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Lessons from the Construction Site

"Listen to the man who works with his hands. He may be able to show you a better way to do it."

— Louis Kahn[1]

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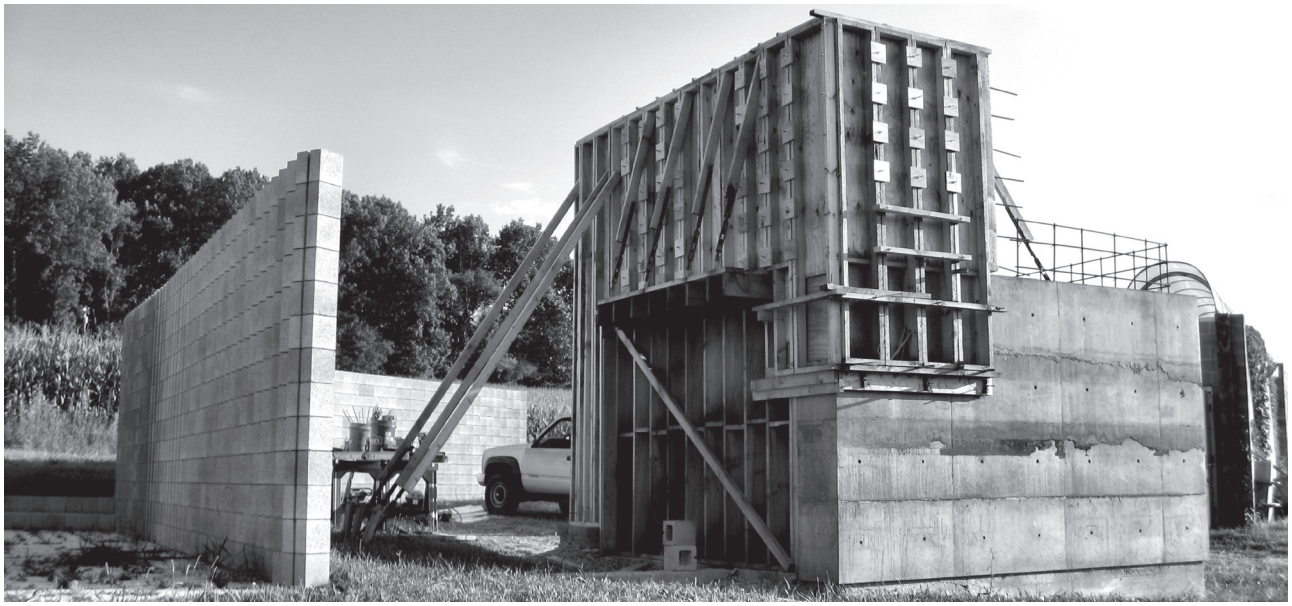
INTRODUCTION

The growing interest and willingness of architecture schools to engage and invest in Design-Build programs as a viable and significant component to their curriculum speaks to a growing trend that is challenging and seeking out alternative paths to the traditional studio based culture. Convincing arguments can be made that articulate and support the development of Design-Build programs; most specifically the 'real world' experience students are exposed to that foster a direct hands-on engagement with the complex social, professional, and constructive conditions at play within the architectural profession. Yet, due to the demands and intricacies that surround the physical realization of any building endeavor, Design-Build programs can at times be overwhelming in their scope, scale, and intent. Seeking out and sustaining financial support and investment, securing clients, addressing building codes / regulations, deadlines, construction site safety / management, building skills, and faculty / curriculum demands are real issues that can strain and challenge the development of a program. Certainly there are examples such as the Rural Studio that demonstrates the success and benefits of such programs. Overshadowed though are other versions of Design-Build initiatives that are just as significant to the students education. With the speed and pressures that are a part of many of these programs, what can be missed is the unique learning opportunities Design-Build offers in regard to the students immersion and inhabitation of the construction site where they are allowed time and the opportunity for failure; two words that can be at odds with the activities surrounding client and time based construction projects yet latent and necessary within constructive inquiry.

It was in this spirit that a Design-Build project was initiated within our school called the c u b e. It stands 13'-8" x 13'-8" x 13'-8", encloses a 96 sq. ft. room, and is composed of three types of cast-in-place concrete walls. It is situated two miles west of Virginia Tech's campus at the College of Architecture and Urban Studies Research Design Facility. The idea for the c u b e originated with Professor William Galloway



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who teaches building materials and construction to students in Virginia Tech's architectural graduate program. His intent for the c u b e was quite simple and direct: construct a room of concrete. The focus of the work was not about the completion of a 'project' or adhering to a time line. Rather it was to provide a place and opportunity for the students to be immersed into the constructive nature of architecture. The work was structured and developed with an understanding that it was an ongoing effort to be passed on to future students and faculty to continue. The construction site of the c u b e became a place of architectural inhabitation where both students and faculty were engaged in the questions and actions of making. Over the course of four years, approximately 200 students and 3 faculty members were involved in this construction effort. The completion of the c u b e culminated as a graduate student's master's thesis.

My role in this project began as an observer that over time turned into chairing the thesis committee for Ryan Seavy, the graduate student who completed the c u b e. What emerged from the project were two observations on how time and failure are accounted for within a Design-Build project. What is offered is a reflection on how Design-Build brings the importance of these lessons to the forefront of the student's education; fundamental lessons that the construction site teaches, where in other parts of the student's architectural education they are not so easily conveyed.

CONSTRUCTIVE INQUIRY

For those whose interest and responsibilities are to teach building technology, how questions of construction are presented, taught, and engaged can be a challenge. Time, understanding, interest, and priorities architecture programs and faculty place on building technology can vary, often pushing constructive questions to the peripheries of a student's education. Primary responsibility for addressing building technology typically falls to a series of required lecture format construction courses. While these may address both NAAB's (National Architectural Accreditation Board) accreditation requirements and a school's particular curriculum agenda, this still might not provide the additional time, depth and scope that is necessary to cover and address the complex nature of building.

Figure 1: Lines of Construction

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The majority of students coming to architecture have very limited experience and exposure to construction. Many have never walked a job site, swung a hammer, or spent a day in an architect's office. While this initial lack of construction exposure does not define a student's ability to grasp and understand these concepts, it does present a challenge to those trying to instill and convey the constructive realities at play in the realization of works of architecture. As teachers, within the studio, lectures, and seminar courses, we try to convey the weight and resistance of materials, gravity, wind, rain, heat, cold, and the cultural and natural forces that inform a building's physical and constructive reality. Still, this can be difficult given that the architect's education in the realm of constructive inquiry is typically gathered from and bounded by secondary experiences and sources such as books, drawings, the classroom, studio, office experience, and construction observation. The involvement with the constructive aspects of the work for the architect is not a direct hands-on engagement in its physical making, but an analogous experience, relying on drawings and models to provide the primary ways in which the student approaches, explores, tests, and demonstrates constructive understanding. For students coming to architecture, these forms of constructive engagement can seem foreign, distant, and abstract, adding to the difficulty of accessing and grasping the connections to the physical richness and implications that is inherent in the relationship between construction and architecture. Robin Evans writes about this quandary:

> "…I was soon struck by what seemed at the time the peculiar disadvantage under which architects labour, never working directly with the object of their thought, always working at it through some intervening medium, almost always drawing, while painters and sculptors, who might spend some time on preliminary sketches and maquettes, all ended up working on the thing itself which, naturally, absorbed most of their attention and effort."2

The *c u b e* project offered a way to bridge this gap and directly engage architecture's constructive realities.

Figure 2: Lines of Architecture

TIME

Watching the work unfold on a construction site, it is difficult to see the actual building that is under construction. Temporary shoring, construction apparatus, workers, and staging areas fill every inch of the site. To the untrained eye this scene must seem chaotic, yet to the architect and builder it is typical of the ebb and flow of the construction site where a dynamic constructive dance of stacking, forming, erecting, and joining set to the tempo of sequencing, schedules, budgets, deadlines, weather, and the typical unpredictability of construction are all part of the day's work. Architect, Louis Kahn, was aware of how quickly a building transformed during construction, describing it as, "A building being built is not yet in servitude. It is so anxious to be that no grass can grow under its feet, so high is the spirit of wanting to be."[3]

Kahn valued and respected construction. He understood that to approach architecture, materials, assemblies, details, and means and methods had to be considered and embraced by the architect. His observations and musings of the crane as an extension of the architect's hand revealed his willingness and desire to allow the construction site to teach the architect and inform architecture.

> "There is in the design the consideration of the difference between the order of structure and the order of construction. They're two different things. There is an order to construction which brings in the order of time. They're very much married to each other. The order of structure can make conscious the crane. The crane that can lift twenty-five tons should appear in a specification of present-day architecture which does not appear now. The architect says "Oh! They're using a crane on my building. Isn't that nice – so they can pick it up more easily," never realizing that the crane is a designer; that you can make something that's twenty-five tons coming something that's twenty-five tons, and you can make a joint that's so magnificent, because that joint is no little thing. In fact, if you'd put gold into it, you wouldn't be spending too much money, because it's so big."[4]

While Kahn appreciated and respected the work taking place on the construction site, he was reluctant to give in to its speed. For Kahn, time was not calculated and accounted for by the seconds, but was savored and taken as an opportunity to consider, ponder, and debate. He worked deliberately and methodically trying to draw out what was most appropriate to the work, no matter the stage of the project or deadline demands. It was in fact Kahn's 'slowness' in ruminating over pending questions and decisions during the construction of the Kimbell Art Museum that almost led to his firing from the project.[5]

Kahn's sense of 'construction time' is important to recognize and fold into the discussion of Design-Build. His words bring to light two important aspects of time present on the construction site: tempo and sequence. Within the construction of a work, there is pace set on the construction site. Schedule certainly drives the timing of the work to be performed, but materials themselves embody a tempo. The students working on the c u b e learned about the tempo of concrete and quickly came to realize that constructing proper form work takes time. The planning and effort required to craft and erect form work is significant. This is in contrast to the quick pace that must be maintained in the mixing and placing of concrete, which is then followed by the time required for curing and the breaking of test cylinders.

Coupled with tempo is the sequence of construction. The order in which the building parts are brought together is an important lesson that can be missed at the student's

desk. On the construction site, sequence is inescapable. Louis Kahn recognized the importance of sequential thinking when describing how an architect draws:

> "I draw a building from the bottom up because that's the way it's constructed. It depends on gravity. You begin with the way all the weights can be distributed on the land, and then you build up. If you do that, then you draw like and architect."[6]

In addition, sequence brings to the foreground questions of details and assemblies. At each material juncture and turn of the corner there is both a constructive consequence that is made and a foreshadowing of what is to come. Missteps in thinking through how something goes together can cost time, money, and frustration. What the construction site teaches and instills in the student is the necessity to plan and anticipate; that sequential thinking is an inseparable part of the architect's practice.

FAILURE

To consider failure as an acceptable option in construction seems to be at odds with a works intended goal. Work on a construction site is approached with a plan of action regarding the stages and sequencing of work. Drawings and specifications establish the scope of work to be completed. Many of the pressures Design-Build faces is that 'failure is not an option.' The work must be performed and conform to the agreed upon documents. This places an enormous amount of responsibility upon faculty regarding oversight, management, and completion not to mention pressure upon students who often have never built at this scale or under the real obligations and constraints of a schedule and budgets. With these challenges a larger question comes about regarding the ability to fail. To fail is typically taken as a negative; that what has been made lacks value because the completed work does not meet an established criteria or vision. Recasting failure, at least in the realm of the architect's education, can be seen as when the intended outcome differs from the constructed outcome. It is not so much a judgment of good or bad, but rather a question of what was learned followed by how the student responds, redirects, and engages the constructed reality. Failure in this sense is about discovery, lessons learned, and wisdom gained. Certainly failure at the 1:1 scale (when it does not involve life safety issues) is a rather intimidating consequence to embrace because the work cannot be torn down. It becomes a permanent condition that must be engaged not discarded. Starting over is not always the option.

An example of this moment was experienced during the casting of one of the to the walls to the c u b e. During the removal of the form work it was noticed a distinct line and pockets of honeycombing on the finish concrete face (figure 3). While this did not compromise the structural integrity of the wall, it did create a disappointing and frustrating moment in regards to the concrete finish. A distinct line told a constructive story of where first and second pour meet, revealing a number of factors that probably contributed to the honeycombing: the set up time of the concrete between first and second pour, vibration, the stiffness of the concrete mix, and the use of a pump truck. While this moment might have caused a very tense conversation with a client based project regarding the wall finish, at the c u b e it became a physical record of the walls making and a learning lesson demonstrating concrete's complexity. The wall opened up an unexpected conversation about different ways in which this 'now existing condition' can be approached. Is the finish of the wall left alone, patched, covered, or (half- jokingly) inlaid with 'gold'; elevating a perceived construction defect into a noble architectural moment?

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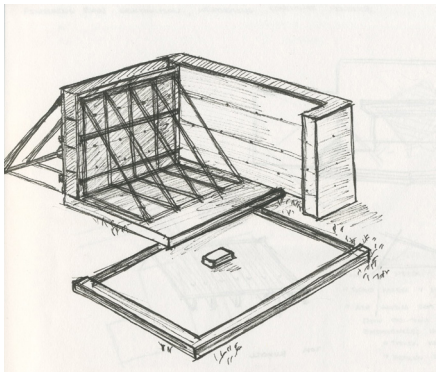
Figure 3: Teaching Moment



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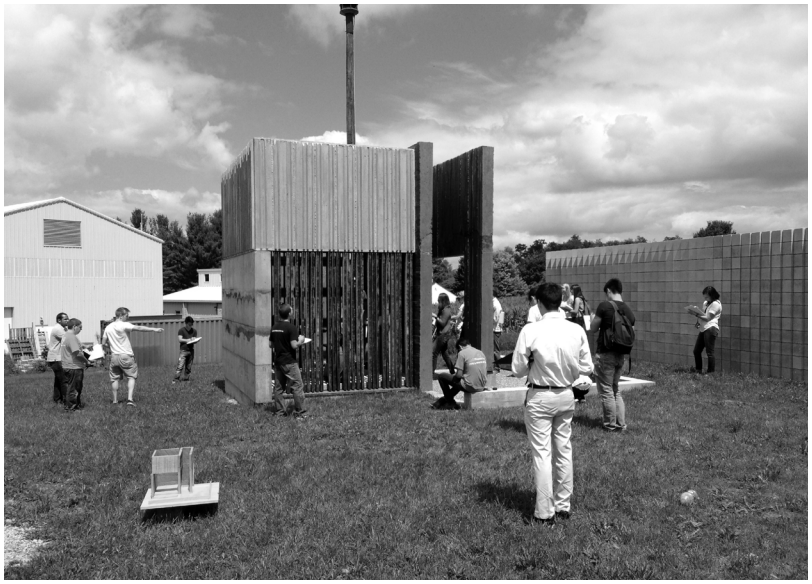
CONCLUSION

The nineteenth century French architect Viollet-le-Duc wrote, “Architecture and construction must be taught, or practiced simultaneously.”[7] This is a necessary reminder of architecture’s constructive nature. What the *c u b e* offered was a chance for student’s to directly engage in this relationship. While the *c u b e* at this point is no longer a construction site, it has become a classroom for architectural students to study, inhabit, measure, and draw. It has taken on a new life within the school that demonstrates and reveals how Design-Build can contribute to the growth and development of future architects.



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ENDNOTES

1. Louis Kahn, “Comments on Architecture by Louis Kahn,” in *Light Is The Theme: Louis I. Kahn and the Kimbell Art Musuem,* ed. Nell E. Johnson (Ft. Worth, Texas: Kimbell Art Musuem, 1988), 54.
2. Robin Evans, “Translations from Drawing to Building,” in *Translations from Drawing to Building and Other Essays* (Cambridge, Mass: MIT Press, 1997), 156.
3. Louis Kahn, “The Room, the Street, and Human Agreement,” in *Louis Kahn: Essential Texts*, ed. Robert Twombly (New York: W. W. Norton & Co., 2003), 258.
4. Louis Kahn, “Silence and Light,” in *Louis Kahn: Essential Texts*, ed. Robert Twombly (New York: W. W. Norton & Co., 2003), 250.
5. Luca Bellinelli, “Preface,” in *Louis I. Kahn: The Construction of the Kimbell Art Museum*, ed. Luca Bellinelli (Milan, Italy: Skira editore, 1999), 7.
6. Louis Kahn. *What Will Be Has Always Been: The Words of Louis Kahn*, ed. Richard Saul Wurrman (New York: Access Press and Rizzoli, 1986), 176.
7. M. Eugène-Emmanuel Viollet-le-Duc and George Martin Huss. *Rational Building*. (New York: Macmillan and Co., 1895), 1.

Figure 4: Speculations of Making, student sketch

Figure 5: Measuring Existing Conditions