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05-001-CD	Construction Documents	13	\$926.25	40	\$185.25	\$185.25
05-001-CEP	Existing Conditions Phase	5	\$356.25	100	\$178.13	\$178.13
05-001-SDO	Schematic Design Development	18	\$1,282.50	100	\$641.25	\$641.25
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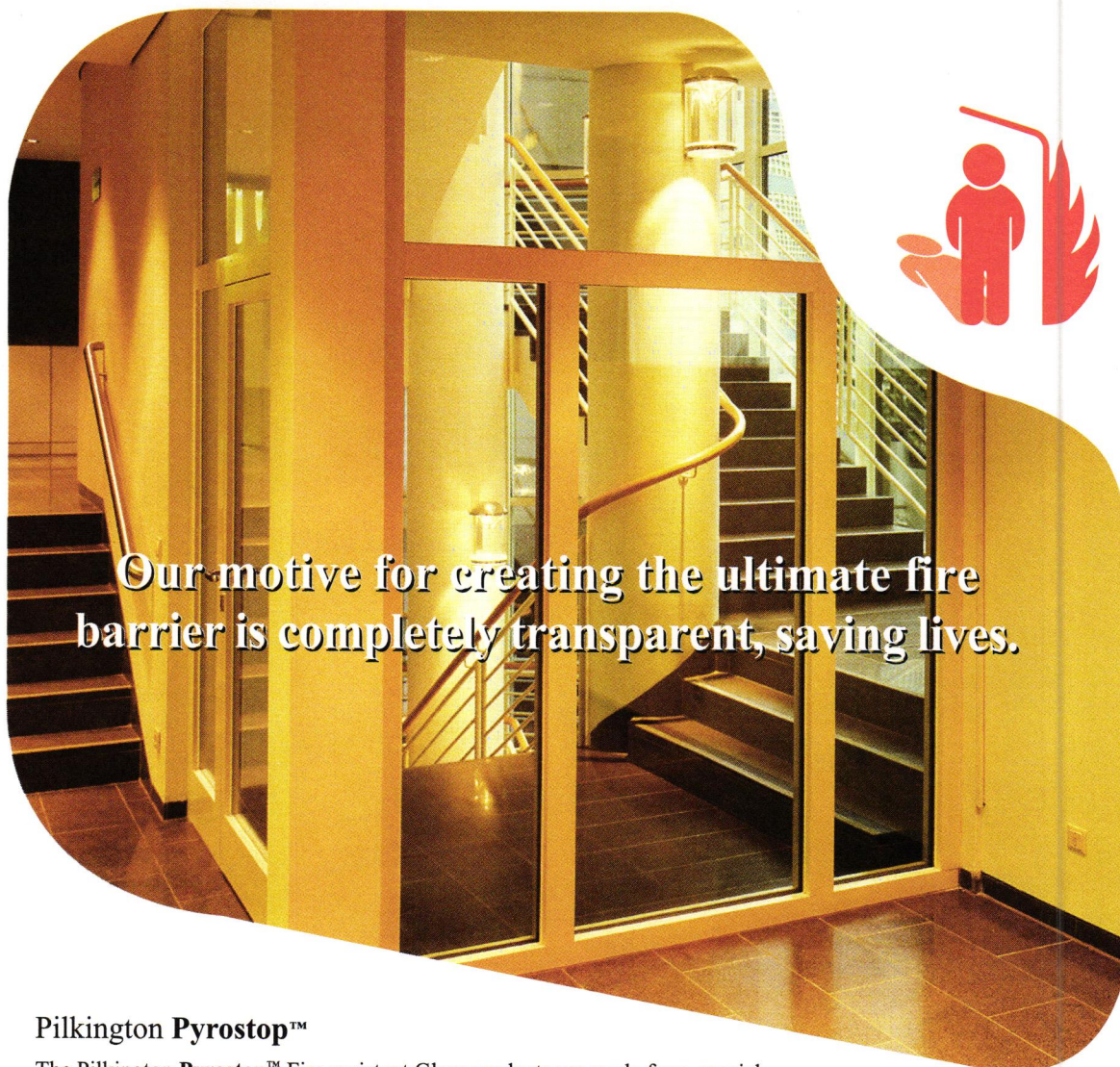
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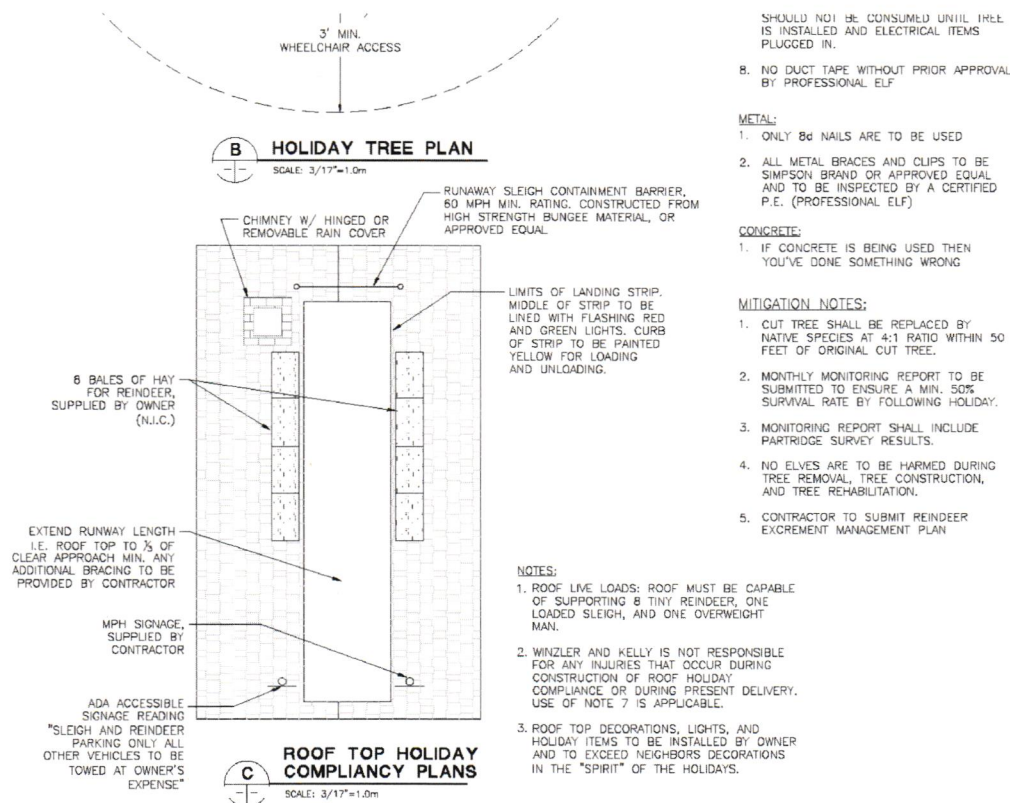
Lori Reed

While we were working on this issue on construction documents, a holiday greeting came in over the wires from Winzler & Kelly Consulting Engineers of Eureka. They have been kind enough to let me share a portion of it with you (please see below).

I also want to mention two terrific new books. *Bassett* is a breathtaking selection of the drawings of Edward Charles (Chuck) Bassett, the late design partner of SOM San Francisco. It has been published in a limited edition by SOM and is available from William Stout in San Francisco. All proceeds go to the SOM Foundation, which was co-founded by Chuck and supports the education of architects through traveling fellowships. *Saarin*, by *arcCA* editorial board member Peirluigi Serrano, is the fifteenth in a series of beautiful but inexpensive monographs from Taschen. Look for it at one of California's fine, local architectural bookshops—Stout, Builder's Booksource in Berkeley, Hennessey & Ingalls and Form Zero in Santa Monica.

I won't say much about the current issue, except to note that it is the first in our expanded format, which gives the eye—and we hope the mind—a bit more room to breathe. Please let us know what you think.

Tim Culvahouse, AIA, editor





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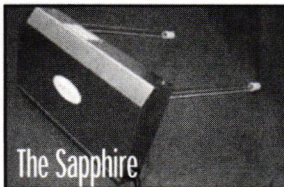
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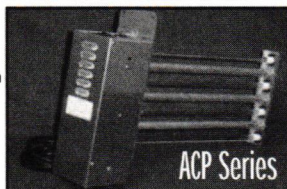
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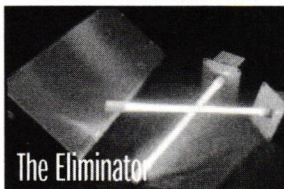
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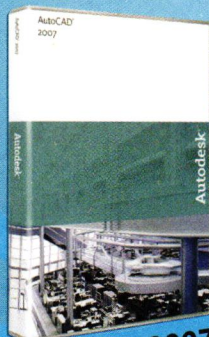


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Dana Buntrock has studied Japanese architecture and construction practices since 1987. This text, an excerpt from her 2001 book *Japanese Architecture as a Collaborative Process: Opportunities in a Flexible Construction Culture*, was the result of extensive research on construction sites in Japan in the late 1990s, supported in part by the National Science Foundation, the Japan Society for the Promotion of Science, the Japanese Ministry of Education, and the Graham Foundation. She teaches construction in the Department of Architecture at the University of California, Berkeley, and is working on a second book on how conceptions of time affect the materials and detailing of contemporary architecture in Japan. She may be reached at danab@berkeley.edu.

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Christopher Johnson, AIA, is principal of Johnson Architecture in Fresno, a firm specializing in historic preservation, renovation, rehabilitation, urban revitalization, planning, project management, interior and graphic design. For six years, Chris served as a

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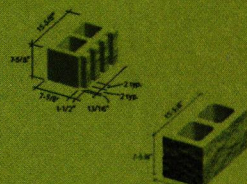
Paolo Tombesi is an associate professor in Architectural Design and Practice at the University of Melbourne. A former Fulbright Fellow, he has a Ph.D. in architectural practice and regional development from UCLA. Between 1990 and 1996, he was the North American correspondent for the international journal *Casabella*. Currently he is on the editorial boards of the *Journal of Architectural Education* and *UME*, and an editorial correspondent for *Construction Management and Economics*. His writings have also appeared in *Architectural Research Quarterly*, *Art China*, *Cartas Urbanas*, *Center*, *Costruire*, *Domus*, *Journal of Architecture*, *Il Giornale dell'Architettura*, and *Harvard Design Magazine*. In 2004, he was 'scholar in residence' at Harvard, where he co-taught International Practice. He is a visiting professor in Economics and Organization of Practice and research fellow at the Polytechnic of Turin. He may be reached at p.tombesi@unimelb.edu.au.



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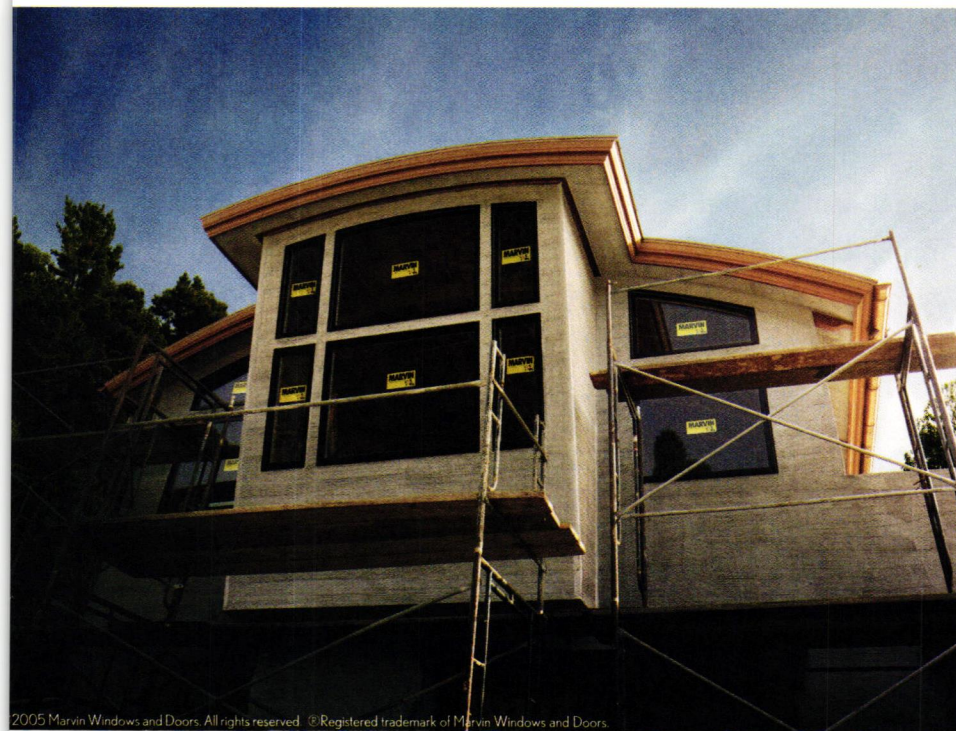


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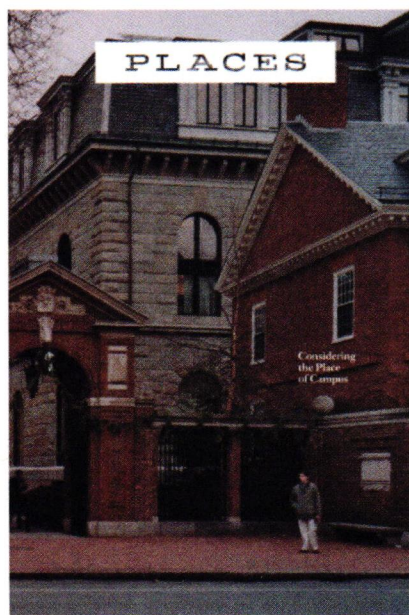
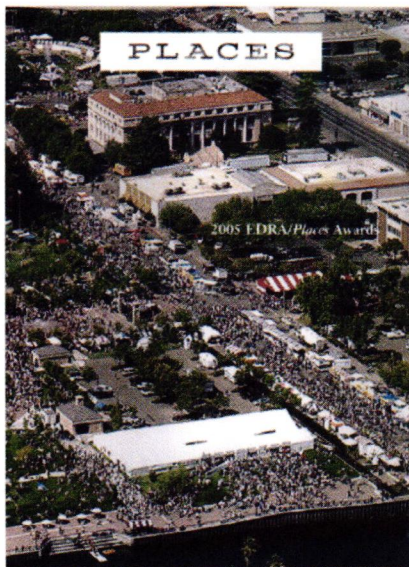
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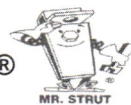
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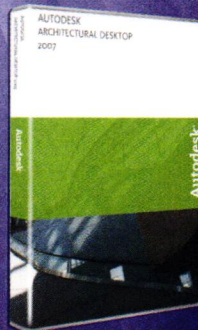


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re: *arcCA* 05.2, "Other Business":

The theme of your recent issue indicates that non-traditional architectural practices are generally acceptable to the profession. This was not always the case. In 1968, when a small group of architects and engineers created a company devoted to architectural exam preparation, few in the profession were supportive. Several colleagues, including the Executive Director of the NCARB, strongly suggested we drop the whole idea.

Our group was mostly trained at Berkeley during the Wurster era, and many had conventional practices for several years prior to establishing our new company. Although the profession was, at best, indifferent to our activities, exam candidates were enthusiastic. Within a year or two, Architectural License Seminars, or more popularly, ALS, demanded so much time we were unable to continue our private practices. Our new work consisted of conceiving, writing, and illustrating study materials, holding seminars throughout the country, and acting as surrogate therapists to exam candidates.

Two years ago we sold our company to a national education firm, exactly 35 years after it was established. My engineer partner Robert Marks retired, and I resumed the conventional architectural practice that was put aside years earlier.

ALS was a successful and exciting experience. Looking back now, I am convinced it succeeded because of our early architectural training. We not only related easily to the exam material and experience, but we could analyze, organize, and present ideas concisely and attractively, just as most architects do each day. Clearly, employing an architectural education in an alternative way can bring great satisfaction. On the other hand, returning to the drawing board has been as exhilarating as ever.

Lester Wertheimer, FAIA
Encino

re: *arcCA* 05.3, "Drawn Out"

Congratulations for the newest edition of *arcCA*, which I especially liked for the first time in many issues: the emphasis on architects and drawings, both sketch methods and presentation and construction drawings.

This issue is as an architect's journal should be! As an architect, I still enjoy drawing on trips and making sketches for client's projects. The computer is coming and eventually will probably supersede all our drawings and sketches, but *architects need to know how to draw*, and your fall issue illustrates just that. Hurrah.

Bill Bocook, AIA
Palo Alto

Regarding John Chase's article ("Coda: 1414 Fair Oaks Avenue"): if we fast-forward to the present, there is an important preservation success story in the making.

A couple of years ago, the building was nearly taken by the South Pasadena Unified School District through eminent domain, to be demolished for a parking lot. It was saved and designated a local historic landmark, through the efforts of the South Pasadena Cultural Heritage Commission, the South Pasadena Preservation Foundation, the LA Conservancy Modcom, and the Pasadena & Foothill Chapter of AIA. The South Pasadena Preservation Foundation is also pursuing National Register listing for 1414.

This building is of special importance to our chapter, because its architects and many of those who worked there during its design collaborative days were among the founding members of our chapter. In fact, a number of the "1414 Alumni" worked on our chapter's committee to help save the building. Laurie Barlow, AIA, who worked there as a young architect, headed the committee. The owner decided to put the building on the market, shortly after designation blocked the school district's plans.

Chase's description of the type of tenants and condition of the building at that point is accurate. About five years ago, however, a young architect named Vincent Choi had seen and fallen in love with 1414. When he learned that it was on the market, he formed a new design collaborative to purchase and occupy the building. They are now working on restoration plans and are in the Certificate of Appropriateness process with the City of South Pasadena.

1414 was significant enough to be one of three buildings included in Cal Poly San Luis Obispo's freshman field trips to Los Angeles, along with the Bradbury and Standard Oil Buildings, dur-

ing the 1960s. Even now, in its slightly downtrodden state, its "good bones" and the compelling space of the courtyard are very evident. The original design collaborative used to hold Friday afternoon get-togethers in the courtyard, and the Pasadena & Foothill AIA is looking forward to another courtyard party in the near future to celebrate 1414's revival.

Joseph Catalano, AIA
Director of Government Relations
Member of the 1414 Legacy Committee
Pasadena & Foothill Chapter AIA

re: arcCA 05.4, "SustainAbility":

Marian Keeler makes a good point in her article, "PVC: The Controversy Summarized," (05.4) encouraging architects and designers to sort through the "noise" in order to make informed decisions. Unfortunately, she goes only part-way in the research she reports, missing important contributions and raising the noise level rather than lowering it.

Ms. Keeler acknowledges one of the most important recent studies of PVC issues, but she gives it short shrift, referring only to its "taking the side of industry." This is the December 2004 draft report of the PVC Task Group of the U.S. Green Building Council, which reviewed some 2,500 studies to evaluate the life-cycle health/environmental impacts of products made of vinyl versus those made of competing materials in four major building applications.¹

The PVC Task Group found that "the available evidence does not support a conclusion that PVC is consistently worse than alternative materials on a life-cycle environmental and health basis." It added that discouraging use of vinyl could "steer designers to use materials which performed worse over their life cycles with respect to the bulk of the impact categories."

Ms. Keeler also neglects to mention that a European Commission review of life-cycle studies of vinyl and major competing materials published in final form in July 2004 reached similar conclusions.²

We urge readers of *arcCA* to review these studies not only for what they say about vinyl but also for what they say about the larger principles at work in making environmentally informed choices among building materials:

- All products have environmental impacts; the "greenness" of a product depends on what it is being compared to.
- The health and environmental impact of a material depends significantly on the specific application.
- A long-lasting product will have an entirely different life-cycle profile than a product with a short life span. The use phase will dominate in the long-lasting product.
- Product design is more important than material selection.

Ms. Keeler raises several allegations in her piece that can be traced back to Greenpeace, which co-founded Health Care Without Harm (referenced in the article), supplied the staffers to the Healthy Building Network (referenced in the article), once employed Joe Thornton (referenced in the article), and provided much of the background for *Blue Vinyl* (referenced in the article). An extensive body of evidence has debunked these allegations.

Allegation: vinyl is associated with persistent toxins like dioxin. Fact: So are diesel and gasoline engines, fireplaces, iron ore sintering, cement kilns, secondary copper and aluminum smelting, coal-fired utilities, volcanoes, forest fires—and the list goes on,

according to data compiled by the U.S. Environmental Protection Agency. The vinyl industry has worked to reduce its dioxin emissions to grams per year, on par with or less than these other sources you never hear about. The Bay Area Air Quality Management District analyzed major sources of dioxin in the San Francisco Bay area and concluded that on-road and off-road mobile sources and fireplaces accounted for more than 80 percent. Vinyl was not even mentioned. The best news about dioxin—the fact that really exposes the hollowness of this allegation—is that dioxin emissions have been falling for decades even as vinyl production and use have soared. A fair analysis of dioxin would ask what other building-related sources exist and how much they generate.

Allegation: vinyl can't be made without "heavy metals" like lead and cadmium. False. Lead and cadmium were commonly used in the past as vinyl stabilizers, but they have been replaced in the vast majority of products by compounds based on tin, calcium, zinc and other highly acceptable materials (even though they were never shown to cause harm in vinyl products). Vinyl products are able to meet the right-to-know requirements of such stringent programs as California's Prop 65. A fair analysis of this issue would ask what ingredients, feedstocks, and by-products are associated with other building materials.

Allegation: vinyl manufacturing creates health problems in local communities. False. Data from the Louisiana Tumor Registry submitted to USGBC during the PVC Task Group's review showed that cancer rates among Louisianians living in vinyl manufacturing communities are similar to rates nationwide except for white males, and their higher rate in Louisianans is attributed to smoking. Fairness question: what emissions are produced by the manufacture of other com-

monly used building materials, and what fenceline issues are associated with these emissions?

Allegation: vinyl contaminates recycling. Professional recyclers know that anything other than the target material in a recycling operation is a "contaminant." Vinyl may melt at a different temperature than other plastics, but this has not stopped recyclers of other plastics from recovering and selling millions of pounds of non-vinyl plastics annually. The Vinyl Institute helped support development of high-tech recycling equipment such as optical scanners that make the job easier. The main impediment to recycling vinyl today is the long service life of most vinyl building products, making them simply unavailable. There are recyclers hungry and willing to pay for used vinyl. Fairness question: what percentage of any commonly used building material is recycled during construction or demolition? At what cost? How can we increase the cost-effective recycling of all building materials?

Allegation: vinyl poses a fire hazard. False. The chlorine in rigid vinyl resists burning. Vinyl is accepted in most building codes, and vinyl pipe and wire insulation is commonly used in residential and commercial buildings across the United States. PVC made with extra chlorine (CPVC) is widely approved for sprinkler systems in commercial buildings. Fairness question: what happens when materials competing with vinyl burn? (Hint: burning wood produces dioxin.)

Finally, permit me an opportunity to mention the value that vinyl/PVC brings to building and other sectors of the economy. Vinyl is the most versatile and third largest-selling plastic on the market today. The molecule is more than half-derived from plentiful salt (conserving fossil fuel). Vinyl can be made rigid or flexible (even semi-liquid), clear or colorful, brick thick or film thin—economically. As most readers of *arcCA*

know, vinyl is equally at home in pipes, window frames, siding, flooring, wall covering, carpet backing and roofing, offering durability, resistance to corrosion, thermal efficiency, color retention, ease of cleaning and other benefits, including recyclability.

Vinyl has important uses outside building. You may not be aware that it is the material of choice in blood bags and medical tubing and other critical-care products regulated by the U.S. Food and Drug Administration, with a virtually unique ability among plastics to resist kinking and necking down, to withstand freezing and steam sterilization, and to be tough enough (as a result of solvent-welded joints) to be air-dropped onto battlefields. Even some alternative plastic medical products rely on welded vinyl joints.

You can read almost daily about new PVC production facilities in planning or under construction, from Louisiana to China.

Ms. Keeler concludes by endorsing the precautionary principle, adopted by San Francisco, as a tool that will "be the measure by which we guide, not squelch, the technological ingenuity we so value in our culture." The problem with the precautionary principle is that it lacks metrics. One person's precaution is another person's necessity. How do we reach consensus—how do we get through the "noise?" The metric used by the PVC Task Group and EC in the studies cited above is life-cycle assessment (LCA), which looks at a material or product from cradle to grave (or cradle to cradle, if it is recycled). LCA is not perfect or complete, nor is any other metric. But, many health and environmental experts believe it is the most complete tool by which to measure where and when precaution should be imposed. As shown above, vinyl does quite well when compared fairly against other materials with a good measuring stick.

Tim Burns,
President, The Vinyl Institute

1. *Assessment of Technical Basis for a PVC-Related Materials Credit in LEED* (public review draft), TSAC PVC Task Group, U. S. Green Building Council, Dec. 17, 2004 (http://www.usgbc.org/Docs/LEED_tsac/USGBC_TSAC_PVC_Draft_Report_12-17-04.pdf)
2. *Life Cycle Assessment of PVC and of Principal Competing Materials*, PE Europe GmbH, July 2004 (http://europa.eu.int/comm/enterprise/chemicals/sustdev/pvc-final_report_lca.pdf).
3. *The Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States: The Year 2000 Update*, U.S. Environmental Protection Agency (External Review Draft, March 2005; EPA/600/p-03/002A) (<http://www.epa.gov/ncea/pdfs/dioxin/2k-update/>).
4. Bay Area Air Quality Management District. 1998. *Air Emissions of Dioxins in the Bay Area*; Bay Area Air Quality Management District. 1996. *Air Emissions of Dioxins in the Bay Area*.
5. *Summary of the Dioxin Reassessment Science*, USEPA, June 12, 2000 (http://www.epa.gov/ncea/pdfs/dioxin/factsheets/dioxin_short.pdf).
6. Mary Bird Perkins Cancer Center, April 1, 2004 letter to USGBC (http://www.usgbc.org/Docs/LEED_tsac/Mary_Bird_Perkins_TSAC_Letter_04-01-04.doc).

The image displays four architectural drawings for the entrance of the New York Public Library, designed by John Russell Pope. The drawings are as follows:

- PLAN ON LINE "DD"**: Scale $\frac{1}{8}'' = 1'-0''$. This plan shows the entrance area with dimensions ranging from 2'-0" to 24'-0". It includes notes: "Interior finish not shown" and "All walls & plaster fireproofing".
- PLAN ON LINE "CC"**: Scale $\frac{1}{8}'' = 1'-0''$. This plan shows the entrance area with dimensions ranging from 10'-0" to 4'-0". It includes notes: "Interior finish not shown" and "Walls Laths and Plaster fireproofing".
- PLAN ON LINE "BB"**: Scale $\frac{1}{8}'' = 1'-0''$. This plan shows the entrance area with dimensions ranging from 10'-0" to 4'-0". It includes notes: "Interior finish not shown" and "Walls Laths and Plaster fireproofing".
- HALF PLAN DEVELOPED COFFERED CEILING OVER ENTRANCE**: Scale $\frac{1}{8}'' = 1'-0''$. This drawing shows the coffered ceiling over the entrance, with dimensions ranging from 10'-0" to 4'-0". It includes notes: "Interior finish not shown" and "Walls Laths and Plaster fireproofing".

Note!
OTHER ARCHES OF MAIN
ENTRANCE SIMILAR EXCEPT FOR
REVOLVING DOORS IN CENTER ARCH

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Knowledge

Brett Roberts

For those of us with a passion for how things are built, construction documents represent an apotheosis of design evolution, a point at which vision is meshed with knowledge, innovation, and artistry in order to bring ideas into reality.

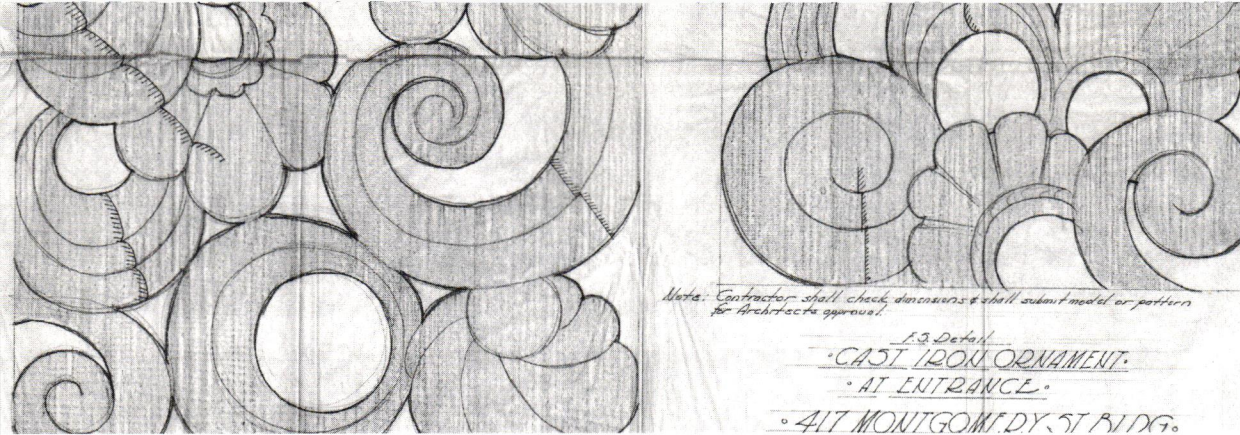
Any architect who has the opportunity of working on an older building usually asks if any original drawings exist. Sometimes the answer is “yes,” and we are brought face to face with the history of our profession. For me, the older building was the Mark Hopkins Hotel shortly after the 1989 Loma Prieta earthquake. With little flourish, I was handed a modest-sized roll of original, ink-on-linen tracings comprising the complete architectural, structural, and mechanical plans for this 1926 Weeks & Day landmark building.

Aside from my first impression of how beautifully crafted the tracings were, what surprised me most about the plans was how integrated the information was. My immediate feeling was that a builder could construct (and probably did) the entire building from just that drawn on the architectural sheets. Structural and mechanical information were both shown on architectural plans, in contrast with current construction documentation canon.

Seemingly missing, however, were sheets of details. While some beautifully drawn details were present in the set, where were the hundreds of drawings needed to show elaborate terra cotta ornamentation, intricate masonry construction, iron work on the canopies, sheet metal cornices, to say nothing of the interiors? How could so complex and ornamented a building be constructed with just these scant, albeit beautifully rendered, plans, elevations, and few, small-scale sections? Clearly the building had been constructed, and looking exactly like the 1/8" = 1'-0" elevations, but without the balance of information necessary for all the trades to perform their work.

In the weeks that followed, as I studied the documents further, I became aware of how much material knowledge was imbedded within the architectural drawings. Every convolution of architectural terra cotta demonstrated not only ornamentation but also a thorough understanding of how material was formed, fabricated, and secured to the building. Comparatively few notes appeared on the tracings, but knowledge of materials and assembly were clearly present and crafted into beautiful drawings. It was as though the artistry of the construction drawing equaled

opposite: Mark Hopkins Hotel, San Francisco (1926), Weeks & Day, courtesy Lurie Management, LLP.



the craft of the trade constructing the building. And that was enough.

How different is our profession today? Architects design beautiful and complex buildings, but how do we indicate knowledge of materials and assemblies in our designs? Moreover, is it ultimately important that we clearly demonstrate a knowledge of building, or is it better if the architect leaves the building to the builder and concentrates instead on form, idiosyncrasies of program, coordination with consultant disciplines, and countless life-safety provisions that every design must integrate? Or, how many of us believe that project specifications can and do carry the balance of information not shown in our drawings?

Some of you are probably already nodding your heads in agreement or girding yourself for battle after such an audacious set of questions. Nevertheless, this very subject is being actively debated within our profession and affects how we perform our work and our role in the building process.

The profession of architecture has changed since the building of the Mark Hopkins Hotel. Construction documents are not the same device now that they were in 1926. Today's construction documents serve many roles: They must give the contractor what he needs to understand design intent and construct the building; they must also clearly define information that regulatory agencies need to understand in order to review and permit the building. Construction documents are also key instruments of coordination with our numerous consultants; they serve as a road map for where information is found

and how it integrates with the architecture of the building. And construction documents are a critical vehicle for constant pricing that takes place during the genesis of a project, culminating with a final bid, pricing that can and does determine the fate of our designs. Lastly, for those of us with a passion for how things are built, construction documents represent an apotheosis of design evolution, a point at which vision is meshed with knowledge, innovation, and artistry in order to bring ideas into reality.

Who among us have the fees for that? Better yet, for those grizzled veterans of construction administration, who among us have the fees *not* to do that? In this age of complex, highly integrated buildings, it's no secret that architects are drawing more than ever. Projects I work on daily are multi-volume mammoths measured in thousands of sheets, with boxcars of specifications hitched to each drawing. Still, it is often not enough to build a building.

I return to the example of Weeks & Day and contrast those drawings with the knowledge invested into our documents today. Can each of us say that our drawings have imbedded within them knowledge of materials, assembly, and construction process like that of our predecessors? How many of us are using systems or products for the very first time? Have we been just a bit rushed to get the project out the door? In today's environment of compressed schedules and reduced fees, how many of us look to construction documents as the most likely place to achieve schedule and fee savings? Can this phase be contracted out to a third party to complete? Can architects today

above: cast iron detail, 417 Montgomery Street, San Francisco (1938), by W.D. Peugh, courtesy of Lurie Management, LLP.

relinquish direct authorship of construction documents and still maintain the control necessary to complete our designs? Or, do we instead follow conventional documentation practice, which states, "If you want it, draw it"? Should the architect who wants more draw more?

The Architect as Master Builder

Architecture is rooted in the concept of a "master builder": an individual who is fluent enough in all building technologies not only to assemble materials as they are intended but also to combine them in new and different ways. This need to innovate is not just an expression of design in our age; it is also a response to budget pressures, codes, local building practices, and an avalanche of new materials, products, and systems. Each of us must, in turn, assess new products as any knowledgeable builder would: in light of construction methods, ease of assembly, warranty, exposure to liability, and complete fulfillment of our design. Any architect who holds himself distant from the master builder paradigm is delegating responsibility for his design decisions to another and runs considerable risk of losing design control altogether. How then can today's architects, with today's fee structure, possibly function in this high-stakes model of construction documentation, where we must thoroughly document each material and building system extensively for fear of someone misunderstanding—wittingly or unwittingly—our design intent?

Only when the architect can build his design in his mind and then on paper
can someone even hope to build it with his or her hands.

For years now, the answer seems to have been efficiency. Construction documents in the computer age have stressed standardization and the benefits of only having to draw something once and then make "minor" modifications. Others praise the efficiency of specifications that, in contrast to the adage of "a picture being worth a thousand words," can describe a system and eliminate our need to draw multiple conditions. We talk of constructing "intelligent" models that can be sliced and diced at any scale, virtually eliminating specialized detailing. While all of these notions contain a promise of efficiency, they have not yet allowed us to substantially reduce our increasing load of documentation.

For my part, I believe an important concept of architecture is first to build our designs abstractly. Only when the architect can build his design in his mind and then on paper can someone even hope to build it with his or her hands. This process also connects the architect with traditions of building and the process of construction that is inextricably tied to how we work. This is the imbedded knowledge each of us must place in our construction documents in order that they fulfill their goal of transmitting a great complexity of information, as well as the careful study that each of us puts into our work. Successful communication of that knowledge to a skilled work force is the greatest challenge any of us will ever face. Designing increasingly complex buildings only intensifies that challenge. How, then, are we to work in a world that requires us to know more, say more, and draw more in order to see our designs complete?

The Architect as Master Collaborator

One future of construction documentation may be a process that teams builders and architects together early in the design process and charges them with successful completion of a project. Many of us are already using this model in one form or another. Known by many names, including "design assist" or "designed/design-build," I prefer to call it what it is: collaboration. Developers have successfully used this process for years, because they long ago realized that savings in time and efficiency of construction can easily outweigh savings achieved by competitive bids based upon enormous sets of plans and specifications.

In this process, the design vision of an architect is augmented by the specific construction expertise of builders who will construct the building. Architects benefit, because design ideas are quickly evaluated, and his or her efforts are focused upon refinement of design rather than inefficient excursions down paths of construction methods and materials that are not often the best way to accomplish design objectives. Builders benefit by taking on much less of the financial risk associated with "guessing" what it will take to build a design as well as covering commensurate risks of his subcontractors doing the same. Owners benefit by having real-time evaluation of project costs and much less exposure to cost overruns.

This is not a simple task, however, and, if anything, demands a more focused and greater knowledge of participants involved in this process. To be successful in this collaborative model, architects must not only bring design leadership to the table but also the qualities

of successful construction documentation: namely experience, knowledge with systems being considered, and ability to rigorously research new materials.

Contractors, for their part, will more than likely be preparing shop drawings to a greater level of detail than they are used to submitting. In some cases, those shop drawings are incorporated directly into the construction documents and reviewed by building departments. The architect's role in documentation will be to coordinate between subcontractors, much as he or she does with engineering consultants. In an era of greater and more detailed documentation, this collaborative approach is a good way to leverage experience and knowledge at an early point in construction documentation. The architect, by conducting an open and informed dialogue with a builder and owner, has the ability to push design and innovation without unilaterally bearing the brunt of documenting and pricing that innovation.

As in the example of Weeks & Day in the early part of the twentieth century, it is clear that, when architects strive for innovation or even excellence in design, we must bring a great amount of knowledge to our drawings and specifications. While design doesn't start with construction documents, it will be severely tested in this phase, and it is up to our profession to recognize the importance of construction documents and their role in the practice of architecture. ●



Reorganizing around BIM

John Mitchell

From volume 02/2005 of _line, AIA San Francisco's online journal, www.linemag.org; reprinted with permission of the author and AIA SF.

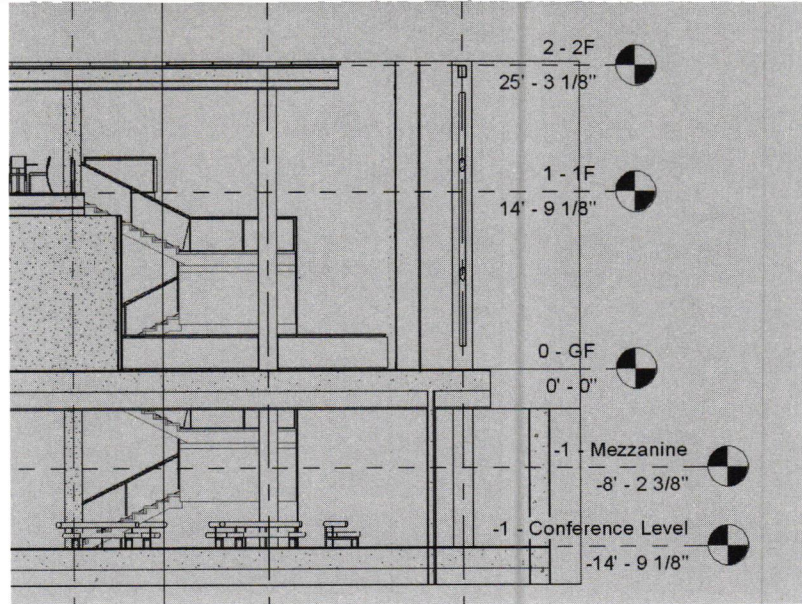
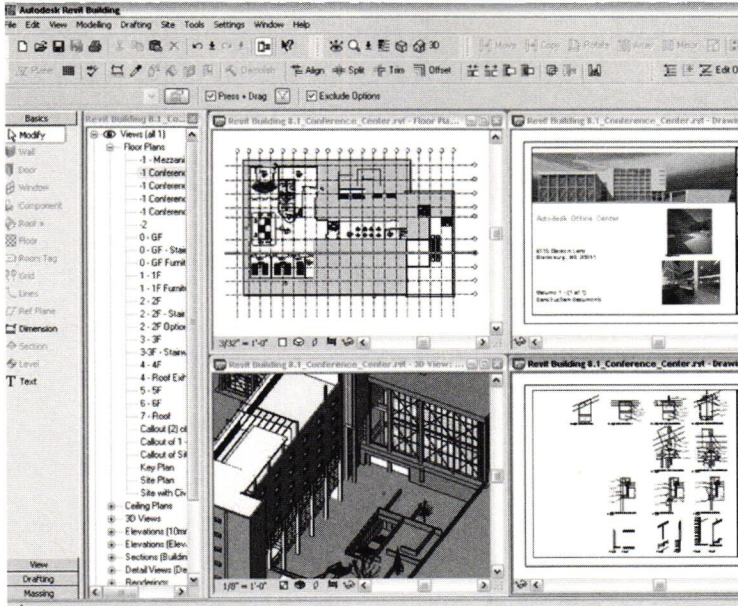
The resistance to building information technology that I've heard reminds me of a survey of architects using computers in 1988, *Computers in Australian Architectural Practice*, by Antony D. Radford. There's a nice introduction that is still *apropos* today. The author starts, "Why write a book on computers in architectural practice? There are no books devoted to drawing boards in practice or typewriters in practice or filing cabinets in practice, yet computers overlap all these things... Because they can affect so much in architectural practice and because they imply new and different ways of working, it is worth sharing the experience of how best to use the technology."

Along with the rest of the business world, architecture practices have adopted computer technology. And on the way we've converted drawing boards into 2D CAD drawings and delivered them as PDFs. But unlike other comparable industries, such as banking or manufacturing, we haven't materially changed work practices; we are still using work concepts from 1900. So far, we haven't considered what computing really means and how we should use it.

So is this a revolution coming? You bet! This is the real change in the industry. Instead of taking whatever vendors sell us, we make a conscious choice—indeed, we do what we tell our clients to do: we plan, not only as individuals, but as an industry. The technology at hand is building information modeling (BIM), an integrated model of a building that does not consist of the independent lines and arcs of drawings, but of objects, accurate in 3D, described by properties, and related to their surroundings. These models can be visualized, audited, analyzed, priced, and automated. Choosing BIM, however, is just one of our planning tasks. Another decision is whether we tackle the problem of sharing information known as "interoperability," revealed in all its embarrassing detail by a study by the National Institute of Standards and Technology—and ignored by most as too hard to achieve.

But it isn't too hard, for the issue is whether the industry decides on its own information standard and its own future or lies back, whines, and complains about clients and builders

opposite: Revit building rendered view, offering the design team as well as future occupants an opportunity to better understand the space, courtesy of Autodesk.



Revit Building Information Model workspace (above left), section view (above right), and axonometric view (opposite), courtesy of Autodesk.

and fees. We need a standard that supports the activities and needs of one of the most complicated sets of processes of any human endeavor: designing, constructing, and operating buildings. Every other industry has such a standard. When you travel overseas, you expect to be able to get money anywhere, enabled by a global standard for financial transactions. Yet you'll probably put this article down and go off to a meeting where the project team has discovered yet another error on the construction site causing delays and extra costs. Shouldn't that situation be changed?

The biggest single issue is the development of industry standards. The best analogy is the emergence of railways in the nineteenth century. Until the government in Britain decided upon a standard gauge, a multitude of train companies had their own railway systems—working in their own area (FEM), specialized for some task (DWG), with wide tracks (XML), narrow tracks (HTML), light loads (VRML), heavy loads (TIFF), etc. When the standard gauge was agreed upon (when

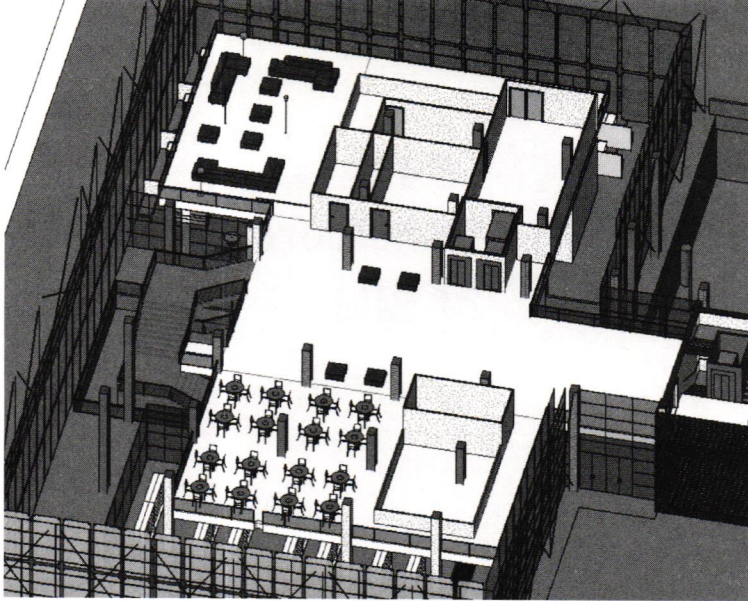
industry and government made a strategic decision for the benefit of all), train companies found they could connect (interoperate), and an astounding increase in commerce occurred. Some companies disappeared, some people lost money. Travelers embarked on a transportation revolution. That's what we need for the built environment now.

The International Alliance for Interoperability (IAI), a global partnership of construction industry organizations, has developed such a standard for the construction industry. The industry foundation classes (IFCs) are an ISO standard that allows building information models to be shared among the multitude of participants in the development process and over the life cycle of a building. Any application that supports IFC can share data—between architect and thermal engineer, contractor and steel manufacturer, contractor and facility manager, and design team and client.

Building information modeling will replace drawings as the definitive source of building information. It has not only automated draw-

ing production, an essential prerequisite since drawings are far too useful to ever disappear, but also, more importantly, enabled simulation and performance measurement. We can get a more accurate thermal load. We can develop options faster. We can actually spend more time on design optimization than when we had to have a team of our expensive staff obsessed by drawing lines (or have a quantity surveyor measuring lines). From this same model we can now calculate embodied energy. With the client, we can calculate life-cycle cost. With the contractor, we can really test constructability.

You're skeptical? Your vendor tells you it's impossible, too early, not feasible? Wrong. That vendor wants his obsolete 2D CAD or his non-interoperable 3D products to continue on the market. Too late! The technology has arrived and has been definitively shown to work. Look at the website for the Nordic Chapter of the IAI (http://www.iai.no/2005_buildingSMART_oslo/buildingSMART_Oslo.htm) and see the presentations given at the chapter's industry day in May, 2005. Sixteen software



Architects have an unparalleled opportunity to reestablish themselves in the design and construction process. But they have to lead!

vendors demonstrated in-sequence importing, value-adding, and checking a common IFC model. It works. (A cheeky games vendor and the innovative captain of the Oslo Fire Brigade took that same model data and simulated burning the building down). Norway's building agency also demonstrated the Byggsøk Planning Approval system, using IFC models and integrating GIS data from planning authorities and other government utilities.

And it would work even better if you and your consultant partners evaluated and tested this concept. Take a cool look at your business and where it wants to go in the next ten years. Do you want to be an architect of a decelerating drawing commodity business? Integrated practice is essential. Look at the leaders of the professions and what distinguishes them—the way they collaborate, examine problems from every angle, and squeeze out every last drop of innovation. To do that, you must have every piece of information at your fingertips and be able to analyze and manipulate that data. Collaboration depends on the open and rich data

that IFC provides—not a proprietary or private data environment, and not a set of products called myCad, myStructure, myMechanical because they only talk to themselves rather than to the industry.

This is not just a problem for architects, of course. Yet, my experience is that the problem is laid at their feet when the subject is discussed in industry forums. Why? Because the architect is the person trained and skilled in managing information (or designing, if you prefer to call it that). Architects have an unparalleled opportunity to reestablish themselves in the design and construction process. But they have to lead!

It means working with the industry to decide upon a common environment for building information and proactively adopting a technology—BIM—that is manifestly a better way to manage our processes.

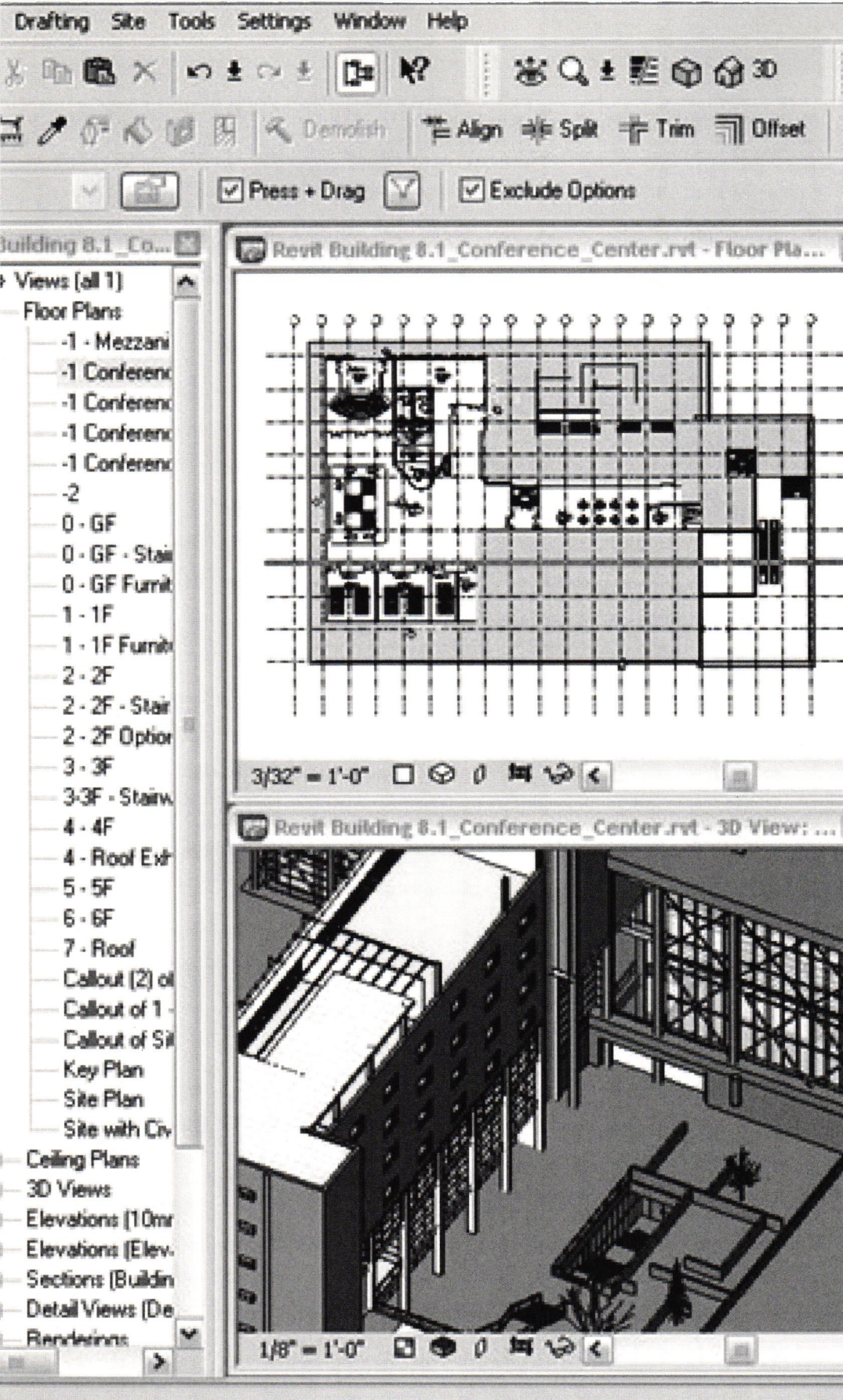
It means making some hard decisions and looking out globally at what's happening elsewhere, such as Scandinavian countries, where Finland and Norway have established a big lead.

It means understanding the GSA directive for what it is: a big step toward changing the U.S. construction sector to be able to exploit IT for the benefit of construction (instead of sales for suppliers) and to achieve better value and a better performing building stock.

It means developing a technology strategy and plan for your company that articulates the business objectives first and then selects providers and vendors that support you, not side-track you.

It means addressing the serious social issues of energy consumption, environmental quality, productivity, reliability, sustainability, innovation, and that nebulous concept, design.

Isn't that what an architect signs up for? ●



Legal Considerations of BIM

Steve Sharafian, Esq.

Building Information Modeling (BIM) can significantly change the way projects are designed and delivered. As this technology is used and matures, construction industry conventions, protocols and practices will develop. BIM's legal ramifications will depend in part upon these protocols and the relationships, both working and contractual, that develop among owner/developers, professionals, builders, manufacturers, and users. The following is a brief investigation of how BIM might affect a professional's standard of care and ownership and use of project documents.

Standard of Care

California law judges an architect's performance against a professional standard of care. When making this evaluation, the law asks what would a "reasonable" architect have done on a similar project under similar circumstances. California law does not obligate architects to guarantee perfection. Errors and omissions are negligent and give rise to liability only if an architect's services fall below the standard

of care. Describing an architect's documents as instruments of service is intended to clarify an architect's standard of care; the architect's documents are not a product being purchased by the architect's client.

In my opinion, BIM should not change this fundamental, professional standard of care. What constitutes a failure to perform in accordance with the industry standard of care relative to BIM is unknown at this time. Although the professional standard of care is entrenched in our legal system, those bringing claims against professionals will likely view BIM as an opportunity to change the appropriate standard of care. Potentially complicating the application of standard of care to BIM are the numerous contributions to the model by both professionals and non-professionals. Should the law judge each participant's contribution by a different standard of care? Those making claims against an architect may argue that courts should view the BIM model as a "product" (such as a car or power tool) rather than an instrument of service. Generally, there is no standard of care issue when evaluating a manufacturer's actions when it produces a product that causes damage. Manufacturers are strictly liable (i.e., responsible regardless of fault) for the damages caused by their defective products.

Ownership of Documents & Copyrights

Existing intellectual property, licensing, and applicable statutes provide rules to evaluate who can own and use a BIM model and its various contributions. However, construction industry participants can modify many of the rights by written agreement. California case law and federal copyright law generally provide that architects own their instruments of service, and, as the authors of their drawings and designs, own the applicable copyrights. However, architects' clients often want ownership of the project documents and copyrights for various reasons. It is not unusual for these clients to use contracts to extract these rights.

The type of information contained in a BIM model is potentially more complex and valuable than the information contained in a reproduced set of working drawings. Professional service and construction contracts will generally need to address who owns the overall model, the various contributions to the model and its data, and how the model's data can and cannot be used. Contract provisions will need to address the model's administration and maintenance; ownership and use of the design(s) embodied in the model and in the model's components; software licenses; and rights of modification and reuse. Disputes will arise that raise other questions—what happens if a party is not paid and it suspends its services and the right to use its contributions to the BIM model?

Conclusion

BIM has the potential of fundamentally changing how professionals think about creating and developing designs, producing construction documents, and constructing buildings. BIM encourages and facilitates the flow of diverse information between and among parties. The model encourages, facilitates, and responds to the flow of information. How contributions affect the legal liability of all the project participants is an issue that will be defined first in contracts and ultimately in statutes and case law as disputes are litigated. Unanticipated issues will no doubt arise and present themselves as the technology is used and develops. Many are hopeful that BIM's technology will reduce errors and omissions and promote greater collaboration in our construction industry. ●



Working in the Midst of Construction

Dana Buntrock

Excerpted by permission of the author from
*Japanese Architecture as a Collaborative Process:
Opportunities in a Flexible Construction Culture*
(London: Spon Press, 2001).

A survey of design and construction periods in Japan (as reported in *Shinkenchiku*) shows that about 20 percent of projects report overlapping design and construction phases. Yet this number is almost certainly low, since the process of design development and construction supervision is not distinctly separated. Often, project supervision must of necessity include design development, although it may not be reported as such. On all but the smallest projects, the builders and professional staff work together on site, during construction. This is in marked contrast to the norms for design and construction in most countries. In the U.K., the chairman of the National Vocation Qualification working group on architectural technology once stated baldly, "The job of the architect is complete within the initial third of the design process."¹ Robert Gutman, an anthropologist studying a 400,000-square-foot site in the U.K., concurred, reporting that during construction, "No architect ever appeared."² The United States is no better; Robert Greenstreet, Dean of the School of Architecture and Urban Planning at the University of Wisconsin-Milwaukee, in an essay entitled, "What Do I Do on Site Anyway?" said, "The short answer is, of course, relatively little, although there are numerous instances of architects acting, often in good faith, beyond the limitations of their contractual obligations and getting in all sorts of trouble."³

In Japan, the contractors are on site from the beginning, and most professional staff move to the site about the time that the building's foundation is completed. The representatives of each group are in frequent (often daily) contact and focus almost exclusively on the project at hand. Meetings with other relevant groups, including manufacturers and suppliers, also occur on site or in the factories and plants producing materials for the project. Fumihiko Maki portrays the site as a refuge: "The field office is not only a place for the liberation of the work of the architect from the world of thought, but also is a place where many people participate in the effort towards its crystallization."⁴

The site offices and much of the equipment—even servers connecting all organizations on

Japanese contractors
draw strong parallels
between manufacturing trends
and construction,
and tend to perceive construction
as a largescale assembly process,
in spite of the differences
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and construction sites.

site—are supplied by the contractor, although architects may call for certain equipment in specifications. Whereas architects remain positive about the role of the construction site, both contractors and clients have begun to look closely at the costs of such a system, because of Japan's current and prolonged recession. Because of this, skirmishes over the construction site have recently emerged: For example, the period of construction has been progressively shortened by clients, although architects to date have been able to respond simply by putting more staff on site. Contractors are not threatening the existence of site offices, so much as trying to rationalize costs, for example by reusing equipment that might otherwise be disposed of at the end of construction. The qualitative benefits, more difficult to measure, stand in stark contrast to the very clear costs of human labor. The site office, however, cannot be assessed on purely economic grounds. In another context, the anthropologist Thomas P. Rohlen noted:

The general emphasis on the group context of work is not entirely explained by an interest in supervision or some other technical consideration. It arises from something much more elemental—the inclination, found throughout Japanese society, to organize activities into small face-to-face groups, to enjoy this kind of environment, and to work efficiently in it.⁵

Office staff (including not only constructors and professionals, but also secretaries or others acting as “office ladies” whose role is to keep things neat and serve sweets and tea) tend to arrive on site as early as 8:00 a.m., and professionals generally do not leave until 11:00 p.m. or later. As laborers quit by early evening, the architect and other office staff can draw and make models in the evening, and supervise, or even occasionally participate in, construction during the day. The architect's team may include at least one junior member with less than five years of practical experience. (This seems to be truer for design studios than commercial firms.) For these individuals, the opportunity to closely observe construction practices is certainly an important influence in their development as designers.

Architectural staff move back and forth between an area under consideration and their drawings or test an idea with full-scale models studied in place. Materials and colors under consideration can be viewed under the same lighting and in relation to other parts of a building prior to making a final decision, and the design team can observe proposed construction techniques before deciding what is most suitable. Architects are also able to observe views, quality of light, and relationships of parts of the building over a longer period of time and to react to those factors in the refinement of a design. It is understandably far easier to frame a view from existing construction than it is when working prior to the grading of a site, or building the structural frame.

This is because drawings have different uses in different construction cultures. In North America, the saying is that drawings are “quantity” and specifications are “quality.” The Japanese correlate would be to

say that drawings broadly define what is built; the activities of the job site work out how. Many of the results of liability concerns found in North America—extensive pre-bid detail documentation, detailed specifications outlining quality and specific acceptable products or materials, and tightly written contracts—are simply not part of practice in Japan.

In an American office, pre-bid detail documentation accounts for around 40 percent or more of a typical set of construction drawings. By contrast, the documents produced in a Japanese office and used by contractors to prepare bids are simple. Most will be drawn at 1:100 (roughly approximate to 1/8" = 1'0"), and details account for perhaps 5 to 10 percent of these drawings. Those that are drawn tend to be special features of the building, rather than illustrations of typical construction. Western architects who visit Japanese architectural offices often voice surprise at the sketchy quality of documents. One architect noted that, "Typically, drawings are not taken to the contract document stage that is common in the USA. In Japan, that phase just does not exist."⁶

Furthermore, the document set is not binding. On one site, when the design team struggled to resolve a thorny question about an assembly, the contractor suggested that it was time to reconsider the area in detail and make adjustments, as the documents were not "a Bible." Instead, manufacturers produce shop drawings for correction and comment, using simple drawings or even models produced by the professional consultants. To a much greater degree than I have witnessed in the United States, the modification and review of shop drawings is an iterative process; it is expected that professionals and contractors will return shop drawings to the manufacturer not once but several times, with revisions. Perhaps this is why the initial submissions are often relatively substandard according to North American expectations, but the process does allow manufacturers to assess and respond to the specific goals and intentions of each design team. Both document production and the necessity for expertise are shifted to the manufacturers, permitting the architect to rely on greater and more current knowledge of materials and processes than would be available in the designer's office, while still maintaining control of design.

On one project I observed in 1994, the original document set (including drawings produced by the engineers) was 148 A-1 sheets for a 35,000-square-meter (377,000 square foot) complex of two buildings. (A-1 is a standard sheet size, roughly 23.4" x 33.2".) On site, though, I counted 2,105 sheets of shop drawings that architectural staff had approved; the building was only 80 percent complete. In a rear storage area were roughly twice as many shop drawings, marked and returned to the manufacturers for correction. Drawings ranged from structural, electrical, and mechanical (502 sheets) to shop drawings specific to the installation of a track for a rooftop crane (five sheets). Doors, windows, counters, and cabinets accounted for close to half of all shop drawings; the original bid documents only minimally defined these areas. In addition to and following approval of shop drawings, the manufacturer may submit a prototype for authorization (usually because the architect has called for it in specifications). In the case of a larger, unique element such as a stair or top-light, the architect and contractor will decide in advance that it is necessary to revisit the factory during fabrication, allowing them the opportunity to give final approval of the components before delivery.

Shifting production of construction documentation from the architect's office to the manufacturer has the added advantage of allowing architects to maintain control over relatively large projects with few staff. This is especially important today, as architects often report public clients squeezing detail development and document production to three months—even on extremely large projects. The office that produces 150 sheets of drawings and reviews thousands is far smaller than the office that produces all the documents itself. Not all firms seem to manage this process equally effectively, however. Another project involved 131 sheets of drawings done in basic

design—quite extensive—and the document set was followed by an estimated 2,800 detail drawings done by architectural staff on site during construction. The staff produced an overwhelming number of large-scale drawings, especially studies of how different patterns of punched metal would affect the buildings' facades. Their effort did not reduce the volume of shop drawings to be reviewed by the architects, and may actually have increased what fabricators thought necessary. One fabricator produced approximately 655 shop drawings for pre-cast work, and the total volume of shop drawings filled more than six floor-to-ceiling cabinets on the site. Compared with the first office, which had only three people involved in detail development and construction supervision, the latter office had over two dozen people on site.

Japanese contractors draw strong parallels between manufacturing trends and construction, and tend to perceive construction as a large-scale assembly process, in spite of the differences between assembly lines and construction sites. Frequently, plans and elevations of a building are being reworked and further refined long after the structure is up. "Just in time" delivery has proved to be useful on the minuscule Japanese construction site, but it also has been utilized in the United States, most extensively in the construction of the Getty Center in Los Angeles. However, in Japan, just-in-time fabrication also means that building components are normally produced specifically for a project, rather than being supplied from inventory stock. Thus, people in daily contact with the building while it is under construction determine detailing and material sizes based on *in situ* conditions. Details are more closely coordinated to the earlier stages of construction already in place, since measurements for a door, for example, will be taken after the opening has been roughed out. This allows the architect to call for materials with tolerances based on actual construction, rather than the more liberal tolerances necessary when one is taking into account possible variations in the initial stages of construction or the parallel manufacture of more than one component. In contrast to the Japanese approach, in most countries, architects must rely on trim to bridge gaps in construction. One result of finer tolerances is the more neatly finished appearance of Japanese buildings.

Drawings, however, are only one part of the way the design team communicates ideas. As Beatrice Colomina wrote, "Only the social division of labor ... makes it necessary for the architect to draw. The fact that such a division exists—and with it a kind of bilingualism: the language of information is severed from the language of experience..."⁷ On occasion, architects may supervise simple work without resorting to drawings. More often, teams on site rely on three-dimensional media to communicate. Consultants, fabricators and contractors pass models back and forth for study, samples fill the site offices and mockups are a normal part of the process of testing ideas and developing the design.

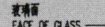
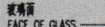
In areas where there is a potential for failure, either aesthetic or performance, it is not uncommon to further work out designs with full-scale mock-ups, to be used to assess the materials and detailing under consideration by the construction team. Architects have the

Notes

1. P. Smith, "Comment," *Perspectives in Architecture*, September 1995, p. 7.
2. R. Gutman, *Architecture: A Clinical Practice*, Princeton Architectural Press, 1988. pp. 35-6.
3. R. Greenstreet, "Laws and Order," in A. Pressman, *Professional Practice 101: A Compendium of Business and Management Strategies in Architecture*, New York, John Wiley, 1997, p. 210.
4. F. Maki, *Kenchiku to iu Genzai—Genba kara no Ripotto [A Presence called Architecture: Report from the Site]*, Gallery Ma Shosho no. 5, Tokyo. Toto Shuppan, 1996, p. 37.
5. I. P. Rohlen. *For Harmony and Strength: Japanese White Collar Organization in Anthropological Perspective*, Berkeley, Los Angeles and London, University of California Press, 1974, p. 30.
6. D. Normille, *World Architecture*, November 1997, p. 30.
7. B. Colomina, *Privacy and Publicity: Modern Architecture as Mass Media*, Cambridge, Massachusetts and London, M.I.T. Press, 1994, p. 65.
8. Arata Isozaki: *Construction Site, The Japan Architect* 12, Winter 1993-4, p. 150.


opportunity to use the mock-up to test proportions, relationships between parts, and even the colors of materials. Where there is a concern about the weatherability of the proposed design, larger contractors also have the research facilities necessary to expose the mock-up to various conditions to assess performance—and are sometimes even required by the government to do so. Sometimes this coordination may seem unnecessary to an outside observer: architects routinely require large prototypes of quite simple elements, even those utilized on earlier projects easily observed *in situ*. Isozaki, for example, described the necessary mock-ups of a concrete panel as requiring that the contractor "vary the type and size of stones in the aggregate, the proportions of the mix, and the surface finishing."⁸ Furthermore, the design team will often decide that these submittals are unsatisfactory and use them as the basis for design development. This may have as much to do with defining the larger goals of the team as it does with the acceptance of a specific material or assembly.

Mock-ups include modest 1:1 models of lighting, handrails, and door pulls, built by the architect out of foam core or cardboard and sometimes attached to other mock-ups of facades several bays in length, built by the contractor of the materials that are under consideration for use in the building. Manufacturers and subcontractors also furnish prototypes and full-scale assemblies. Mock-ups are of course used in the United States as well, but the extent of use and the range of applications are much greater in Japan. If one includes the relatively simple full-scale samples produced by contractors to demonstrate material finishes and detailing options (usually ranging from roughly a half meter square up to 1 x 2 meter panels), there is literally not a project directed by architectural firms that does not rely on full-scale mock-ups. Larger mock-ups can be quite elaborate; one project I observed in 1993 was a relatively uncomplicated ten-story research facility, a project that would not normally call for mock-ups in the United States. The largest mock-up on the project was used to assess the composition of exterior elements and included wall panels and fenestration, a narrow exterior walkway with handrails, and solar panels. It extended over six meters in length and was one-and-a-half stories high. ●



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100

選用材料：
SCHEDULED ITEM

FIN FIN

FL	FW
GL	GU

INS_ INS

LY_	LOU
MP	MEZ

RS- ROO

SE_ SEA

ST_ STC

NO. 1000

KEYNOTES:

330 STRUCTURE

结构柱

519 STEEL 1

钢管

522 CAPPED
加帽

2000

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

715 FLUID A
流态 A

762 STAINLE

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801 SCHEDULE

選用裝

821 END DA
閉塞水

822 CURTAIN

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928 CEMENT

上漆水

Construction Documents in China:

SOM's Experiences

C. Keith Boswell, AIA

An Historical Comparison

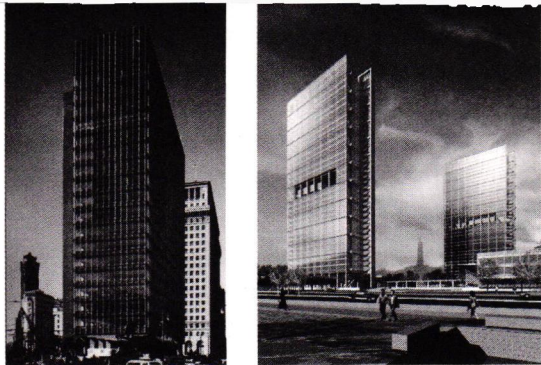
The bottom image at left is a curtain wall detail from the Poly Guangzhou Complex, a current SOM project in Guangzhou, China. It is compared here with a curtain wall detail from the firm's Crown Zellerbach Building in San Francisco of 1959, to suggest a notable difference between details of the two periods. Because curtain wall construction was a novelty at the time of Crown Zellerbach, the architects drew every detail and specified every material; the drawing was about describing the curtain wall element itself. In current practice, the emphasis is instead on describing the relationships between manufactured curtain wall elements and the other building systems.

Drawings courtesy of Skidmore, Owings & Merrill LLP.

Ask any architect who has developed a set of construction documents to describe "what constitutes a thorough set of construction documents and what is the process used to develop construction documents," and you will get as many varied opinions as the number of architects you ask. Expand the discussion to include developing construction documents for use in other countries that are not the architect's home base of operations, and many additional comments and observations will come to the fore.

Construction in China is booming. The San Francisco office of Skidmore, Owings & Merrill LLP has been very active in design, documentation, and construction-phase services in China since the early 1990s, working with Local Design Institutes (LDIs) to develop construction documents that integrate local practice and incorporate international standards of construction quality. We entered the Chinese market early on, starting our first significant project, the Industrial and Commercial Bank of China's (ICBC) Beijing headquarters, in 1994. ICBC's design required details for several systems, such as steel-frame construction, custom curtain wall, and custom stonework, which were fairly rare in China at that time. The project's success established an important precedent for SOM's subsequent commissions throughout China. The more recent rapid growth of China's economy, the country's desire to advance its own design and construction capabilities, SOM's expertise in large-scale project execution, and our desire to achieve the highest level of design and construction set the stage for a remarkable period of advancement.

The process of developing construction documents in China has been, and continues to be, a learning experience. Our approach has evolved significantly over the last decade, reflecting the tremendous amount of change and advancement we have witnessed on both sides of the table. Our knowledge of local practices and relationships with local institutes and fabricators has expanded with each project, allowing us to anticipate issues and propose new approaches to col-



left: Crown Zellerbach, San Francisco, 1959, photo by Morley Baer

right: Poly Guangzhou Complex, rendering by Michael Sechman

laboration with the local Chinese design and construction industry. To fully understand the challenges and possibilities, it is helpful to compare the approaches to and philosophies about construction documents in China and the United States.

What are Construction Documents in China?

This seems like a simple question, or it did to me when I started this effort, but as with most issues the answer has evolved over time. With ICBC, our first full-service project in Beijing, the client's design brief requested "an international quality project that would be respected worldwide." For this discussion, full services meant design, documentation in all phases, and involvement in the construction phase of the project. At the same time, the client, recognizing the opportunity for knowledge transfer, stipulated that local builders and fabricators should be involved to the highest degree possible.

Acknowledging the physical distance between our office and the project—a time difference of sixteen hours—the unknowns of local manufacturing capabilities and fabricators, and the language difference, our first step was to place key team members on the ground for several weeks to gain a basic understanding of the capabilities of the local design and construction industry and the existing local standards and rules of engagement. We knew from working in other countries that if you are going to play in someone else's yard and succeed, you had better know the local rules of the game. Our reviews and interviews included visiting local construction sites, meeting with the client to reach a mutual understanding of the definition of "international quality," interviewing Local Design Institutes, and gathering information on manufacturing capabilities of

architectural building products and systems. We realized early on that our investigation had a parallel track with project team members in China, who were trying to understand our process. Some significant findings resulted from this early review. One of the most memorable was the review of examples of construction documents for recently completed projects prepared by the LDIs. Floor plans, building elevations, and sections were comparable to a set of design development drawings prepared for projects in the United States. Drawings for detailed items such as doors, exterior enclosures (curtain walls, windows, stone, etc.), partitions, and interior finishes exhibited very little or no detail and were largely left to the local builder. The building systems for these items consisted of "stock" materials and systems selected from manufacturers' brochures.

The client's objective of "international quality" set a level of material and system quality, which at the time required importing a high quantity of materials. The construction documents were required to define materials and assemblies, establish quality standards using U.S., European, or Japanese standards, and define the method of installation that could be performed by the local workforce with some or no formal training in these trades.

The majority of the construction documents and specifications were prepared by SOM in the San Francisco office, incorporating English and Mandarin text. The common ground between the English and Mandarin text was a numerical indicator for each note. To aid in drawing legibility, a master notation system incorporating each language with the numerical notation was developed for each material or assembly. The notation system was included on each sheet to facilitate use of full or partial

drawing sets by SOM, the LDI, and international fabricators and contractors. The completed set of construction documents was structured in a similar fashion to a set of documents we would prepare in the U.S., with the addition of the numerical notations for bilingual use.

A thorough and well-coordinated set of construction documents is one of the key factors of a successful project. However, if the documents' authors are not actively involved during construction, interpretation of the design and detail intent for both typical and atypical conditions is at best a roll of the dice. To assist the local and international contractor team, we contacted international fabricators and contractors of curtain wall, specialty metal fabrications, and stonework that we knew possessed the ability to deliver the more custom aspects of the design in a locale where this type of work had not been performed before. In addition to the recruitment of selected fabricators, we placed several of our team members on site for extended durations to work hand-in-hand with the LDI and local construction trades to guide and offer assistance in the work.

We recognized that the opportunity for this type of in-depth involvement is more the exception than the norm. Local owners and companies were impressed with the results of the project, but noted that while they were also interested in a quality project, it was not financially viable to enlist a U.S.-based architect to provide full scope of services and to import a high quantity of building materials, systems, and expertise. To be financially competitive and still achieve an edge in design and building technology required a balance of involvement with the LDI, local building industries, and the U.S.-based design team.

Ultimately, the fundamental consider-

The construction documents were required to define materials and assemblies, establish quality standards using U.S., European, or Japanese standards, and define the method of installation that could be performed by the local workforce with some or no formal training in these trades.

ations and level of detail documentation for construction documents are not significantly different in China. Each project design sets forward materials and systems that will result in either "manufacturer's standard" systems, materials, and details, "customizing a manufacturer's standard," or "custom" detailing. Similar to practice in U.S. cities, there are national and local regulations that vary by city. The construction document sets are tailored to the specific requirements of each project. The answer to the question of "what are construction documents," therefore, is directly linked to the question of "who does what."

Who Does What in China?

The basic answer to this is whoever is the most qualified of the U.S. or China design team members to perform the detailing of specific portions of the documents. There are many local jurisdictional requirements regarding which the LDI is more knowledgeable. In cases where the engineering disciplines (structural, mechanical, electrical, etc.) are local, the coordination effort between the architecture and engineering teams puts a heavier work emphasis on the LDI, and the converse is true in projects with more U.S. consultants. Highly customized details that are critical to the success of the design—exterior enclosure, public spaces, and specialized uses or systems, for example—are developed and detailed by SOM. The construction documents for these areas include both drawings and specifications. The custom details are developed to illustrate size, profile, and type of materials, as well as interface with adjacent materials or systems. The specifications include a combination of local materials and internationally available products. We include local products or fabricators

only after a thorough review and screening process for that particular material or system.

The construction documents for floor plans, reflected ceiling plans, and other overall layout drawings is a shared effort. We develop these drawings during the schematic and design development phases, and usually the LDI takes them through construction documents phase with reviews by us at key milestone dates in the construction document process.

Where are the Construction Documents Prepared?

In a shared documentation effort, the lead firm, SOM or LDI, prepares the documents in each home office and exchanges and shares at deliverable milestones for review. To develop drawings concurrently at separate locations requires careful delineation of responsibilities in the early planning stages of the project. In addition to face-to-face coordination sessions between the architect and engineering disciplines, the LDI and SOM hold regular coordination sessions, typically in the city where the project occurs. Even in the age of computer file transfers, face-to-face working and coordination sessions are essential for team members to fully understand the necessary drawing content.

When Are the Construction Documents Prepared? When Are They Finished?

Usually the most difficult question to answer is, "When are construction documents complete?" Those who have developed a set of construction documents know that there never seems to be enough time to fully detail the project. The pace of construction in China is much faster than in the U.S. On recent projects we have developed details for the customized areas in a staged sequence that generally follows the stages of construction. To accom-

modate the accelerated pace of construction, we have prepared some of the more custom details that apply to large areas of the project by the end of the design development phase. Construction documents have been prepared in distinct trade packages such as exterior enclosure, public spaces, elevator/escalator system details, and special use areas. For larger-scale projects, these construction document trade packages are further divided into distinct packages for (for example) exterior enclosure for the building base, for typical floors, and for the top.

Why Does a U.S. Firm Prepare CDs in China?

The projects we have completed and are currently working on are complex buildings with custom-designed systems and details in select areas that support and enhance the design. To facilitate a finished product that meets the original design intent to the greatest degree possible and to achieve the necessary quality level, the author of the design must be the author of the details. Additionally, we have developed expertise in several areas that do not currently exist with LDIs.

On the other hand, the LDIs possess specific local knowledge, expertise, and capabilities in areas that U.S. architects do not. There are many similarities in this international collaborative approach to situations when two architects are teamed together on domestic projects. Beyond the delineation of who does what the heart of the issue is developing a working collaborative in which there is mutual respect. The basics of clear and constant communication, buildability, and clarity of document information must be monitored from the inception of the design intent to final completion of the documents and occupant move-in. ©



Drafting Culture

Paolo Thombesi, Ph.D.

A spider conducts operations that resemble those of a weaver and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. At the end of every labor process we get a result that existed in the imagination of the laborer at its commencement. He not only effects a change of form in the material on which he works, but he also realizes a purpose...

Karl Marx, *Capital*, 1867, Vol. 1, Part 3, Section 5

Three years is not a long time in the life of a mature, capital intensive industry—possibly enough to produce a new model, but not enough to retool a whole production line or change market perceptions. The same, however, may not be true for those sectors of the economy exposed to socio-technical turbulence and characterized by product agility. A good example is provided by distant architectural services.

When I contributed some ink to the paper of this journal in 2003 (“Foreign Routines,” *arcCA* 03.2), I noted how convergence technologies had managed to uproot traditional modes of professional exchange and interaction. Yet I was cautious about the professional take-off potential of the market for three reasons. One was that I sensed its clear polarization towards geographic reorganizations of the same company on one side, and cottage industry operators and commercial drafting bureaus on the other. The second was that, within this environment, I felt that the social division of responsibilities that traditionally characterizes design activity was likely to give way to a detailed division of production, “where drawings are turned into (and turned out as) goods, and where workforce training needs and profiles shift from spatial and technical understanding to work station dexterity.” Finally, the third reason was that the profession itself seemed extremely coy about the entire arrangement, and unwilling to concede its undeniable lure openly.

Today, I am no longer sure this is the case, and I am prepared to admit defeat by evidence.

Average annual growth in GDP, 1990-2002:

U.S.: 3.3%

China: 9.7%

India: 5.8%

Average annual growth in Services, 1990-2002:

U.S.: 3.7%

China: 8.8%

India: 7.9%

Digital exposure has certainly reached new levels. Try a search of Off-shoreXperts, a website of distant outsourcing, and armies of potential drawing-services subcontractors, divided by world region or type of specialty, will scroll before your eyes. Not that they all qualify for NASA consulting, but their cyberspatial presence still betrays a degree of organizational infrastructuring that was unthinkable only a few years ago.

More significant, however, is the fact that distant services have come out of the proverbial professional closet and situated themselves at the forefront of the architectural sector restructuring debate. Both professional and management journals now give digital outsourcing a modicum of coverage, and the many professional firms that have used such services are more prepared to talk about it, at least compared to the past. This may be partly connected to the recent evolution of building design markets in advanced economies, where firms' specialization in construction documentation or project administration—services valued by sophisticated clients particularly on complex projects—is finally coming of age as a legitimate professional strategy to hedge knowledge-acquisition costs and reduce office exposure.

Be that as it may, the CEOs of some of the most successful design services subcontractors have entered the professional scene from the front door of AIA, RIBA, and CAA meetings, with addresses or workshop presentations aimed at debunking myths of makeshift competitiveness through the display of professional wares and office workforce preparation. As a matter of fact, many of these business structures have come to resemble (or literally to replace) commercial design or executive architectural offices in the U.S. or the U.K. They use the same language, publicly subscribe to an ideology of scrupulous productivity and value for money, and in some cases have graduates of prestigious universities or former associates of renowned firms at their helm.

Provided that one changed "Public" to "Private," the set-up is not too dissimilar from the Departments of Public Works established across the British Empire during Queen Victoria's and King Edward's reigns, headed by highly qualified minds and staffed by well-trained, conscientious avatars. Had technological circumstances allowed for it earlier, digital collaborations may have been able to build some historical lineage. Albert Khan would have been happy to contract a sister firm for the design documentation and on-site administration of his Russian factories in the 1930s; Bruno Taut would have been a good design director

In a widening market, . . . the appropriate use
of drafting routines, detail libraries,
and quality assurance guidelines
is the necessary condition to operate at
a minimum competitive level.

for a Turkish export-oriented firm; Antonin Raymond and Kunio Maekawa would have conscientiously dispatched flawless architectural details from Japan to international clients; and Fernand Pouillon could have made a killing servicing French companies from his office in Algeria.

My flippancy has the purpose of highlighting one element I consider important for the discussion: that, within the newly forming regime, notational correctness of the documents exchanged will cease to be the discriminating factor for digital outsourcing. In a widening market characterized by firms' long-term strategic decisions and high levels of public information, and where there is ample opportunity to preview skills and undergo preliminary pilot tests, the appropriate use of drafting routines, detail libraries, and quality assurance guidelines is the necessary condition to operate at a minimum competitive level. And by the time all the players allowed on the field know the basic rules of the discipline they are in, the pickets of the game will have to be relocated onto farther (or higher) grounds, in this case delimited by design skills and cultural perceptiveness of sorts.

For too long, professional handbooks have treated construction documents as neutral translations of design decisions taking place somewhere else, the format of which could then be standardized or reduced to norms. Instead, we all know that architectural practices tend to conform to and employ, either explicitly or implicitly, systems of design procurement, decision making, element costing, and technical linkages that have major consequences over the formatting/layout of contractual information and associated graphics. This generates markedly specific collaborative needs, which can easily become the basis for selective alliances and the arrangement of complementary services in a fee-shrinking environment. Several drafting outsourcing firms are now firmly onto this, and eager to prove their ability to move up the design or project development chain. It is not by accident that the name of one large company in the business comes from the compression of "satellite" and "atelier."

This evolution, in a sense, suggests that digital outsourcing has changed, or is changing, its geographic narrative: no longer a way to bring two distinct socio-economic and professional worlds together in order to benefit from their wage differentials, but rather one of transacting within a much larger territory of practice, where firms can locate themselves more freely according to production advantages. The reasons to pursue distant collaborations remain the same—competitiveness and professional sustenance—but the industrial repercussions are drastically different, because, in the second case, distant servicing may mean structural relocation of previously closer function and replacement of previously local employment. Coping with the challenges of the times, in the end, may require more than retaining construction documentation skills. It may imply drafting a new culture of professional services that recognizes the winds of change while acknowledging that there are still plenty of softer areas, such as urban, community, landscape, and interior design, which are less adaptable to non-local agendas but equally necessary to the public welfare. ●



What the Drawings
Don't Show:

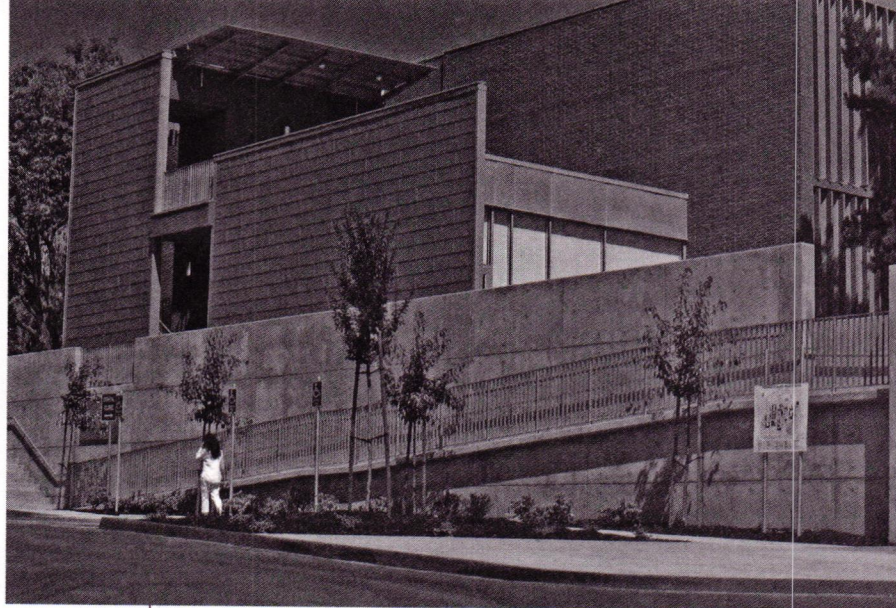
Four Recent Buildings

Interviews by Kenneth Caldwell

Anshen + Allen was commissioned to design an addition to an existing physical sciences building, designed by John Carl Warnecke, FAIA, at Diablo Valley Community College in Pleasant Hill. We asked Associate Principal and Director of Interior Architecture Lynn Befu and Project Architect and Project Designer Shelley Anixter, AIA, about how the construction documents contributed to the effort to preserve a mid-century building.

What were the challenges, and did your construction documents answer most of the questions?

Anixter: The largest challenges were seismic upgrade issues, the restoration of the original aluminum sun louvers, and the zinc shingles on the new addition. The zinc shingles, although a new product on the West Coast, were well explained in the documents. The louvers, as with many preservation elements, needed clarification. Some of them were manually operated and some were automated. Originally, we thought the louvers could be mechanically cleaned and painted, and we left it to the contractor to decide whether to dis-



above, opposite and below: Anshen + Allen,
Diablo Valley College addition and restoration.
Photographs courtesy of Anshen + Allen.

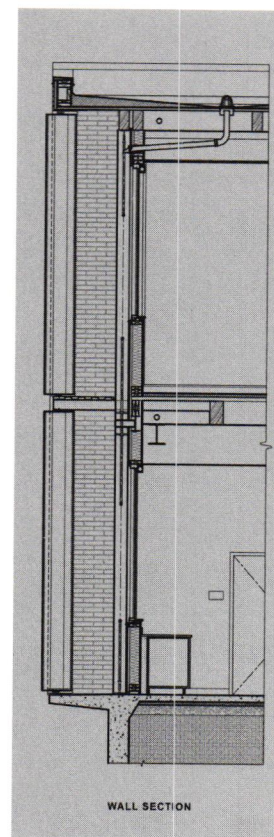
mantle the assembly. But the aluminum was not a heavy gauge, and it was not possible to remove decades of rust and dirt without removing them and having them dipped in a solution and repainted. In the end, we had to test several kinds of paint to be sure it would adhere to the bare aluminum after it had been stripped and cleaned.

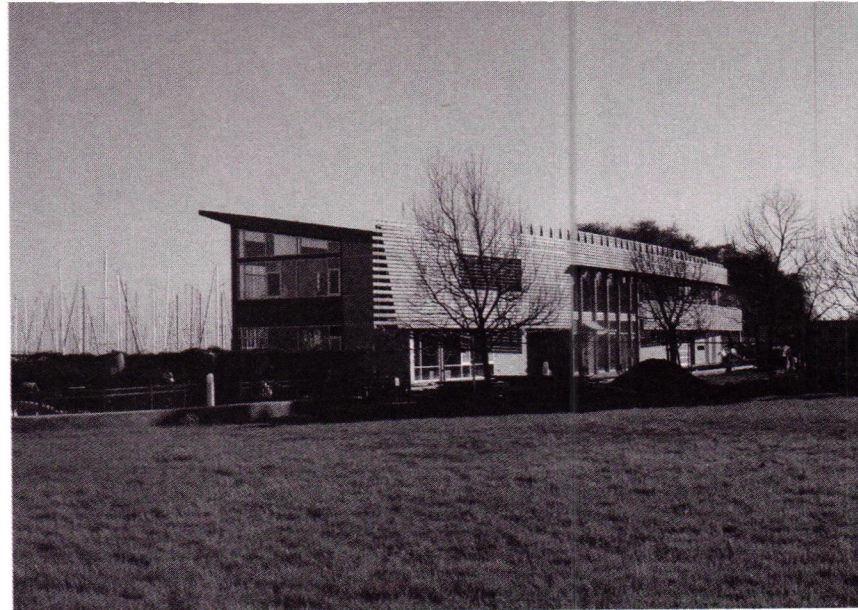
How are drawings and specs different for mid-century buildings?

Befu: Mid-century projects are like other preservation projects: You don't know what you are getting into until you open up the walls. There are two key differences from earlier twentieth-century buildings. The materials used in "modern" projects were often experimental and sometimes failed. On the positive side, drawings can be easier to obtain, as they were in this project.

Why did you use a relatively new material—the zinc shingles—on a publicly bid project?

Anixter: For one, it is a sustainable material. It has been used successfully on the East Coast and in Europe. Since it was new out here, two manufacturers gave us an enormous amount of attention and assistance. Their review of our drawings, specs, and shop drawings was very valuable to us. The contractor wanted to substitute another material, but the client supported us. There were instances in which we had to reject some of the contractor's details and refer them to the drawings, which were very clear. In the end it turned out well.

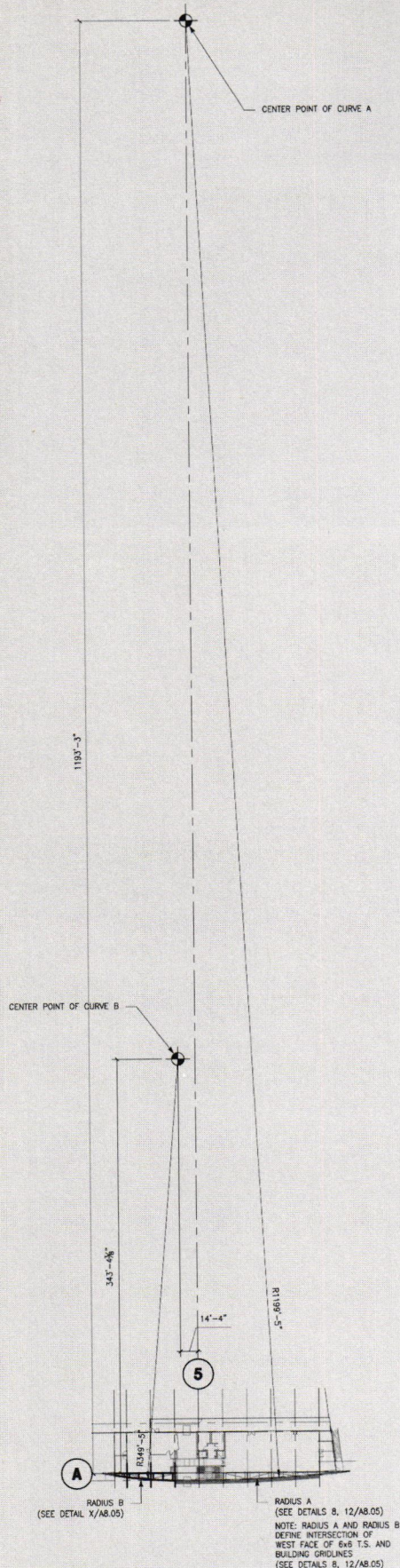




above: Tom Eliot Fisch, South Beach Harbor Building, San Francisco. Photograph courtesy of Tom Eliot Fisch.

left: South Beach Radii Plan

right: South Beach Screen Wall Detail



The new South Beach Harbor Building by Tom Eliot Fisch employs an Ipe wood screen to give the building shape, relate to the marine uses, and offer protection from the western sun. We spoke to Principal Amy Eliot, AIA and Associate Principal Alyosha Verzhbinsky, AIA.

Why did you employ this kind of design element?

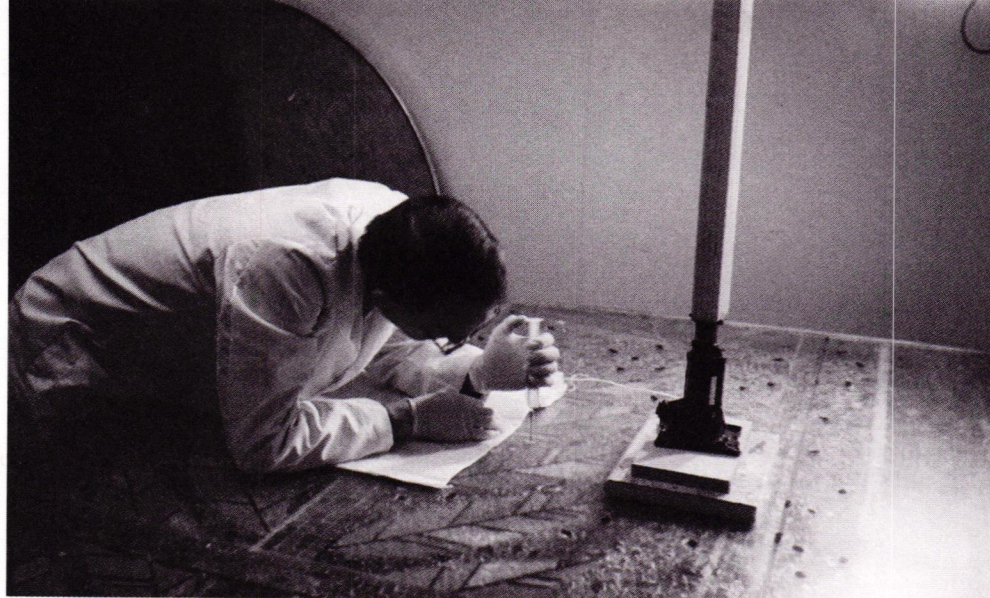
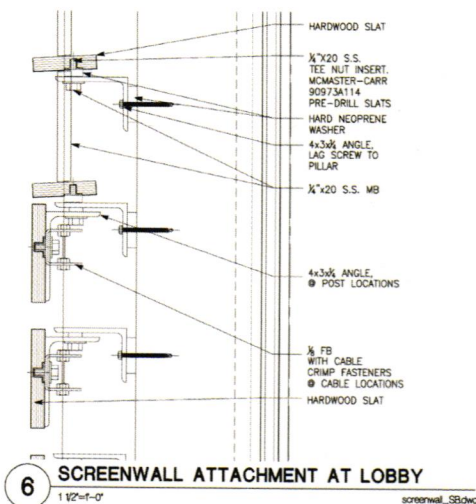
Eliot: We wanted the building to relate to marine and harbor uses in a way that avoided the clichés of blue metal roofs and porthole windows. On the west side, there is a need for sun protection, and it is the dominant view from public transit. There was an opportunity to create something that is an abstract characterization of what boats are and how they were historically made.

What were some of the challenges in terms of the documents and constructability?

Eliot: Ipe is very hard to work with, because it is so dense. That's why it stands up well in marine conditions.

Verzhbinsky: The number one challenge was the geometry of the arcs. One radius is over a thousand feet and the other is over three hundred feet—the center is somewhere out there in the Bay. The contractor couldn't inscribe those circles on the ground, but the work points we gave them allowed them to calculate the lengths. The fortunate thing is that this wall was one of the last things they built, so they had a lot of time to consider it.

Another issue was tolerance. We had a wood building onto which we attached a steel structure onto which we attached a wood screen wall. These three construction methods have different tolerances, both vertically and horizontally. With a 200-foot-long screen wall, you don't want to see much deviation vertically, from board to board. And the wood came with differences as much as 1/4" in a 1 x 6. I am not sure if it's our batch, or normal tolerance for Brazilian-produced wood, but



above: Masonic Auditorium mural restoration, injection of adhesive at bowed panel

it's definitely outside tolerances for American milled product.

We paid particular attention to shedding water. We didn't want the slats to be completely horizontal; you don't want standing water in a recessed fastener. We used wood spacers to adjust for different tolerances. These angled the wood slats so water can run off. In our drawings, we had called for neoprene spacers, but those couldn't be found, so the contractor custom milled wood spacers.

How much work was done in the field?

Verzhbinsky: One contractor thought building it in their shop and assembling it on site would make sense, so it was designed to be modular. We thought that would allow us to deal with the tolerances. But the contractor who won the bid preferred to build it on site, piece by piece. This was a surprise. The final tolerances are fine for a building exterior.

Do you see this as a Bay Area building?

Eliot: Yes, but in an unusual context of water-

front buildings that are highly industrial in nature, of the overwhelming ballpark, and of massive condominium towers. The site needed a strong move that could acknowledge this complexity in a simple but elegant way. When we think of the best of Bay Area architecture, the things that come to mind are tautly wrapped and beautifully composed structures, often utilizing wood as both structure and skin, a certain density of texture, and an immediacy in the way a structure expresses how it is put together.

San Francisco's Masonic Auditorium, designed by Albert Roller and completed in 1958, features an unusual and very large mural overlooking the building's lobby, which many mistake for stained glass. The creator, artist Emile Norman, called it "endomosaic," a process by which a number of materials are sandwiched between two sheets of acrylic. The restoration of this mural involved two distinct construction documentation processes, one for reinforcement of an existing exte-

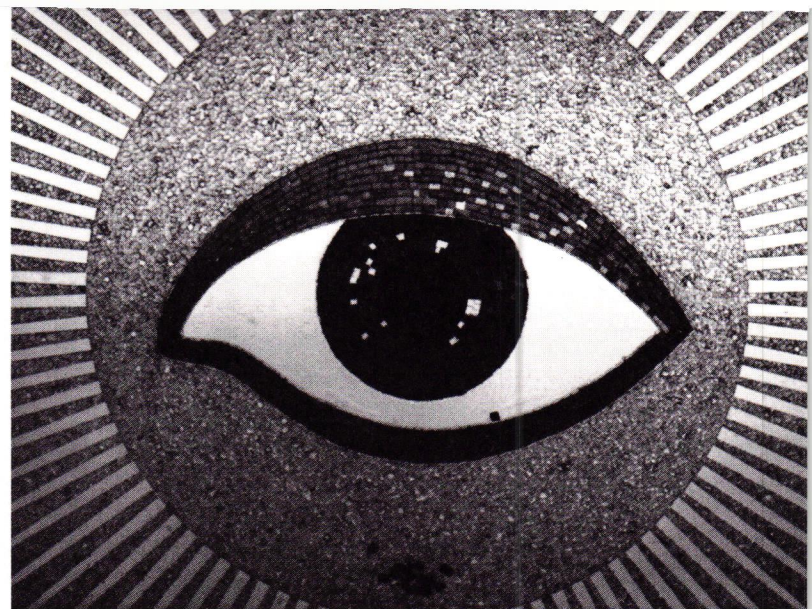
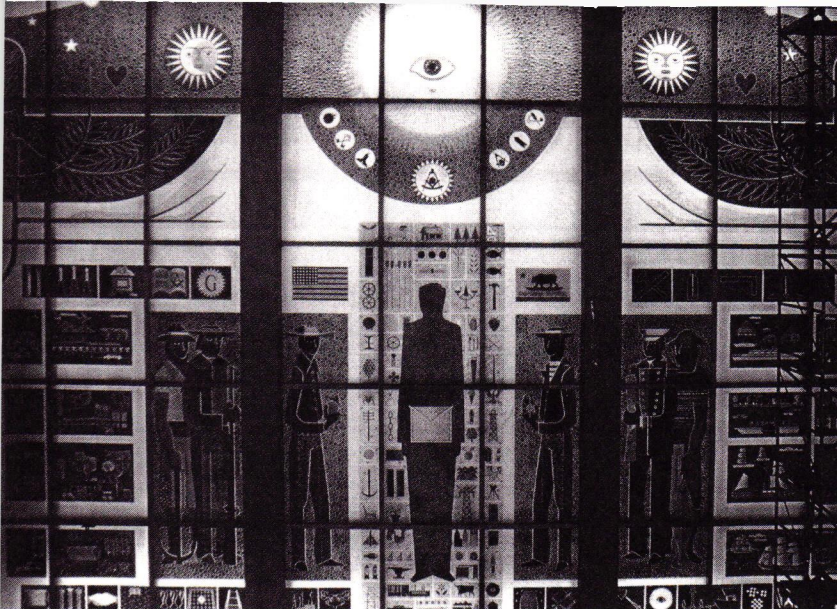
rior screen, to which new exterior panels that block out ultraviolet rays are being installed, the other for the removal and restoration of many of the forty-five panels that make up the mural. We spoke with David Wessel, Assoc. AIA, Principal of Architectural Resources Group, and Glenn David Mathews, AIA, a Principal of Architectural Resources Group Construction Services.

Why two distinct processes?

Mathews: The restoration of the mural is more akin to a design/build process. Nobody has ever restored an acrylic mural like this, because it is unique. The restoration survey and analysis will serve as the construction documents for that portion of the work. The screen work is a straightforward construction process with a set of working drawings. The screen protects the mural, but they don't meet physically, and two different parties perform the work.

How was this mural made?

Wessel: Each of the mural panels measures 5' 3-5/8" x 7' 3-5/8". The artist sanded a sheet of



above: Masonic Auditorium mural, Emile Norman, 1958.
Photographs courtesy of Architectural Resources Group.

acrylic to make it translucent and placed it on a light table. He then arranged what are called the “tesserae” on this sheet to make up the symbolic imagery. These tesserae include glass, acrylic, fabric, metal, dirt from every county in California—sent in by each Masonic lodge—and bits of stone. He glued all this material in place using an adhesive called polybutyl. 3/8” plastic spacers were placed within the image, along with edge strips. A second clear sheet of acrylic was glued over the edge strips.

Why the need for restoration?

Mathews: Exposure to the elements and to UV rays has caused deterioration in both the acrylic sheets and the materials that make up the mosaic. Some of the pieces have fallen out of place, and in some places dirt and moisture have seeped in.

How do you repair such an unusual piece of art or architecture?

Mathews: Carefully. We determined that opening the sandwich panel was not an option.

Wessel: We will remove a damaged panel from the frame and lay it flat. A small opening in the side can be made and a piece of metal inserted. Outside the panel, a magnet will help guide the fallen piece of mosaic back into place. Once positioned, a very small hole, just large enough for a syringe, will be drilled above the relocated tessera. The adhesive resin will be reapplied and the hole plugged with invisible material. We will use a similar technique for adhering the acrylic sheets that have delaminated.

Throughout this project, we have been replicating the artist’s original moves. He knew that it might be necessary to repair the mural. He prepared an envelope for the Masonic organization, to be opened only after his death. Amazingly enough, they still had it, and of course they never opened it. We visited Mr. Norman down in Big Sur, and he opened the envelope for us. He had made clear instructions on how the mural was constructed and how it could be repaired. It validated what all of our scientific testing had told us! Likewise,

we have thoroughly documented the mural, so it would be possible to recreate it photographically, should the actual mural become too fragile beyond our lifetimes.

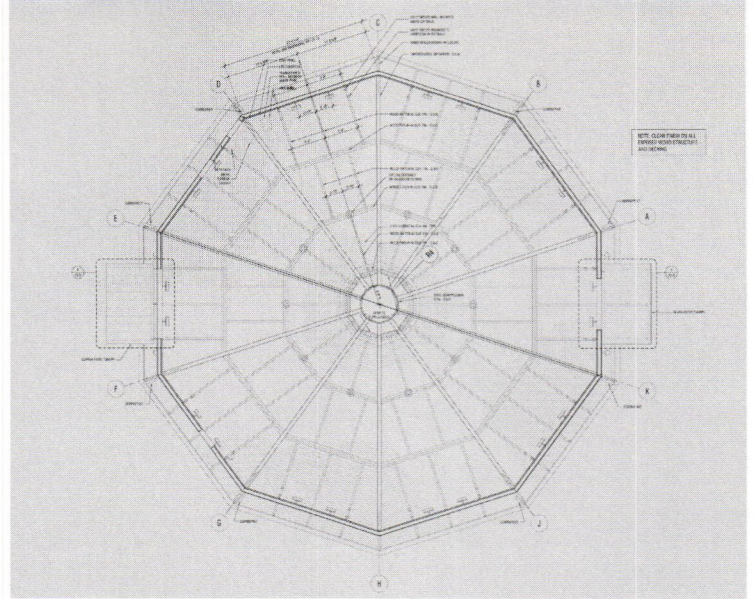
Douglas Thornley, AIA, of Baum Thornley Architects LLP designed a new winery for Paraduxx Winery in the Napa Valley. A ten-sided fermentation building offered some unusual challenges. We asked him about the construction.

Why a ten-sided fermentation building?

Our client desired a unique form for the heart of a new winery and asked us to look at indigenous barn traditions. It turns out that a ten-sided structure is the most efficient in terms of arranging the fermentation tanks in a circular layout.

So it’s not just for aesthetic effect?

No. The client requested a column-free space. The building is seventy-five feet across without any columns. There is great efficiency in the



above and below: Baum Thornley Architects LLP, Paraduxx Winery Fermentation Building.
Photograph by John Sutton.

roof framing material. You don't have to draw ten different conditions. Each steel roof beam (hip rafter) is exactly the same size and tapers toward the top, where they are collected in a compression ring. There is less load at the top of the roof and more at the perimeter, which allows for the taper. The expressed roof enclosure, which appears like a wood lattice, sits above the steel beams.

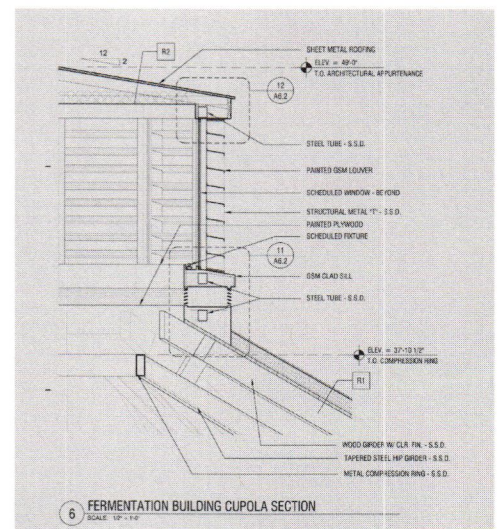
Can all this be understood from the construction documents?

Essentially, yes. But the structure is not self-supporting until all of the primary members are in place. It goes up fast.

Were there a lot of questions during construction?

The structural engineer had to be fairly involved, especially around questions of shoring. Most buildings are seen as sequential. What is unique about a roof framing system like this is that you have to get everything in place for it to work. It depends on unity—and the necessity of shoring during erection.

That is hard to convey in drawings. It helps if everybody involved has worked on this kind of structure before, as I had in William Turnbull's office. We are going back to a way of building that was figured out a long time ago without all our modern technology. That is more challenging for us today than it was for our agrarian forefathers. ●



Are you concerned about the future of the profession and the ways in which your practice will evolve in the years ahead?

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November 3-5, 2006

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AIA California Council

... and Counting

Number of construction drawing sheets for Mies's Crown Hall at IIT - 11.

Number of drawing sheets in the bid set for a California K-6 elementary school.

In 1985... 20 to 25.

In 2005... 75 to 80

(Stafford King Wiese Architects)

Average calendar days for state plan review and back check (without overtime charges) - 151.

(California Division of the State Architect).

Materials used in the façade of the new deYoung Museum -

950,000 lbs of copper.

300,000 lbs of glass.

7,200 unique panels with 1,500,000 embossings.

(Fong & Chan Architects)

Construction documents for the new deYoung Museum -

860 construction document sheets.

1,837 submittals.

100 bulletins.

(Fong & Chan Architects)

San Francisco's largest AIA firm by number of employees - Gensler / 1,700 (AIASF).

Los Angeles' largest AIA firm by number of employees - DMJM / 5,400 (AIALA)

San Diego's largest AIA firm by number of employees - NTD Stichler / 120 (AIASD)

Sacramento's largest AIA firm by number of employees - Lionakis Beaumont / 170 (AIACC)

Number of architecture firms/paid employees in California - 3,265 / 27,546.

State with second most - New York with 1860 / 16,929.

(Greenway *Almanac of Architecture & Design*)

Number of new California architectural licenses issued in 1989 - 1,339.

Number of new California architectural licenses issued in 2003 - 389.

(California Architects Board)

David Meckel, FAIA

Current California construction project posted at Dodge's online service with:

Largest number of sheets - Tom Bradley Int'l/LAX In-line Baggage Screening Facility
- 2,627 plan sheets / 2,951 spec pages.

Fewest number of sheets - East 17th Street Rehabilitation Facility in Oakland -
0 plan sheets / 12 spec pages.
(McGraw-Hill Construction)

Number of consultants on MRY's recently completed US Courthouse in Fresno - 20:
civil engineering / structural engineering / mechanical & plumbing / precast
concrete / electrical / geotechnical / vertical transportation / landscape architecture
/ exterior wall / lighting design / security / graphic design / life safety & code
compliance / public art / acoustical / audio-visual / blast / cost estimation / speci-
fications / green specifications.
(GSA)

Three professional organizations that didn't exist in 1980 -

Design-Build Institute of America, www.dbia.org

US Green Building Council, www.usgbc.org

The One Percent Solution, www.theonepercent.org
(Google)

Most exotic drawing tools in a '70s office -

beam compass, transfer lettering, & electric eraser.

Most common tools in same office -

Maylines, triangles, lead pointers, & drafting tape.

Constant tool in offices between then and now - tracing paper.
(www.archsupplies.com).

Number of years that slide rules were used by everyone from schoolchildren to scientists - 350.

Years that the scientific calculator has been used - 34.
(architect/historian Victor Carrasco).

"A bid is an educated guess carried to two decimal places" - Anonymous

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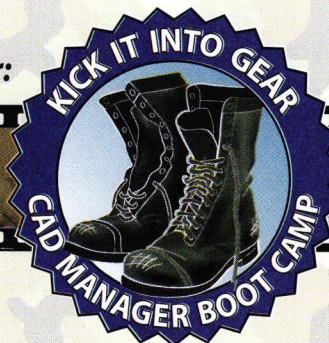
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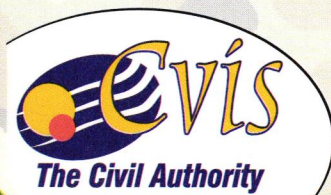
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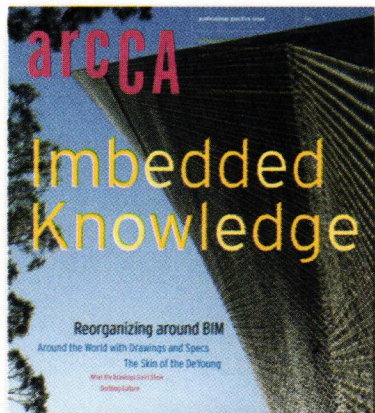
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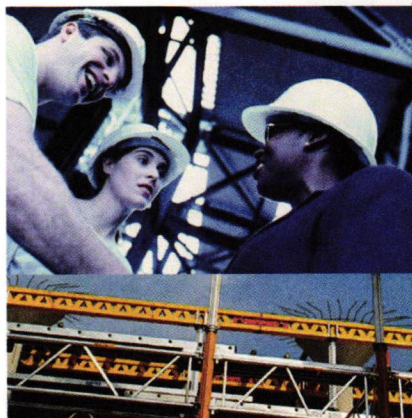
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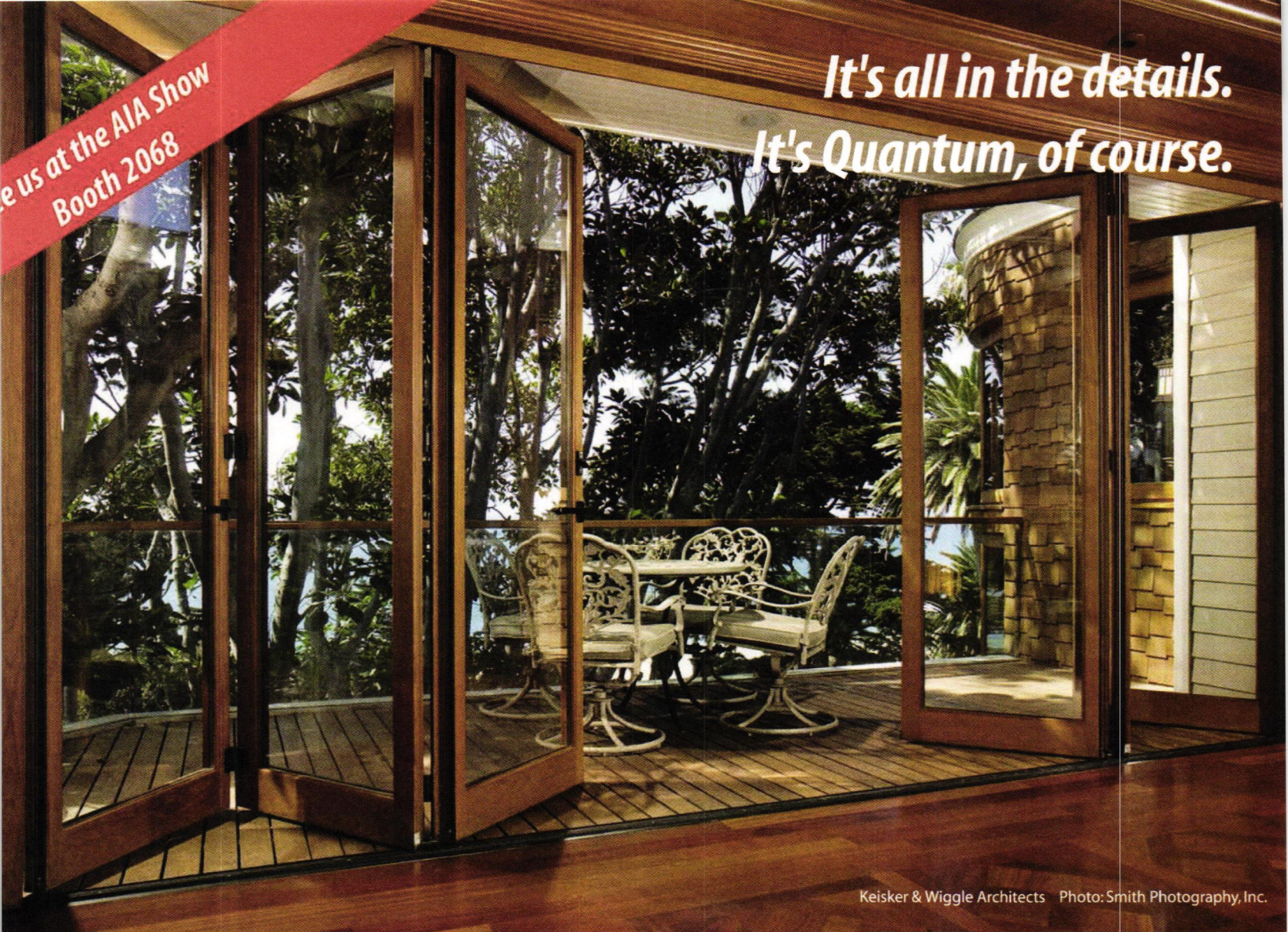
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In Autumn 2004, The American Institute of Architects, East Bay launched Exceptional Residential: Bay Area Regional Design Awards (ExRes), a Bay Area design awards program offered every other year. What sets ExRes apart from other design award programs is that it is open to residential projects only, and those projects can be submitted by anyone: architects, design professionals, self-designing home owners, and so forth. ExRes requires only that the projects be located within the Bay Area.

Since many of the construction projects in the region are residential in nature, one would assume a large proportion of design award winning projects would also be residential. And, while we see juries awarding affordable housing and mixed-use projects, the number of single-family homes selected is always low. It's not because of a lack of design excellence in these so-called "jewel-boxes"; it is usually because juries have a communal sense towards awarding projects that serve the greater good of our communities.

In the San Francisco Bay Area, our homes are a defining element of the fabric of our community. Recognizing this, the AIA East Bay leadership decided to highlight residential design excellence through an award program of its own. "The AIA East Bay knows it's important to honor exceptional residential design that exemplifies what Bay Area living is about," explains John Nelson, AIA, 2004 AIA East Bay President, "More importantly, the AIA strives to inform the public of the impact good design has on our lives. ExRes aims to do just that by examining what we all have in common: a living space."

Equally important, the program is open to the public. In 2004 a number of the projects entered were submitted by residential designers and homeowners, groups that do not often have the opportunity to enter AIA awards programs. "While many awards programs tend to be exclusive, ExRes honors first-class residential design—no matter who was responsible for the vision. Most times, an architect is behind design excellence, but when the person is outside of the profession, we need to applaud their success," asserts Nelson.

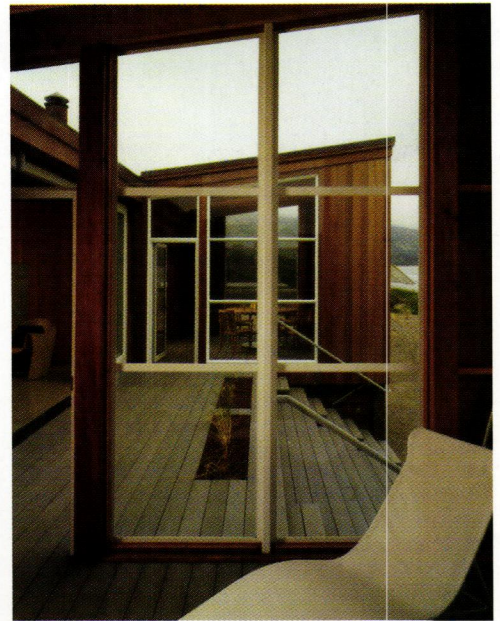
The ExRes 2004 jury (David Miller, FAIA; Larry Scarpa, AIA; and Lisa Findley, AIA) recognized projects ranging from a unique Airstream trailer to 60,000 square feet of affordable housing infill. Speaking on behalf of the jury, David Miller, FAIA, said, "Each of the twelve residences selected for an award uses a different approach to create a sense of home. Whether the project is affordable housing, single-family renovation, or mixed use, they each demonstrate an attitude toward issues and ideas. Focusing on good design, they offer experimental and clear solutions to critical issues."

ExRes 2006 is scheduled for Autumn 2006. Those interested in submitting homes in the nine Bay Area counties should contact the chapter at 510/464-3600 or info@aiaeb.org.

The AIA East Bay has grown more than 60 percent in the past two years, largely due to the fact that its membership highly values the role of the residential architect and sole proprietor in the profession. Exceptional Residential: Bay Area Regional Design Awards is one of the many programs this chapter uses in educating the public on the importance of design excellence in building and renovating homes.



Regan Bice Architects, Crumpacker Residence, San Francisco.
Merit Award. Photo by Joshua McHugh.



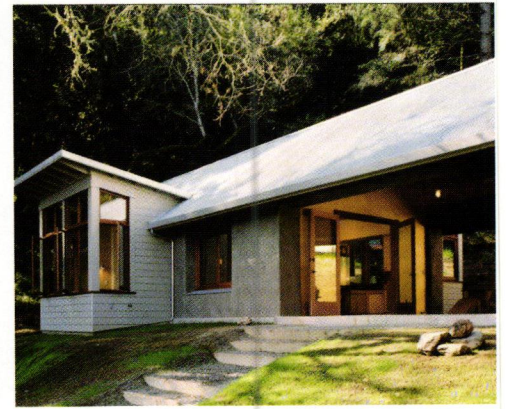
Turnbull Griffin Haesloop, Jones
Residence, Stimson Beach. Honor Award.
Photo by Matthew Millman.



Endres Ware, Martin Studios,
Oakland. Merit Award.
Photo by Ian Martin.

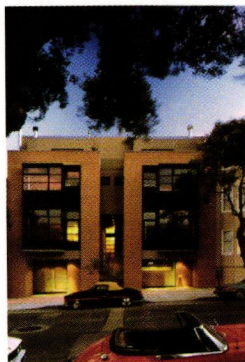


Paul Welschmeyer Architects, Edison. Honor Award.
Photo by Mike O'Callahan.



Siegel & Strain Architects, Wine Creek Road Residence, Healdsburg. Merit Award. Photo by J.D. Peterson.

Paulett Taggart Architects, Sacramento Court, San Francisco. Merit Award. Photo by Nic Lehoux.



Kuth/Ranieri Architects, Lodi Bunkhouse, St. Helena. Honor Award. Photo by Felipe Villas Boas.



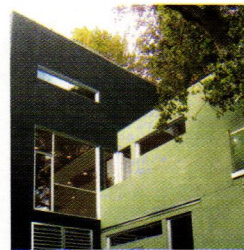
Office of Jerome King, AIA, Architects + Planners, El Paseo Studios, San Jose. Citation. Photo by Bernard Andre.



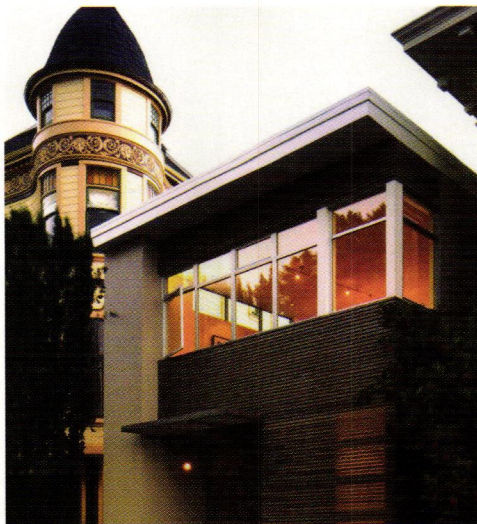
Regan Bice Architects, Shaw Residence, Hillsborough. Citation. Photo by Regan Bice Architects.



Assembly, Darling Flower Shop Building, Berkeley. Honor Award. Photo by Cesar Rubio.



Ming Lee, Architect, Underhill House, Orinda. Merit Award. Photo by Amey Bhan and Carl Hampson.



CCS Architecture, Haus Martin, San Francisco. Merit Award. Photo by Tim Griffith.

The Skin of the DeYoung



Underlying the design of the new DeYoung Museum is the idea that it should be integrated into the natural landscape of San Francisco's Golden Gate Park. Heeding recommendations against a wood-clad exterior, design architects Herzog & De Meuron turned instead to copper, which would develop an appropriate patina over time. Following other work of their firm, in which images are inscribed on the building surface, they sought to reproduce in copper panels the impression made by light filtering through a tree canopy, creating an abstraction that resonates with the de Young's tree-filled park setting.

Because off-the-shelf copper panel systems did not afford sufficient variability, executive architect Fong & Chan Architects invited three metal fabricators to discuss possible approaches. A.Zahner Co. of Kansas City, being the most experienced with sophisticated design explorations, were chosen for the job.

The architects worked back and forth with Zahner to explore ways of capturing the effect of the tree canopy, eventually deciding on the

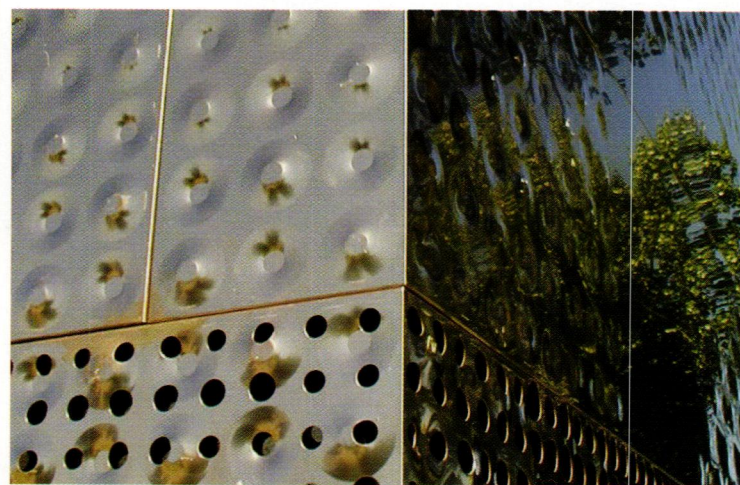
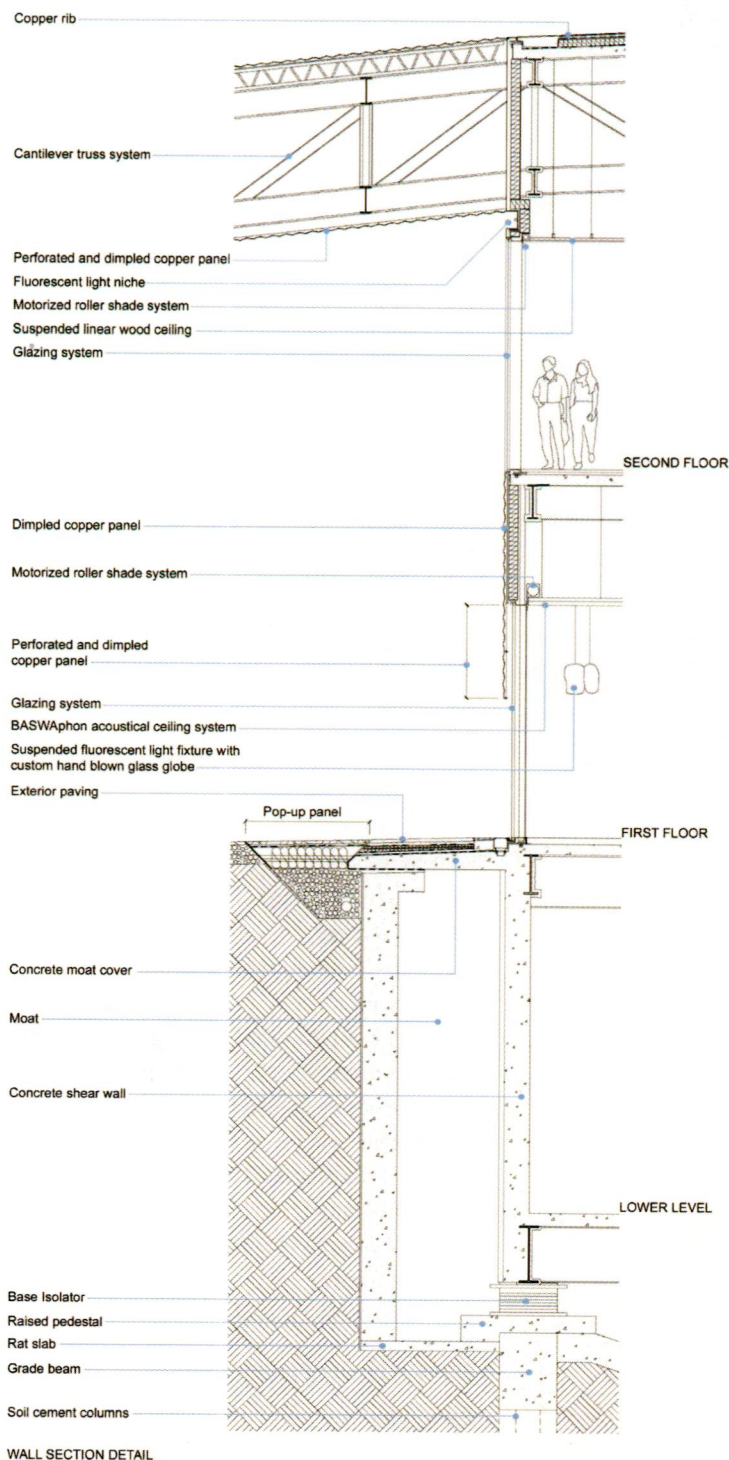


photo opposite by Mark Darley; above © Corporation of the Fine Arts Museums

use of two overlaid treatments: a pattern of circular perforations varying in diameter from 0.625" to 1.875", and a pattern of alternating inward and outward dimples impressed into the copper panels, varying in depth from 0.125" to 0.75". These treatments could be executed using custom dies on Zahner's existing machinery.

The architects layed out test panels in AutoCAD, but, as Fong & Chan project architect Nuno Lopes observes, if they had drawn every panel of the building in AutoCAD, they would still be drawing holes today.

To make the process practically expedient, Zahner commissioned custom software to translate data from a JPEG image into a DWG file, which in turn could be used to direct the fabrication machinery. Herzon & DeMeuron abstracted photographs of the tree canopy in Photoshop. Fong & Chan prepared outline DWG file drawings of each of the building's folded faces at their true dimensions, and imported them into Photoshop. The tree canopy abstractions were overlayed onto the rasterized outline images, with two independent files made for each of the building's folded faces—one to produce the dimple pattern, the other to produce the pattern of perforations.

Zahner then translated the Photoshop files into corresponding DWG files, in which each depth of dimple or diameter of perforation was indicated by a different color. Just as color assignments designate pen widths when a drawing is sent to a plotter, so here the color assignments correspond with the dies to be used in the metal stamping process.

Two sets of manual corrections were required. The architects tweaked the patterns in AutoCAD wherever there was insufficient visual continuity from folded face to folded face; and Zahner made sure that the inward/outward alternation of dimples was consistent from panel to panel. Otherwise, the digital translation was error-free. ●



Under the Radar

Santa Fe Depot Rehabilitation

Christopher Johnson

Project Team

Owner: City of Fresno

Architect: Johnson Architecture;

Christopher A. Johnson, A.I.A.,

Principal Architect;

Thomas E. Pyle, Project Architect

Structural Engineer:

Structural Focus

Mechanical Engineer:

LP Consulting Engineers

Electrical Engineer:

Kruse & Associates

Landscape Architect:

Boro Landscaping Architect

Civil Engineer:

Blair, Church & Flynn Consulting Engineers

Acoustic Engineer:

McKay Conant Brook Inc.

Historic Consultant:

Milford W. Donaldson, Architect

Estimator:

Leverton & Associates LLC

General Contractor:

Reyman Brothers Construction



Built in 1899, the Santa Fe Depot served as the halfway point between Los Angeles and San Francisco. It was a passenger rail station until 1966. In 1974, Amtrak resumed passenger service and converted the depot's freight house into a passenger station, while the original depot was turned into offices.

The Santa Fe Depot is one of a handful of Mission Style buildings built prior to 1900 still standing and is listed on the National Register of Historic Places. Prior to the rehabilitation, the depot's exterior was worn, faded, and marred by graffiti, and a textured coating had been applied to all surfaces. Most of the original windows were removed, filled in, or boarded up, and the landscape was deteriorating. After five years of unsuccessful attempts to build a new station, preservationists prevailed in their efforts, demonstrating that it would be more prudent and cost effective to rehabilitate the Santa Fe Depot.

There were nine major additions to the original depot; several were removed to restore its historic character. These included an addi-

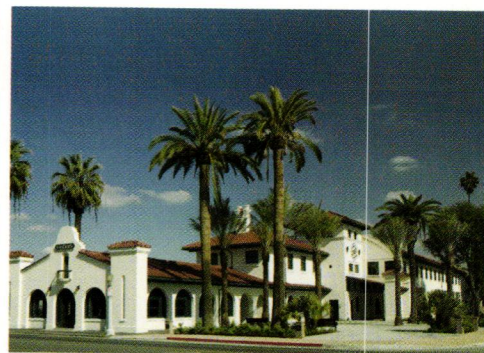
tion on the second floor, which obscured the original clock tower and main entry, and an annex building adjacent to the depot.

Original 1899 drawings were used to rehabilitate the entire building, including replicating the clock face on the clock tower, original windows on the first and second floors, sliding baggage doors, and the wooden benches in the waiting room.

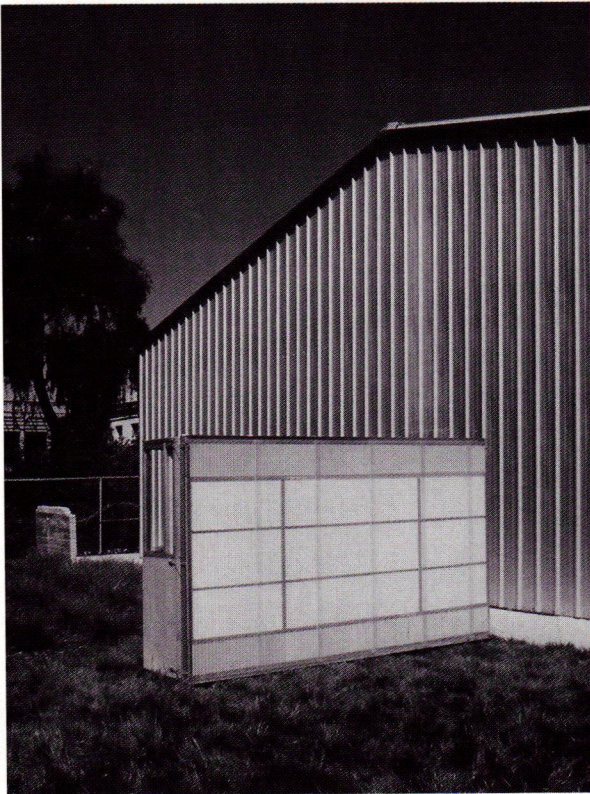
A hybrid of structural reinforcement systems was used to minimize the impact on the building. They were concealed in existing walls, floors, and attic spaces.

The rehabilitation of the Santa Fe Depot has returned the depot to its original use and has saved an important part of Fresno's history for future generations to use and enjoy. ●

before and after

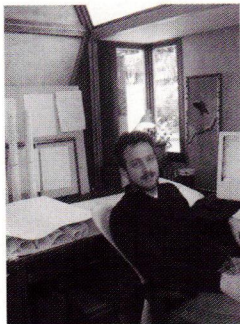


photos opposite, top, and above second by Camerad, Inc.;
above first by Johnson Architecture



Folding Studio

Kate McGlashan



above photos courtesy of McGlashan Architecture
left by Tim Culvahouse

And you thought reappropriating the mobile home was hip. Scott McGlashan of McGlashan Architecture has designed and built a mobile office.

For his master's thesis at the University of California-Berkeley, McGlashan looked to marry design and construction by enabling the architect to design on-site. His background in carpentry, cabinetmaking, and boatbuilding came in handy as he created a collapsible, portable studio that fits through a standard doorway, yet expands to 8' x 11' x 9' high. Once occupied, its flaps, folds, and openings adjust to keep the architect comfortable in varying seasonal and weather conditions—serving as a tool for engaging and measuring a place.

During its creation, McGlashan explored the interaction between the processes of design and construction. However, McGlashan says, “On the one hand, a folding structure is such a tight system, with everything dependent on everything else, that it wasn’t ideal for a design-build investigation. On the other hand, I only had four and a half months, so I did a fair amount of design on the fly.”

McGlashan used a stressed-skin construction, in which 1/8-inch plywood is glued to a Styrofoam insulation core for the walls and to cardboard honeycomb for the floor.

After a few gigs on job sites, the mobile studio is staying put for now. It is deployed full-time in Berkeley as the headquarters for McGlashan’s emerging architecture practice. ●