus arguably empty of content. Yet we have always attempted to assign meaning to how we build, from the formulation of the primitive hut trope, to the cataloging of form in the Enlightenment Encyclopedias, to Gottfried Semper's primitive hut modifications involving cladding principles. More philosophically José Ortega y Gasset's definition of constructing a cannon, which connects making, form and meaning: "For in truth, the most accurate definition of the urbs and the polis is very like the comic definition of a cannon. You take a hole, wrap some steel wire tightly round it, and that's your cannon". Modernist architecture's protagonists, both practicing and proselytizing, were partial to mass production as a way of building or conceiving of form, a notion that has recently been recycled in its latest iteration as remanufacturing, where the process of production bears meaning in the production of form.



The relationship to how we build and what the final form means has been negotiated by formalized theory in its many guises. Theory proper came into its own from the late 70s to the early 90s by channeling numerous concepts including language structure, French Structuralism and Marxist arguments on capitalism and art. Evaluated was: the discipline of writing within architecture, speculation about the relationship of architecture to cultural superstructures, how it carries or generates meaning, and why it does so. That architecture can be debated in terms of, or even as, a theory / theoretical proposition has been a questionable construct for many architects. Architects are uncomfortable with this concept and, in fact, the theory game has been declared by many to have run its course in the last five years or so.[1] On the other hand, architecture continues to rely upon decoding or interpretation; it seems to need to be understood as a work of subjective authorship. As such, it has always been a purveyor or indicator of cultural intent. Therefore, discussions about what it comes to mean, and examining whether architecture is a kind of "midwife" to cultural content, or an interpretable analog or index to a process of its own becoming, are a useful and required discourse whether or not such discussions congress into theory. Diane Ghirardo's work on the social potential and responsibility of architecture in the early 90s is one such discussion that, in many ways, applies to Tilt Wall construction's architectural value. In her book *Out of Site: A Social Criticism of Architecture* Ghirardo says, "the architect can engage critically with contemporary problems solely through formal manipulation", in other words, that through form alone, one could contest things such as the commodification and consumption of culture. She argues that a new notion of architecture, oscillating between self-expression and effete cultural commentary, replaced the traditional "architect as critical interventionist" program of social, economic and political content. To facilitate this, architects and critics conspired to create a rubric for evaluating buildings, which in turn became the architect's conceptual framework—all discourse not in this closed system is excluded and critics only address, in the end, areas in which architects have had some input. Thus questions regarding economic consequences, social implications and so on, can (and indeed have) been carefully edited out of critical consideration. In short Ghirardo concludes that entire discourses over questions such as building processes and methods are written out of "critical" architecture in favor of correct surface



MODERNISM
POSTMODERNISM
STRUCTURALISM
POSTSTRUCTURALISM
BLOBISM
BIOMORPHISM
CONSTRUCTIVISM
DECONSTRUCTIVISM
MINIMALISM
BRUTALISM
CLASSICISM
ECLECTICISM
FUNCTIONALISM
FORMALISM
EXPRESSIONISM
REALISM
URBANISM
FUTURISM
NATURALISM
ROMANTICISM

**TILTWALLISM**

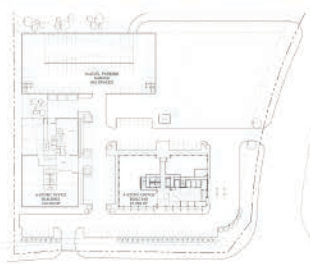


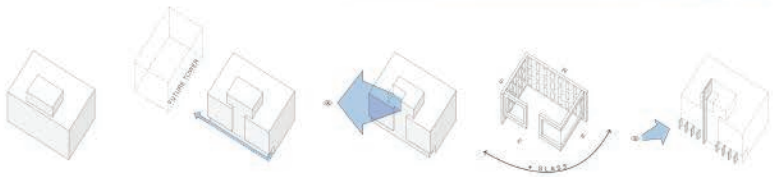


## Wallis

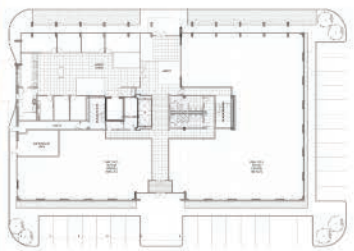
Wallis State Bank's site is what Mario Gandelsonas termed "ex urban", a site type that we commonly encounter in our work in Houston. At 5 acres and located some 10 miles from the Central Business District, it might be considered suburban, but it is closer to the actual demographic center of Houston, (just a mile south) and is activated by its frontage on the second of now four loops or ring roads (mega highways in actuality) that organize Houston's 624 square mile territory. Thus it is also quite urban and the clients' expectations of what goes on it (program) and how it is organized (form) have more in common with an infill site than a greenfield one.

The site is master-planned for four structures: the bank and administrative facility, a future lease building, a parking garage, and a water-detention facility (further evidence that, despite all, it is an ex urban site). The first phase is a 19,000 square foot floor plate office and bank function. This three-story building also has an executive 4th floor at 5,000 square feet, making a total of 65,000 square feet. It occupies the hard corner and is positioned to have favorable views from the executive level—not to be blocked by the second phase six-story building, (and guarded from the views in by a mesh fin)—with the garage at the "back" of the site buffering the next tier in sites dominated by warehouses.









**TILTWALLISM**
**A Treatise on the Architectural Potential of Tilt Wall Construction**
**Jeffrey Blaine Brown**

*TILTWALLISM* is designed to be an introductory resource to architects and an inspiration to contractors, developers and structural consultants who have encountered the technology of Tilt Wall construction. The vast amount of trade and technical information available on the subject is interpreted in a formal treatment for the first time on a subject at the forefront of the architectural role in an era of lowered construction costs.

Brown provides a full synthetic treatment of Tilt Wall construction by laying out the design opportunities in engaging in the architectural exploration of a low technology / low cost form of construction. He explains its history, methodology, and relationship to current architectural approaches to meaning. Brown writes in a balanced style targeted at both architects and academics that will also be accessible to non-architects and allied professionals. The title is richly illustrated in an effort to be useful to the many ancillary professions such as contractors, developers, and real estate brokers who are driving this increasingly prevalent approach to "investment" architecture.

**ISBN** 978 1 86470 575 1 **Format** 254mm x 254mm **Binding** Square edged 40 oz. cardboard **Pages** 228 **Illustrations** Full colour **In bookstores** Mid 2014

For publicity information contact **Merry Lovell**: merry@imagespublishing.com +61 3 9561 5544

**Distributed in North America by ACC Distribution www.accdistribution.com**
To place an order contact ACC Distribution at +1 413 529 0861 or orders@antique-acc.com

**Distributed rest of world (excluding Australasia and Asia) by ACC Distribution www.accdistribution.com**
To place an order contact ACC Distribution at +44 (0) 1394 389 950 or sales@antique-acc.com

**Distributed in Australia by NewSouth Books**
To place an order contact +61 2 8778 9999 or orders@tldistribution.com.au

**Distributed in New Zealand by Bookreps NZ www.bookreps.co.nz**
To place an order contact Bookreps NZ at +64 9 419 2635 or sales@bookreps.co.nz

**Distributed in Asia by Azur Corporation www.azurbook.co.jp**
To place an order contact Azur Corporation at +81 3 3291 0725 or azur@galaxy.ocn.ne.jp

**Distributed in China by Beijing Designer Books www.designerbooks.com.cn**
To place an order contact Beijing Designer Books at +86 010 59626195 or import03@designerbooks.com.cn

**Distributed in Hong Kong by APD Hong Kong asiapubs.com.hk**
To place an order contact APD Hong Kong at edward_summerson@asiapubs.com.hk

**Distributed in South East Asia by APD Singapore www.apdsing.com**
To place an order contact APD Singapore at +65 6749 3551 or ian@apdsing.com

images
Publishing