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Laminated Glass: Glazing Material for all Conditions

by H. Scott Norville, PE, Ph.D

Introduction

In most large-scale disasters such as hurricanes, earthquakes, and explosions, window glass fractures. In many instances, such as the Oklahoma City bombing, the Northridge earthquake, and Hurricane Andrew, news reports and damage investigations focus on window glass breakage and associated damage, frequently including injuries. One glazing material, laminated glass, can reduce damage and injuries in many types of disasters at a cost not significantly higher than that of normal window glass. Laminated glass provides these benefits because it prevents glass shards from falling and flying through the air while maintaining closure of its fenestration under the most severe loading conditions. In addition, laminated glass possesses strength equivalent to that of monolithic glass in resisting wind loadings.

A Brief Discussion of Window Glass

Glass design professionals use many terms, unfamiliar to architects and engineers, in discussing window glass. A brief review of some of this terminology will provide a basis for understanding laminated glass. Annealed, heat-strengthened, and fully tempered comprise the three basic monolithic window glass types. Annealed window glass forms the basis for all other window glass types and constructions.

Major glass manufacturers produce annealed window glass by melting its composite raw materials to produce molten glass and then pouring the melt onto a bed of molten tin where it cools and hardens. After it hardens on the molten tin, the glass then goes through an annealing lehr that heats it to temperatures near its softening point. After heating, the glass cools slowly in a controlled manner, eliminating undesirable residual stresses. Glass manufacturers term this procedure the float process. The end result, annealed window glass, commonly known as plate glass, appears optically clear and very smooth. Manufacturers produce annealed window glass in twelve nominal thicknesses ranging from 3/32-inch (2.5-mm) to 7/8-inch (22-mm).

Annealed window glass produced by the float process, though far superior to window glass produced by older methods, remains a brittle material that fractures at rather low magnitudes of load or load-induced tensile stresses (PPG, 1979; Kanabolo and Norville, 1984; Norville and Minor, 1985). When it fractures, annealed glass usually produces large, razor-sharp shards (GRTL, 1987). Because of its relatively low strength and the significant lacerative hazards associated with its shards, designers should never use annealed glass to resist loads other than wind loading.

Glass temperers produce the other two monolithic window glass types, heat-strengthened and fully tempered, by heating annealed window glass to high temperatures and then quenching it. Because heat-strengthened and fully tempered window glass fractures uncontrollably when cut, temperers first cut annealed window glass into the size and shape of the fenestration it will glaze. They heat the annealed window glass lite to temperatures near the glass softening point and then cool it rapidly. The outer surfaces cool first while the interior of the glass remains hot. As the interior cools more slowly, it contracts and pulls the outer surfaces into compression, producing residual compressive surface stresses of relatively high magnitudes. Figure 1 shows stress distribution through the thickness of fully tempered window glass.

The cooling rate in the heat-strengthening process controls the magnitudes of the residual

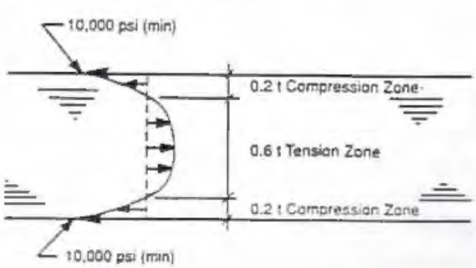

Figure 1: Residual stress distribution through fully tempered glass thickness

compressive surface stresses. Heat strengthened window glass has residual compressive surface stresses ranging from 24.1-MPa (3,500-psi) to 51.7-MPa (7,500-psi). Fully tempered window glass has residual compressive surface stresses with magnitudes of at least 69.0-Mpa (10,000-psi). ASTM C1048-97b, "Standard Specification for Heat-Treated Flat Glass—Kind Heat Strengthened, Kind Fully Tempered Coated and Uncoated Glass," spells out all the criteria for classification of window glass as either heat-strengthened or fully tempered. ASTM C1279-94, "Standard Test Method for Non-Destructive Photoelastic Measurement of Edge and Surface Stresses in Annealed, Heat-Strengthened, and Fully Tempered Flat Glass," provides non-destructive methods for estimating magnitudes of residual compressive surface stresses in heat-treated window glass.

Window glass almost always fractures when the net tensile stress at one point exceeds some critical value (Brown, 1974; PPG, 1979). Under uniform loading, fracture always originates on a window glass surface. Heat-strengthened and fully tempered window glass obtain their high strengths to resist uniform loading because the magnitudes of load-induced tensile stresses must significantly exceed the magnitudes of the residual compressive surface stresses before fracture can occur.

Monolithic window glass, regardless of type, comprises the most rudimentary window glass construction. Laminated glass and insulating glass comprise the other two major window glass constructions. Laminated glass consists of two or more glass plies bonded together by elastomeric interlayers. Although other interlayer materials exist, fabricators most commonly use polyvinyl butyral (PVB). The thickness of the PVB interlayer can range from 0.38-mm (0.015-inch) to 5.10-mm (0.200-inch). Fabricators can use any combination of glass thicknesses and types. Most laminated glass constructions consist of two symmetric glass plies with one interlayer bonding them (Figure

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Learning Objectives

After reading this article and completing the exercises, you will have:

1. learned the different types and properties of manufactured window glass;
2. understood the requirements for a safety glass rating;
3. differentiated the design considerations to be considered when specifying glazing; and
4. learned the effects of air blasts, hurricanes, and earthquakes on glazing materials.

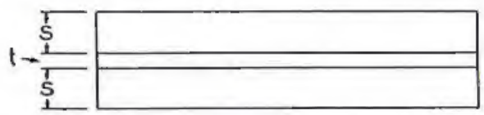

Figure 2: Symmetric laminated glass cross-section: glass ply thickness S, interlayer thickness t.

2). In the U.S., PVB thicknesses typically range from 0.76-mm (0.030-inch) with annealed glass plies to 1.50-mm (0.060-inch) with heat-treated, i.e., heat-strengthened or fully tempered, glass plies. ASTM C1172, "Standard Specification for Laminated Architectural Flat Glass," provides the definitions and constructions for laminated glass. ASTM E1300, "Standard Practice for Determining the Load Resistance of Glass in Buildings," presents a table of standard symmetric laminated glass constructions with nominal thicknesses ranging from five-mm (3/16 inch) to 19-mm (3/4 inch).

Insulating glass consists of two window glass lites with a sealed air space between them. As its name implies, insulating glass provides thermal insulation far superior to that of monolithic window glass. When fabricated using laminated glass, insulating glass provides excellent sound insulation, too.

At noted above, window glass behaves as a brittle material. In the event of fracture, both annealed window glass and heat-strengthened window glass produce large shards that can cause severe injuries. To reduce lacerative hazards, U.S. model building codes (SBCCI, 1997; ICBO, 1997) require the use of safety glazing materials in certain situations.

Model building codes recognize only two safety glazing materials: laminated glass and fully tempered glass. They earn their safety glazing rating for entirely different reasons. Fully tempered window glass displays extremely high strength in comparison to annealed window glass, but it earns its rating as a safety glazing material for another reason. When fully tempered window glass fractures, the residual compressive surface stresses, combined with the interior tensile stresses (refer to Figure 1) cause fully tempered window glass to dice into numerous, very small shards that reduce the lacerative hazards typically associated with fractured annealed or heat-strengthened window glass. Laminated glass earns its rating as a safety glazing material because when it fractures, glass shards, regardless of glass ply type, adhere to the interlayer, eliminating lacerative hazards to persons nearby.

Because glass shards adhere to the PVB interlayer should the plies fracture, laminated glass maintains a degree of stiffness after breakage, even when both plies fracture. The term "post breakage behavior" describes the ability of fractured laminated glass to remain in its frame. Its post breakage behavior makes laminated glass an ideal material for many glazing applications where monolithic glass would not provide safety. Such applications include any circumstances where maintaining closure of a fenestration following fracture and prevention of falling and flying glass shards constitute primary design considerations. Examples of design situations of this type include: glazing to provide blast resistance, glazing in hurricane-prone regions, glazing in earthquake prone regions, and glazing that interferes with burglars or other unwelcome intruders entering buildings.

Table 1
Type Factors for Window Glass Design

Window Glass Type or Construction	Type Factor
Annealed Monolithic	1.0
Heat-Strengthened Monolithic	2.0
Fully Tempered Monolithic	4.0
Laminated Annealed (under most conditions)	0.9
Laminated Annealed (all other conditions)	0.75
Insulating Glass (Annealed Symmetric Plies)	1.8

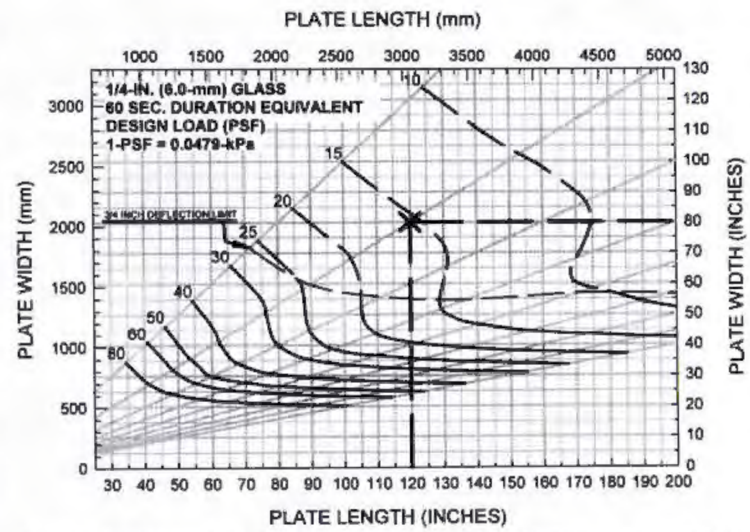

Figure 3: Basic annealed window glass strength chart [Example: A nominal 6-mm (1/4-inch) thick monolithic annealed lite with rectangular dimensions of 2030 mm (80 inches) x 3050 mm(120 inches) has a basic design strength of 0.75-kPa (15.4-psf).]

Window Glass Function and Design

THE PRIMARY FUNCTION of window glass consists of providing a transparent barrier between the environments inside and outside a building. To achieve its purpose, window glass frequently must simply resist wind loading. Typical window glass design, therefore, consists of selecting the appropriate thickness of window glass to resist a specified wind loading for a region given the geometry of the window. To facilitate thickness selection, U.S. model building codes and manufacturers' design recommendations assign design strengths (SBCCI, 1994; ICBO, 1996; ASTM E1300, 1996; LOF, 1980) to the various window glass types and constructions using charts and type factors.

ASTM E1300 provides the most comprehensive approach to window glass design available. ASTM E1300 presents twelve charts, one for each monolithic glass thickness. Each chart relates basic annealed window glass design strength in terms of a 60-second duration, uniformly distributed, constant magnitude loading as a function of area and aspect ratio (long dimension/short dimension). Figure 3 presents a chart similar to one found in ASTM E1300 that provides the basic strength for annealed window glass having nominal six-mm thickness. Once the designer determines the basic strength for an annealed window glass lite with specified rectangular dimensions, ASTM E1300 provides type factors that relate design strengths of window glass types and constructions to the basic window glass strength from the charts.

The designer multiplies the basic annealed glass strength by the appropriate type factor to determine the design strength for a particular glass type or construction. Table 1 presents an abbreviated list of type factors.

In general, the designer can combine type factors. For example, in designing laminated glass with fully tempered plies, the designer would multiply the type factors for fully tempered window glass and laminated glass to obtain: 4.0 x 0.9 = 3.6

To achieve an efficient design, the architectural window glass designer uses an iterative procedure that goes beyond this discussion.

Voluminous published research (Quenett, 1967; Pilkington, 1971; Behr, et al., 1993; Linden, et al., 1983; Linden, et al., 1984; Vallabhan, et al., 1985; Minor and Reznik, 1990; Norville, et al., 1993; Norville, et al., 1998) indicates that laminated glass displays strength and behavior equivalent to that of monolithic glass under wind load. As Table 1 indicates, building codes and design recommendations set laminated glass design strength at something less than that of monolithic window glass having the same nominal thickness and fabricated from the same window glass type. The conditions that allow the designer to use the laminated glass factor of 0.9 cover the vast majority of design situations.

For most glazing designs, the difference between laminated glass design strength and monolithic glass design strength is so small that the same thickness of either construction will suffice to resist a specified wind loading. If wind loading comprises the only consideration in achieving a particular window glass design, then the designer should opt for monolithic window glass. While laminated glass adequately resists wind load, its optimum use occurs when other considerations affect window glass design.

Competing Products

This section divides glazing applications into two areas: new construction and retrofit situations. In new construction, the designer can devise a system using appropriate glazing materials and framing to provide the desired strength and/or behavior for a given design situation. In retrofit applications, existing frames may significantly limit the designer's options. Laminated glass possesses qualities that make it highly suitable for new construction or retrofit applications.

The architectural window glass designer must never use monolithic window glass when factors other than wind load govern the design. Any type of window glass or window glass construction, due to glass' brittle nature, has a finite probability of fracturing under any air blast loading, any impact, or any contact with its frame. If fracture occurs, then the resultant glass shards pose significant lacerative hazard to nearby persons.

The optimum glazing materials for new and retrofit construction include laminated glass, polycarbonate, glass-clad polycarbonate, and insulating glass made with any of the above. The paragraphs below describe each of these glazing materials not described earlier. The closing paragraphs in this section address retrofit security film. Some engineers believe that retrofit security film, though not a glazing material in itself, provides post-breakage behavior for monolithic glass similar to that of laminated glass in the event of fracture.

All the glazing materials discussed below have significantly higher costs than laminated glass. Retrofit window films have initial costs ranging from slightly less to much higher than that of laminated glass, depending upon the thickness used and the application method. Retrofit window films also have a very high maintenance cost over the life of a building because they require replacement at intervals of 6 to 10 years as they degrade due to mechanical action such as abrasion and ultraviolet exposure.

Polycarbonate: Some designers frequently use polycarbonate, a plastic material involving no glass, to resist air blast loading. This material resists large magnitudes of loading through plastic deformation. Polycarbonate does not fracture and produces no shards. When used as blast-resistant glazing, polycarbonate sheets require special framing. To realize the full value of polycarbonate, the frame must either clamp the polycarbonate or have a deep rebate to prevent air blast pressure from propelling the entire sheet from the frame.

Since polycarbonate glazing resists the entire air blast loading without fracture, its supporting frame must have sufficient anchorage to transfer the air blast loading to the structural frame. Polycarbonate possesses ideal blast-resistant qualities, provided the structural frame of the building it glazes can withstand the air blast loading forces. Polycarbonate has a very high initial cost and relatively high maintenance costs. Unlike glass, polycarbonate discolors after prolonged exposure to ultraviolet light and it scratches easily, requiring periodic replacement to provide visual acuity. Polycarbonate has suitability for both new construction and retrofit applications. Retrofit applications may require new frames if the polycarbonate replaces existing glass.

Glass-clad polycarbonate: Glass-clad polycarbonate consists of two glass plies bonded with elastomeric interlayers to a middle layer of polycarbonate. Glass-clad polycarbonate, therefore, is a special type of laminated glass that provides the same blast-resistant qualities. In addition, the polycarbonate layer provides additional stiffness that enhances the lite's ability to remain in the frame following fracture of the glass plies under air blast and impact loadings. If the designer uses a frame that prevents glass-clad polycarbonate from pulling out, it will maintain closure of the fenestration under more extreme loading than will standard laminated glass.

Like laminated glass, glass-clad polycarbonate provides very good sound insulation. The outer glass plies protect the polycarbonate from ultraviolet degradation and scratching, thus providing superior performance to polycarbonate sheet. Glass-clad polycarbonate tends to fail from delamination after it undergoes numerous cycles of temperature variation. Glass clad polycarbonate has high initial cost but remains optically clear over much longer periods than polycarbonate sheets, thus reducing replacement costs. Glass-clad polycarbonate is suitable for new construction and retrofit applications. As for polycarbonate, retrofit applications may require new frames if the glass-clad polycarbonate replaces existing glass.

Insulating glass units fabricated with laminated glass: A sealed insulating glass unit consists of two or more window glass lites with an air space between them. The lites may be monolithic window glass, glass-clad polycarbonate, or laminated glass. Any glass type of the monolithic or laminated glass lites suffices in comprising an insulating glass unit.

For blast- and hurricane-resistant glazing, an insulating glass unit fabricated with a monolithic lite facing the outside of the building and a laminated glass lite facing the inside of the building provides excellent protection to personnel inside the building. Under air blast or impact loading, the monolithic (sacrificial) lite will fracture first, thus greatly reducing the load that the laminated glass lite must resist. On the other hand, shards will fall from the sacrificial monolithic lite, creating lacerative hazards for persons outside the building. The designer can overcome such hazard by using laminated glass for the outboard lite. As their name implies, insulating glass units provide both thermal and sound insulation to a wall system. Because insulating glass is much thicker than monolithic window glass, it finds most use in new construction.

Retrofit security window film: Retrofit security window film is not a glazing material. Installers apply retrofit security window film to extant monolithic window glass using water-based or pressure sensitive adhesives, in an attempt to provide post-breakage behavior similar to that of laminated glass. Retrofit security window film consists primarily of polyethylene terephthalate (PET), commonly referred to under its trade name of Mylar™. Retrofit security window film manufacturers market films with a minimum thickness of 0.10-mm (4-mil) claiming that they provide blast resistance. They also market films with thickness in excess of 0.71-mm (28-mil), claiming the greater thickness enhances blast resistance.

Installers use one of three methods to apply retrofit security window film to existing window glass: a daylight application, an edge-to-edge application, or an anchored application.

In a daylight application, which is the most common retrofit security window film installation method, the installer applies the security film only to the vision portion of the window. The window frame does not capture the film in the frame bite. Until recently, installers applied water-based adhesive to the glass surface, placed the film on the adhesive, and then trimmed the film by running a razor knife along the edge of the vision portion of the glass. Retrofit security window film manufacturers now profess that their installers trim the film before adhering it to the window glass surface, since trimming against the glass surface weakens window glass significantly.

When air blast pressure or impact fractures a monolithic glass lite with a daylight application of security film, it almost always propels the entire lite from the frame. The distance the lite travels from the frame and the amount of shards it retains against it depend upon the intensity of the loading and the age and condition of the film and its adhesive. Building owners should never consider using a daylight application of security film to maintain monolithic glazing in its frame following fracture resulting from impact or air blast pressure.

In an edge-to-edge application, installers remove the window from the frame and then apply the retrofit security window film to the entire window glass surface. They then reinstall the window in the frame, capturing the film in the bite. This provides slightly better post-breakage behavior characteristics than does a daylight application of security film. The cost of applying retrofit security window film in an edge-to-edge application exceeds the cost of installing it in a daylight application simply due to the additional labor required.

The Glass Research and Testing Laboratory conducted blast tests in which new 0.10-mm (4-mil), 0.18-mm (7-mil), and 0.25-mm (10-mil) retrofit security window films in edge-to-edge applications failed to maintain window glass lites in the frame when air blast pressure fractured them. Between 30 percent and 70 percent, by weight, of the glass shards adhered to the films after blast loadings propelled them from their frames. In these tests, certified installers applied the retrofit security window film to the window glass test specimens.

To achieve an anchored retrofit security window film application, installers apply the film to the glass surface with a portion of the film overhanging the daylight opening. They then mechanically attach the overhanging film to the window frame. While this method achieves the highest level of post-breakage behavior available from security film, it has serious problems. First, this application is very labor intensive and, hence, costly. Second, the level of post-breakage behavior achieved in an application depends upon the anchorage. In a blast loading, for example, if the security film is anchored to a window frame not designed to provide blast resistance, then the anchorage achieves little, if any, increase in blast resistance over other security film application methods. Finally, to date, the author remains unaware of aesthetically pleasing anchors for retrofit security window film.

As mentioned at the beginning of this section, the initial cost of installed retrofit security window film having 0.10-mm (4-mil) thickness in a daylight application starts at slightly below that of laminated glass. The initial cost significantly increases with thickness. Due to the labor required, the initial cost of retrofit security window film in an edge-to-edge application or an anchored application exceeds significantly that of laminated glass.

Once installed, retrofit security window film becomes exposed to the environment inside the building and subject to mechanical degradation from window washing and vandalism. It scratches easily. Although manufacturers have made significant improvements, retrofit security window film also degrades and yellows under ultraviolet exposure from sunlight coming through the window glass. Hence, building owners must replace retrofit security window film at regular intervals of six to ten years to maintain visual acuity as well as any blast resistance retrofit security window film might provide. According to Beers (1992), the life cycle of maintaining retrofit security window film can be as high as four to eight times the cost of reglazing with laminated glass.

Laminated Glass Under Extraordinary Loadings

As MENTIONED PREVIOUSLY, laminated glass provides advantages over monolithic glass that make laminated glass advantageous in certain design situations. The following paragraphs will discuss each of these in more detail and explain the advantage of laminated glass in each situation.

Laminated glass for blast resistance: In Oklahoma City on April 19, 1995, a terrorist bomb killed 168 people and injured numerous others (Conrath and Walton, 1995; Norville, et al., 1995). A study of injuries in the Oklahoma City bombing (Norville, et al., in press) indicated that approximately 500 people suffered injuries outside of the Alfred P. Murrah Federal Building. Of these 500 injury victims, approximately 200, or about 40 percent, suffered lacerations, abrasions, and contusions, as a direct result of flying or falling glass shards. Some victims still suffer from glass shards embedded in their skin. Several other victims, in buildings near the bomb's detonation point, suffered hearing damage and other injuries because fractured monolithic window glass allowed blast pressure into buildings. Figure 4 shows the distribution of glass related injuries for buildings in proximity to the bomb's detonation point.

Building designers could not anticipate a large bomb being placed on the streets of Oklahoma City. Had they done so and designed windows that maintained closure of their fenestrations following fracture, such windows would have eliminated the vast majority of the 200 direct glass-related injuries to persons outside the Alfred P. Murrah Federal Building (Norville and Conrath, in preparation; Norville, et al., in press). On the other hand, no commercially available glazing material could have protected the Alfred P. Murrah Federal Building itself.

No widely recognized method currently exists in the U.S. for designing blast-resistant

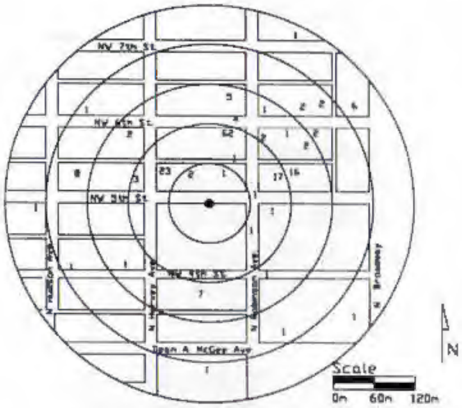

Figure 4: Glass-related injury victim distribution in proximity to bomb detonation point in Oklahoma City [Numbers indicate injuries at a particular location. The black dot indicates detonation point on the north side of the Alfred P. Murrah Federal Building.

glazing. Instead, blast-resistant windows achieve a rating by passing a test method given by F1642-96, "Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings." To date, all glazing systems tested under this method involve laminated glass (Norville, 1995).

Laminated glass installed using standard dry glaze framing significantly enhances blast resistance. Certification under ASTM F1642 merely determines a level of blast-resistant performance. Architects and engineers should consider installing laminated glass whenever a risk of accidental or terrorist explosions exists (Norville and Beers, 1994; Norville and Conrath, in preparation).

Laminated glass for hurricane prone regions: Hurricane winds blow with very high velocity and exert some of the highest wind pressures that any architectural window glass experiences (Minor, 1974; Minor and Beason, 1976; Minor, et al., 1976; Minor and Mehta, 1979; Minor, 1981; Minor and Norville, in press). These high winds rarely fracture window glass simply because of the wind pressure loadings they generate. Instead the highly turbulent hurricane winds carry debris that impacts windows, causing fracture.

Most architects in Texas recall the extensive window breakage that occurred in downtown Houston during Hurricane Alicia in 1983. This breakage occurred even though Alicia's winds blew below the design wind speed for Houston. The breakage resulted from hurricane winds picking up gravel from the roofs of one or two tall buildings and propelling it into windows of adjacent buildings.

Hurricane Andrew, in 1992, caused the collapse of a tremendous number of buildings in Homestead, Fla. Damage investigations attributed the majority of these collapses to internal pressurization of the buildings following fractures of windows caused by impact from windborne debris. Studies funded by the insurance industry indicate that insurance losses rise by 30 percent to 40 percent if a window vacates a fenestration and allows rain and wind into the building, even if no structural damage occurs.

In view of these observations, the South Florida Building Code (1994) instituted a test procedure to certify hurricane-resistant glazing. This method involves subjecting windows to approximately 9,000 pressure cycles subsequent to impacting them with missiles. The pressure spectrum found its basis in a paper by Letchford and Norville (1994). Depending upon the location of the proposed windows in the buildings, the missile impacts come from nine-pound, 2 x 4-inch timber missiles hitting end on at a speed of 15 m/s (50 feet/s), roof gravel, or steel balls traveling at much higher speeds.

The magnitudes of the pressure cycles depend upon design wind pressures for the geographic locations of the buildings the windows will glaze and the windows' positions in the building envelope. To obtain certification as a hurricane-resistant glazing material or system, a window tested under these methods must maintain closure of it fenestration throughout the impacts and the pressure cycles. This test method is rigorous. Other organizations, notably the Standard Building Code (SBCCI, 1997), ASTM, the International Building Code, and the Texas Department of Insurance, are codifying or have codified similar test methods for implementation in hurricane-prone regions.

Dade County, Fla., at its web site, maintains a list of hurricane-resistant window systems that have achieved certification under its version of this test method. The vast majority of hurricane-resistant windows use laminated glass because of its ability to hold together and maintain closure of its fenestration after fracture. As in blast-resistant glazing, most hurricane-resistant windows require special framing considerations to hold the laminated glass in the frame following fracture.

Laminated glass for earthquakes: When earthquake ground motions shake large buildings, they sway. During the swaying, glass frames deform out of the original shapes, both in and out of the plane of the glass. Glass in the frames may fracture, either due to stresses induced by large magnitude accelerations out of plane or as the result of contact with window frames due to large deformations in the plane of the glass.

When monolithic window glass fractures during an earthquake, the resulting shards fall from the fenestrations presenting severe lacerative hazards both to pedestrians on the street and persons in buildings. The Civil Engineering Department at the University of Missouri-Rolla conducted tests in which researchers forced cyclic deformation of glazed window frames both in and out of the plane of the glass. Their published research (Behr et al., 1995; Behr and Belarbi, 1996) indicates that laminated glass can remain in the frame under relatively large magnitude motions for many cycles even though it fractures. In the case of earthquake motions, laminated glass tends to remain in its frame even without special framing.

Laminated glass for forced entry: Intruders can easily fracture monolithic glass of any type and gain entry through the window. A fenestration glazed with laminated glass with no special framing keeps the fenestration closed and requires significant additional effort to gain entry following fracture. If the frame has a positive attachment to the laminated glass glazing it, then forced entry becomes nearly impossible in a short period of time. ASTM F1233-95, "Standard Test Method for Security Glazing Materials and Systems," provides test methods to assess levels of protection that security glazing materials afford.

Conclusions

LAMINATED GLASS PERFORMS all of the functions of monolithic glazing. Laminated glass costs more than monolithic glass of the same glass type. In comparison to other glazing materials suitable for extraordinary loading conditions, laminated glass has significantly lower cost, especially if the designer considers total costs associated with glazing over the life of a building.

In addition, laminated glass possesses post-breakage behavior characteristics that make it an ideal glazing material when extraordinary loadings occur. Under air blast loading, laminated glass nearly eliminates flying and falling glass shards and maintains closure of its fenestration, thereby significantlyreducing injuries and interior building damage. In hurricanes, laminated glass maintains closure of the fenestration under wind pressure following impacts by windborne debris, thus preventing building collapse from internal pressurization and reducing insurance losses from wind and water damage. Its post-breakage characteristics also make it an ideal material for retarding forced entry. In short, whenever considerations other than wind loading govern design of windows, the designer should seriously consider glazing systems employing laminated glass. ***H. Scott Norville***

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Self-Test Questions

1. Which of the following are safety glazing materials: wired glass; fully tempered window glass; insulating glass; laminated glass; annealed monolithic window glass with an anchored application of retrofit security window film. ________

2. True or False: Building codes specify fully tempered window glass as a safety glazing material because of its high strength relative to annealed window glass. ________

3. True or False: Laminated glass fabricated with heat-strengthened glass plies has a higher design strength that is 3.6 times greater than that of annealed monolithic window glass. ________

4. True or False: Laminated glass fabricated using heat-strengthened glass plies is a safety glazing material. ________

5. True or False: In a hurricane, window glass fractures primarily as the result of the huge pressures induced by high wind speeds. ________

6. True or False: Laminated glass requires special framing considerations when designed to resist wind loading. ________

7. True or False: Retrofit security window film in a daylight application provides the best available means of maintaining closure of a fenestration under air blast loading. ________

8. Considering initial installation and life-cycle maintenance, which of the following materials has the lowest total cost? polycarbonate sheet; annealed monolithic glass with a daylight application of retrofit security window film; annealed monolithic glass with an anchored application of retrofit security window film; laminated glass fabricated using annealed glass plies; insulating glass fabricated using glass-clad polycarbonate lites ________

9. True or False: A designer should always use heat-strengthened or fully tempered window glass in earthquake resistant designs. ________

10. Referring to Figure 3, determine the basic annealed glass strength of a window glass lite with rectangular dimensions of 1,500 mm (59 inches) by 3,000 mm (118 inches) and 6-mm (1/4-inch) nominal thickness. ________

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Answers to Self-Test Questions

1. Laminated glass
2. True
3. True
4. True
5. False.
6. False
7. False
8. Insulating glass fabricated using glass-clad polycarbonate lites.
9. True
10. 17 psf or .8kPa

TEXAS ARCHITECT
Continuing Education Report Form • November/December 1998

☐ I have read the article "Laminated Glass: Glazing Material for All Conditions," and I have taken the self-test.

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WOODY: MARRIAGE 'POSSIBLE'
BRANDON LEE GETS HIS FOOT IN THE DOOR
SON OF LEGENDARY KUNG FU MASTER SEEKS NEW ROLES
MONDAY, AUGUST 24, 1992
Andrew hits Florida
1 million wait out hurricane
Biggest storm in decades

TEXAS ARCHITECT

On the cover: Worker making adobe bricks for low-cost housing on the border; see story on page 38. Photograph by Dick Doughty/*Aramco World*.

Above: Meyer and Johnson Corporate Office, Dallas; Good Fulton & Farrell Architects, Dallas; photograph by Craig Blackmon.

SUSTAINABILITY

DEPARTMENTS

TEXASARCHITECT

Nov/Dec 1998 Volume 48, Number 6

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Leading the Way

When we decided to include an issue on sustainability on this year's editorial calendar, I imagined our pages full of straw bales, rammed earth, giant cisterns, and low-e glass. And, in fact, many of those materials and technologies are included here. But I imagined such things used on houses and other small-scale projects designed for unusual clients willing to push the envelope of what was standard, acceptable, possible. I did not imagine the United States Postal Service, the state's General Services Commission, or the University of Texas Health Science Center.

Yet these are the clients we feature in this issue and they are the same clients who are pushing the boundaries of what is possible, who are making it possible for Texas architects to say to their clients, "If they can do it, surely so can we."

I have heard again and again over the past several years that architects are concerned about their place in the design and construction industry: We used to be the leaders, they say, the master builders. Now we are just another member of the team. The stories in this issue describe another chance for architects to take the lead.

As Pliny Fisk III suggests in his story, beginning on page 24, architects are uniquely suited to help clients and users visualize the impact of their decisions on the natural world. Architects are trained to give concrete form to abstract information: a building from a list of needs. They are also trained to address multi-dimensional problems as whole systems rather than as individual parts. The very essence of sustainability is thinking holistically, understanding the relationships of the parts to the whole. If architects can use skills that, on the one hand, allow them to understand the big picture, and on the other hand, allow them to visually communicate that big picture to others, then architects can lead the way toward a more sustainable future. And, as Pliny Fisk also mentions, if they don't lead, architects may again be following, as environmental realities make sustainable design a legislated requirement rather than a design choice.

UPCOMING ISSUES

We invite submission of projects and story ideas for upcoming issues of *Texas Architect*:

May/June 1999 (deadline 4 December) "Dallas"

July/August 1999 (deadline 12 February) "Recreation and Hospitality"

If you have ideas for "News" or "Survey," call us at 512.478.7386, fax at 512.478.0528, or e-mail at williamson@txarch.com.

• • •

Frank Welch, FAIA, has long been one of the favorite voices of *Texas Architect* readers: Whenever we run a story Frank has written we get letters applauding our good sense. In just the past few years, he has written about Philip Johnson's work in Texas, about California architect Joseph Esherick, about Houston's South Main Boulevard, and about his travels in Italy. In addition to his words, the magazine has many times benefitted from the presence of his wonderful photographs. Frank's Dallas-based firm was the winner this year of the Texas Society of Architects' 1998 Architecture Firm Award and his long-awaited book on Johnson is in the hands of the University of Texas Press. All in all, it's shaping up to be a great year for Frank and we thought we should jump on the bandwagon. As of this issue, Frank Welch is officially a contributing editor of *Texas Architect*, a designation probably long overdue. In this issue, Frank writes about the work of Simone Swan to develop a low-cost, adobe-based building system on the border and gives a look at Philip Johnson's design for the Cathedral of Hope in Dallas. We look forward to hearing much more from him in the future.

Susan Williamson

WANT TO SAVE YOUR CUSTOMERS

The real benefit of hard fired Acme Brick's enduring nature becomes apparent "as time goes by." And the further into the future that you look, the better Acme Brick looks. Consider the 30 year maintenance cost of brick as compared either with EIFS or with double plate glass. The cost to maintain an EIFS structure exceeds the maintenance costs for a comparable brick/concrete masonry cavity building* by $330,066.00. Maintenance

BRICK/CONCRETE MASONRY CAVITY — $ 20,021
Replace joint sealant, yrs. 13 & 26; Clean, yr. 22

BRICK VENEER/STEEL STUD — $ 67,717
Replace joint sealant, yrs. 13 & 26; Clean, yr. 22; Repoint, yr. 22

PRECAST CONCRETE — $124,766
Replace joint sealant, yrs. 13 & 26; Re-coat panels, yr. 26; Cement patching, yr. 26; Cleaning, yr. 26

METAL PANEL
Cleaning, every 3 years; Coating, yrs. 12 & 24; Replace joint sealant, yrs. 12 & 24

EXTERIOR INSULATION & FINISH SYSTEM
Replace joint sealant, yrs. 11, 15 & 25; Repair cracks, yrs. 11, 25 & 30; Replace surfaces, yrs. 15 & 30; Cleaning, yrs. 15 & 30; Coating, yrs. 15 & 30

DOUBLE PLATE GLASS
Annual cleaning: Replace joint sealant, yrs. 13 & 26; Gasket replacement, yr. 20; Coat mullion, yr. 20

** Based on a building containing 83,200 square feet of opaque wall area. All figures in these charts are from a 1995 study "Life-Cycle Costing Case Study of Exterior Walls" by the firm of Smith, Hinchman and Grylls Associates, Inc. Details of this study are presented in a booklet "Walls to Save Dollars" that is available from the Brick Institute of America, 11490 Commerce Park Drive, Reston- Virginia 20191.*

TAHDA!

1999 TEXAS ARCHITECTURE FOR HEALTH **DESIGN AWARDS**

THE
TEXAS SOCIETY OF ARCHITECTS
in cooperation with the
TEXAS HOSPITAL ASSOCIATION
is issuing a

CALL FOR ENTRIES

PURPOSE This program has been created to promote public interest in health-related architecture, and to recognize excellence in design.

ELIGIBILITY AND AUTHORSHIP All entries shall be a health-related architectural or interior architecture project designed by a TSA member. Projects must be located in Texas and/or designed by a Texas firm. Eligible projects must have been designed or under construction after January 1, 1994. Projects that completed construction prior to January 1, 1994 are not eligible.

Entries are eligible even though the submitting architect or interior designer may not be the sole participant in the design. All participants substantially contributing to the design must be given full credit for their role as part of the submission.

CATEGORIES Awards may be given in any or all of the following categories. Each category has a separate Architecture or Interior Architecture subcategory. A single project may be entered in more than one category and/or subcategory upon payment of separate entry fees. Entrant shall clearly identify the category of facility design and subcategory.

IN-PATIENT HOSPITAL DESIGN: to include any type of acute care, sub-acute or inpatient care projects located in a hospital, or the design of a hospital.

CONTINUUM OF CARE: to include long term rehabilitation and mental health facilities (nursing facilities, skilled nursing, extended care facilities, hospices, etc.)

OUTPATIENT FACILITIES: to include projects with no licensed beds, such as medical office buildings, physician's offices, surgi-centers, imaging centers, clinics, HMOs primary care centers, any preventive medicine facility, health clubs, aerobics centers, athletic clubs, and other projects whose principal focus is the maintenance of health.

SUBMISSION Upon payment of the entry fee and receipt of completed entry form received no later than December 15, 1998; each entrant will receive a packet with the submission requirements and a data sheet to be returned with the submission. All necessary forms will be provided.

The data sheet will ask for information relating to the project, program, schedule, cost and square footage. It shall be returned, in a black three ring vinyl binder with no visible means of identity, containing no more than 14 other 8 1/2" x 11" pages of information on the project in clear acetate sleeves (using only the front of each page). A narrative, describing the problem and its solution, will be limited to one of those pages, using 11 point, single-spaced typing (no photo reduction) with at least 1" margins.

The other pages shall include photographs (in color or black and white) sufficient to clearly show the full scope of the project, with no more than two images per page. Plans and drawings reduced to 8 1/2" x 11" sufficient to fully describe the project must also be included. North shall be indicated on all plans. A graphic scale should be included on all drawings.

Renderings will not be accepted as a substitute for photographs of a completed project, but may be included if the entrant feels they provide useful additional information.

Any project may be subject to disqualification, at the sole discretion of the jury, if it feels the submission does not completely or accurately describe the project.

Finally, the concealed identification form (provided in the submission requirements packet), which will include the identity of the architect, owner, consultants, location, and person to notify, will be placed in a sealed envelope with no exterior marking and will be taped inside another acetate sleeve at the back of the binder. The entrant's identification shall not be revealed in any way on the binder or within the submission.

All entries shall be sent to the Texas Society of Architects — Committee on Architecture for Health, c/o C. Edward Knight, AIA, 3131 McKinney Avenue, Suite 500, Dallas, Texas 75204.

AWARDS AND AWARD WINNERS The winners will be notified in March, 1999. Certificates will be presented to the designers and owners of the winning projects at an awards ceremony during the 1999 THA convention in Austin.

To defray display and publicity costs, the winners will be assessed $300 for each award winning project and must submit 8 copies of a 8" x 10" black and white glossy photo of the project, no later than June 1, 1999. In addition each winner will need to provide one set of color slides representative of the winning project for use at the awards ceremony. Slides will become the property of the Texas Society of Architects — Committee on Architecture for Health.

Winners will prepare 40" x 40" boards to be exhibited at the 1999 THA convention, and information will be released to hometown newspapers and publications. The award winners will be published in *Texas Architect* magazine in the summer of 1999.

ENTRY FEE An entry fee of $125 is required for each category/subcategory submitted. Submission of one project in more than one category/subcategory requires a separate entry fee. Fees and entry form must be received no later than December 15, 1998. Checks or money orders shall be made payable to the Texas Society of Architects — Committee on Architecture for Health, and sent to C. Edward Knight, AIA, 3131 McKinney Avenue, Suite 500, Dallas, Texas 75204. No entry fee(s) will be refunded.

SCHEDULE

December 15, 1998	Entry fees and forms must be received
January 31, 1999	Submissions must be received
February 15, 1999	Jury review
March 1, 1999	Notification of winners
June 1, 1999	Publicity photos, slides & assessment checks due

Announcement of winners to coincide with the THA Convention in Austin, June 14-15, 1999.

ENTRY FORM

Firm Name________________________________

Contact____________________Telephone__________

Mailing Address____________________________

City____________State____________Zip________

Categories/Subcategories of Submittals

IN-PATIENT HOSPITAL DESIGN

Number of Entries: ☐ Architecture ☐ Interior Architecture

CONTINUUM OF CARE

Number of Entries: ☐ Architecture ☐ Interior Architecture

OUTPATIENT FACILITIES

Number of Entries: ☐ Architecture ☐ Interior Architecture

Amount Enclosed $_________(Total number of submittals x $125)
Make checks payable to Texas Society of Architects — Committee on Architecture for Health.

Fee(s) and entry form must be received no later than December 15, 1998 and sent to Texas Society of Architects — Committee on Architecture for Health, c/o C. Edward Knight, AIA, 3131 McKinney Avenue, Suite 500, Dallas, Texas 75204. No entry fee(s) will be refunded. All questions should be directed to Ed Knight, (214) 880-0100.

News

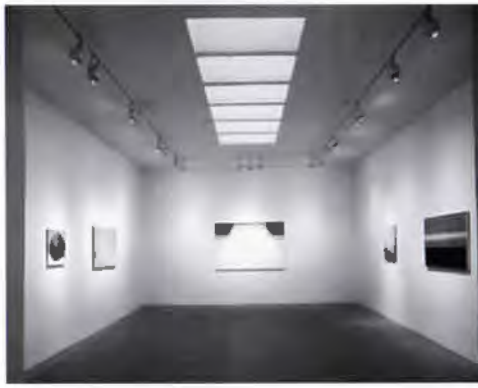
Architecture for Art's Sake

AUSTIN "We're looking for a less heroic aspect of modernism," said New Yorker Richard Gluckman, speaking to a small crowd gathered in September at the Austin Museum of Art (AMoA). For most it was the first opportunity to meet the architect—chosen over other finalists Christian de Portzamparc of Paris and Moshe Safdie and Associates of Boston, Toronto, and Jerusalem—who many hope will shake the moth balls out of dreams for a downtown institution. A previous lecture by Gluckman in July , as well as talks by other finalists for the job, were closed to the public, so the crowd was interested in what manner of man the new architect might be. Simply and elegantly clad, smart but accessible in the delivery of his ideas, he was at once low-key and formal, and in these subtle ways Gluckman might be said to personify the type of building he is likely to design.

Known as an egoless architect, the 53-year-old Gluckman long ago rejected the rigidity of modernist thought that gave heroism in architecture a bad name. In the works that have built his reputation—the Dia Center for the Arts in New York, the Andy Warhol Museum in Pittsburgh, Penn., the new addition to the Whitney Museum in New York, the Georgia O'Keeffe Museum in Santa Fe, N.Mex. and exclusive galleries, including those owned by Paula Cooper, Mary Boone, and Larry Gagosian—Gluckman has consistently striven for such a delicate balance between art and architecture that the architecture can seem to retreat or somehow dissolve, leaving in its wake only the artwork and the viewer. Treasuring this relationship as he does, he easily trades heroism for a form of architectural humility. There is little doubt that discretion, for Gluckman, is the better part of valor.

Gluckman was trained at Syracuse University by modernist architects and has never lost his admiration for Le Corbusier, Louis Kahn, Alvar Aalto, and Mies van der Rohe. Yet, in his comments to the Austin crowd and in more casual conversation, he stresses what he calls the principles of an "enlightened" new modernism. He insists on an architecture that expresses the program and the context, that seeks "a poetic content to the use of materials," and "demands clean, elegant, well-lit space," within a building that "generates structural clarity." He says that he shares these values with many architects of his generation, including Tod Williams and Billie Tsien, Steven Holl, Smith-Miller/Hawkinson, Herzog & de Meuron, and the Texas firms of Lake/Flato and Carlos Jimenez.

Unlike these peers, Gluckman's name does not readily call up images of buildings, nor does it suggest a repertory of completed projects. Even the quality that most distinguishes "en-



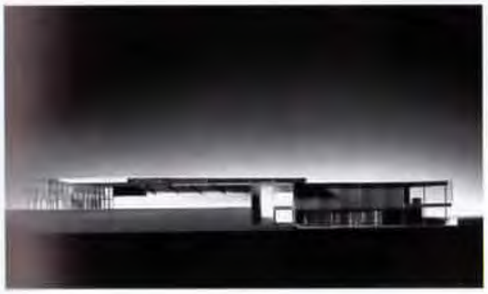
1

photos courtesy of Gluckman Architects, New York

2

lightened" new modernists from their forefathers, namely, a respect for context, is something he has rarely had the opportunity to demonstrate in his own work, for the simple reason that Gluckman has spent his 20-year career garnering prestigious commissions that required the rethinking of interior spaces within existing structures. In the realm of renovation he has honed a distinctly personal style well known to and prized by artists and those—museum directors and gallery owners—who handle art. To them, the notion of a context—an *interior* context, for artworks, that is—is everything, and Gluckman has demonstrated a deft and sympathetic understanding of an object's essential nature and the best way to reveal it.

"I design spaces for art," Gluckman said frankly at the AMoA lecture, and proceeded to illustrate with slides and words what wisdom he brings to bear on his new commission. He credits the minimal artists surrounding the Dia Center—Donald Judd, Dan Flavin, Richard Serra, and James Terrell—with shaping his own minimalist sensibility. "Preserving the structure was their idea," he said. But structure is only part of Gluckman's aesthetic. What matters



1 gallery in the Georgia O'Keeffe Museum, Santa Fe, N.Mex.

2 gallery in the Andy Warhol Museum, Pittsburgh, Penn.

3 model of Gluckman's design for the new Fort Worth Museum of Modern Art

most about the Dia association is that the youthful Gluckman formed the habit of listening to artists. Along the way, the elegance of restraint, the affection for crisp, clean lines, and the challenge of manipulating light became second nature to him.

Recent major renovation projects indicate that he is still listening to artists, if not in person, then through the medium of their work. The Andy Warhol Museum in Pittsburgh, Penn., shows Gluckman creating an ecclesiastically proportioned space in which to hang Warhol's version of "The Last Supper." It has him playing with the way the viewer walks by the artist's repetitive paintings of Elvis, and it finds him imitating Warhol's cinematic propensities with a room precisely designed for 102 canvases that roll by, as it were, like the frames of a film spool.

The Georgia O'Keeffe Museum asked the architect to explore a very different kind of sensibility without the latitude for expression enjoyed in the Warhol Museum. Stymied by Santa Fe's architectural review board, which insisted that the museum, a former Baptist church, look residential, Gluckman used asymmetrically placed skylights to lead visitors from room to room. In the chapel-like space of the former sanctuary, a centrally placed skylight echoes the lines of an O'Keeffe painting just below it. Although Gluckman says the relationship was serendipitous, it is precisely the bond between art and architecture that he hopes to foster through his design.

Gluckman's selection as architect for the AMoA breathes new life into the moribund dream of a downtown museum. A 1984 plan by Robert Venturi was discarded this spring after a decade of moldering while the museum went through the vicissitudes of a site change and loss of city funding. Now with renewed support from the city and private pledges amounting to around $13 million, the museum design can move forward, with a possible completion date of 2002.

Seeking to prime the question-and-answer session following Gluckman's speech, museum director Elizabeth Ferrer became rhetorical. "We want to be very inviting, we want to be accommodating, and we want to be a civic landmark. Is this possible?" she asked. The answer that followed was "yes," in so many words, but Gluckman took the opportunity to muse about the nature of architecture. "Cathedrals did that," he said. "They went way beyond the relationship between man and God." Likewise, he sees the role of the museum expanding beyond its historical role as a "repository of objects with a pedagogic obligation to a more proactive and visible center within the community."

The program Ferrer has presented to Gluckman should give him every opportunity to prepare the 100,000-square-foot AMoA for its future role in the life of the city's art world. She has asked for a large, SoHo-like gallery to showcase cutting-edge artwork, as well as a more polished space for the exhibition of traveling shows; the building is to include galleries for the museum's proposed permanent collection and for its photography department, rooms for educational functions, an auditorium for lectures and art films, a shop, a café, and an outdoor space where people can gather for musical performances or social functions. She has also included a request for state-of-the-art technological equipment for artists who seek to push the parameters of conventional artworks.

"Design is hard work and I think it takes a long time," says Gluckman, "but this is extremely important to us. Even though we've designed buildings, everyone perceives this as our first project." One of those buildings—for the Fort Worth Museum of Modern Art competition, which Gluckman lost to Tadao Ando—not only impressed the selection committee, but others who followed the selection process. Could its low, horizontal, light-filled design presage some of the characteristics of the AMoA? The firm's model showed a structure consisting of five parallel galleries surmounted by a series of metal louvers for protection from the intense Texas sun.

Part of the program of the Fort Worth museum was to respond to the nearby Kimbell and Amon Carter Museums. By contrast, the challenge of the Austin site is to create an architectural context where there is none. Already, Gluckman can talk about how the scale of the new building should work. "We want it to be perceived from ten blocks away, but gradually, as you get closer, you get drawn in." The stages of approach to it are first urban, then pedestrian, and finally personal. He's clear on another point, too: his belief that however provocative a museum is, it must create a meditative environment as well.

Gluckman looks forward to getting to know the architect of the University of Texas' Jack S. Blanton Museum, to be announced this month. He is interested in a setting up a series of discussions with whomever is chosen; the short list includes Antoine Predock, Steven Holl, or Herzog & de Meuron. "It's a great time to be an architect," he said, "And I'm glad to be in the middle of it." ***Lisa Germany***

Lisa Germany, author of Harwell Hamilton Harris *(1992), lives in Ausitn.*

Of Note: New Dean for UH

HOUSTON The University of Houston (UH) Gerald D. Hines College of Architecture has named Joseph L. Mashburn, a UH alumnus and a former professor of architecture at Virginia Polytechnic Institute and State University, as its new dean. Mashburn assumed the UH position on September 1; he graduated from UH in 1978 and earned a master's from the department of architecture at Texas A&M University.

Mashburn was inducted into the UH Architecture Hall of Fame in 1996. The College of Architecture has been without a dean since January 1995; Professor Bruce Webb, who had served as interim dean, has returneo to teaching.

Kelly Roberson

Another Johnson Landmark

DALLAS Philip Johnson and his New York office have designed another major religious structure, this time for a congregation in Dallas. The Cathedral of Hope is the largest gay and lesbian congregation in the world and is currently well on the way to raising $22 million for a 2,500-seat sanctuary and adjoining cloister and bell-tower. At the time of the groundbreaking for the bell-tower, Johnson, now age 92, was quoted in the *Dallas Morning News* as saying, "I keep telling them to hurry up and raise the money! $20 million for a building like this is not expensive. Once people see it going up they'll rush in to help complete it, but the church wants a few more dimes in the box first."

The site includes an existing church on an acreage in a commercial area of Cedar Springs Road near Love Field in Dallas. Ground has been broken on a part of the project, which was the subject of a lecture in August by art historian Richard Brittell, former director of the Dallas Museum of Art. Brittell also reviewed Johnson's long career and his influence since 1950 on Texas's architectural culture.

No other upper-rank American architect of the post-World War II period has designed as many unique worship spaces as has Johnson, a self-proclaimed agnostic. Early in his career, he designed a synagogue in Port Chester, N.Y.; then came the famous Roofless Church in Indiana and the spectacular all-glass Crystal Cathedral in Orange County, Calif. St. Basil's Chapel was dedicated two years ago at the University of St. Thomas in Houston, completing Johnson's Jeffersonian campus plan that was begun in 1957 (*TA*, September/October 1997).

The Reverend Michael Piazza of the Cathedral of Hope contacted Johnson in 1995 after attending a conference at the Crystal Cathedral. His rapidly growing congregation was by then overflowing with three services every Sunday. It was based in the ordinary but functional 1993 church the congregation had recently occupied and was still paying for. Johnson at first refused Piazza's invitation to design a new church, citing his age, but after hearing Piazza's plea for the special kind of building he wanted for his community, Dallas, and the world, Johnson said, "How can I not do this?" The irony of designing the world's largest church for gays in Dallas, a bastion of conservative politics, was not lost on the aged but dynamic celebrity of American architecture.

photos courtesy of Bates Photography, New York

1

2

The design for the church went through several versions. Johnson typically brings sketches to his staff for development; from the first, he sought a form similar to his anti-orthogonal, sculptural Visitors Center at the Glass House, completed in 1995 in what he called a "wanton mode." (Johnson's current term for this kind of design—"structured warp"—is what he calls the architecture of the future, an architecture that "wraps around you.")

After three different schemes were presented, rejected, and abandoned by the church, a final scheme was approved. The hulking, free-form concrete structure is a simplification and also an intensified version of the first scheme. It is all sculptural mass, nearly windowless, the polar opposite of the glittering, prismatic Crystal Cathedral. The massively modeled form evokes an ark, an iceberg, and a great rocky escarpment.

The proposed building rises from the low point of the entry to the 117-foot-tall prow-like upper part of the sanctuary above the altar, which is illuminated by a skylight 100 feet above it. The concrete walls are folded and heavily "pleated" in a highly abstract way, reminiscent of the thick buttresses of early New Mexican adobe churches. It promises to be a mammoth expressionist sculpture, simultaneously exuberant and sombre.

1 The hulking, free-form structure for the Cathedral of Hope in Dallas, designed by Philip Johnson, evokes an ark, an iceberg, and a great rocky escarpment.

2 The building rises from the entry point to a 117-foot-tall prow-like sanctuary, with a skylight placed 100 feet above it.

Johnson adds, "I'm doing real architecture again, no more kicking around bits of history. No more skyscrapers. Churches and synagogues are the only buildings worth doing, unless of course I'm doing something for myself!" ***Frank D. Welch, FAIA***

Frank D. Welch, FAIA, an architect practicing in Dallas, is a TA *contributing editor.*

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Austin honors six

AUSTIN Six projects were honored in a field of over 40 entries from local firms by the jury in the 1998 design awards competition of the Austin chapter of the American Institute of Architects. Jury members included Jane Weinzapfel, FAIA, Leers/Weinzapfel Associates, Boston; Peter Zweig, FAIA, associate professor, University of Houston; and Steve Dumez, Eskew + Architects, New Orleans.

Two projects received honor awards, the highest level of recognition in the competition: the Tonneson House, Milam Ranch, by Kevin Alter and David Heymann (*TA*, July/August 1998); and the Lurie Engineering Center and Tower, Ann Arbor, Mich., designed by Moore/Andersson Architects. Four projects were selected by the jury for citation of honor awards. Moore/Andersson Architects won its second award for the Beach Museum of Art, Manhattan, Kan., as did Kevin Alter for the Gelateria, Austin, designed with Brian Lemond. Black and Vernooy was honored for the Schlotzky's Corporate Headquarters (*TA*, March/April 1998) in Austin, and Page Southerland Page/Lawrence W. Speck Studio received a citation of honor for the Rough Creek Lodge and Conference Center, Glen Rose. ***KR***

Of Note: A Welcome

FORT WORTH The Kimbell Art Museum has selected Dr. Timothy F. Potts, currently the director of the National Gallery of Victoria (NGV), Melbourne, Australia, as its new director. Dr. Potts will assume his post early this fall. Potts is a specialist in Near Eastern and Mediterranean art; he has been the director of the NGV, Australia's oldest and largest public collection, since March 1995. His tenure's achievements were marked by making the permanent collection free to visitors, which doubled annual attendance, and spearheading a major redevelopment of the NGV's building. The Kimbell's director position has been vacant since June, when Dr. Edmund P. Pillsbury retired after a tenure of 17 years. ***KR***


Timothy Hursley

1


Gary Quesada (Hedrich Blessing)

2


Greg Hursley

3


Kevin Alter, David Heymann, Brian Lemond

4


Paul Bardagjy

5

Kevin Alter, Brian Lemond

6

1 Beach Museum of Art, Moore/Andersson Architects

2 Lurie Engineering Center and Tower, Moore/Andersson Architects

3 Rough Creek Lodge and Conference Center, Page Southerland Page/Lawrence W. Speck Studio

4 Tonneson House, Kevin Alter and David Heymann

5 Schlotzky's Corporate Headquarters, Black and Vernooy

6 Gelateria, Kevin Alter with Brian Lemond

Practice Q&A

STEVE ELLIOTT is an associate with Brown Reynolds Watford Architects in Dallas. Bernard Bortnick, FAIA, is director of design for HDR, Inc., in Dallas. They answered questions for *Texas Architect* on trends in the market of security for architecture.

What types of projects typically require special attention to security issues?
Elliott: Primarily governmental, educational, and institutional projects, and facilities that deal with transportation, distribution, and secure, non-public operations, such as airports and federal institutions.

Bortnick: All of the justice projects we do obviously require a great deal of attention to security issues. The issues are different depending on the project type. With courthouses, the issues have to do with screening people as they enter the building or the courtroom. With jails, the issues have to do with separation and circulation of various population groups of prisoners, as well as separation of prisoner from guards. With other project types, such as healthcare, we are concerned with securing access to and within the building. We also have in-house consultants in the area of video and other surveillance techniques, which are being used in projects like large hospitals to observe areas that might be vulnerable or otherwise out of view.

Have concerns about security issues changed in the face of recent terrorist and other violent acts?
Elliott: There is a heightened sense of urgency; however, everyday safety in the workplace has always been a concern. The workforce of the '90s expects a minimum level of security in the workplace.

Bortnick: Some of the federal requirements have changed, especially since Oklahoma City. We have been asked to provide greater setbacks from perimeter to building, that is, implementing a design that can control the approach of vehicles to the building as well as examining the use of large areas of glass. In general, I would say there is a heightened awareness of security concerns across all these project types.

"Practice Q&A" continued on page 21

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Crime and the City

PROJECT *Washington County Justice Complex, Hillsboro, Ore.*
CLIENT *Washington County, Ore.*
ARCHITECT *Zimmer Gunsul Frasca Partnership, Portland, Ore.; Henningson, Durham & Richardson, Inc., Dallas (associate architect)*
CONTRACTOR *Hoffman Construction Company*
CONSULTANTS *Consulting Engineers (civil, structural); Glumac International (mechanical, electrical); OTAK (landscape); Lerch Bates & Associates, Inc. (elevator); Rolf Jensen & Associates, Inc. (fire, life safety); DKS Associates (traffic); Mayer/Reed (graphics, signage); Halliday Associates (food service, laundry)*
PHOTOGRAPHER *Eckert & Eckert; Loren Nelson*

1 The 363,660-square-foot Washington County Justice Complex in Hillsboro, Oregon, designed by Zimmer Gunsul Frasca Partnership and Henningson, Durham & Richardson, Inc., is the largest component of an urban criminal justice system. With a 544-bed jail sited in a downtown area, the facility is committed to direct supervision and the logical arrangement of detention functions in relation to the law enforcement aspects of the complex.

2 The new four-building complex includes a jail, a law enforcement center (LEC), a community corrections center, and a parking garage. The L-shaped LEC creates a landscaped plaza, which opens up to a light rail station and the downtown core; it also serves as the hub for all county law enforcement operations and as the control center for the jail. The jail, organized along a 700-foot-long corridor, includes a special trustee-housing pod and four cubical inmate units. Each housing unit is two stories, and each story represents a two-level pod, allowing a single control desk to monitor each pod's jail cells. Windows around the entire building draw in natural light and convey an open image.

3 Housing units are placed along one side of the main corridor; primary support functions fall along the other side, allowing for efficient operation and permitting each unit to act independently and change the use of housing units to adjust to changing population parameters. All services, from visitation to meals and recreation, are managed in each direct supervision pod, assuring consistency of control and staff accountability.

Secure Mail

PROJECT *Air Mail Center Security Upgrade, Dallas*
CLIENT *United States Postal Service*
ARCHITECT *Brown Reynolds Watford Architects, Inc., Dallas*
CONTRACTOR *TriCoastal Systems, Inc.*
CONSULTANTS *Reed Fire Protection Engineering (fire protection); Southwest Security Consultants, Inc. (security)*
PHOTOGRAPHER *Christine Davis*

1 The U.S. Postal Services' 350 processing and distribution centers throughout the country are not only a target for thieves but also potential conduits for mail bombers and terrorists, says *Security Management Magazine*. The Air Mail Center Security Upgrade in Dallas, completed by Brown Reynolds Watford, updated an existing 115,000-square-foot mail processing and distribution center at D/FW Airport. It involved a comprehensive site and building perimeter security and fire alarm system upgrade, including access control, entry/exit gates, turnstiles, and fire alarm improvements.

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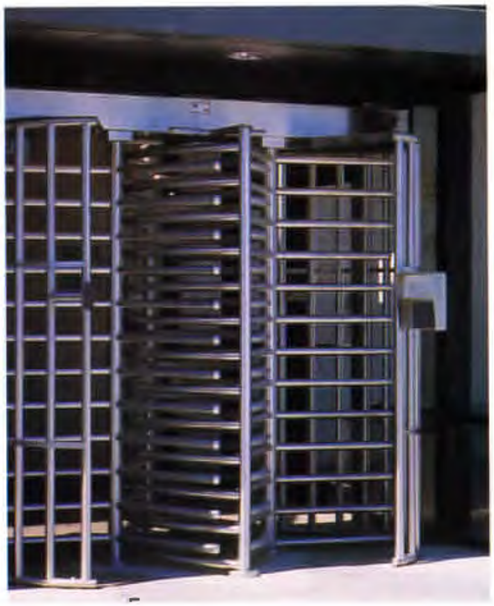
2 Construction on the facility was completed while it maintained daily operations. Existing circulation paths were modified to separate pedestrian and vehicular traffic and employees and customers as needed.



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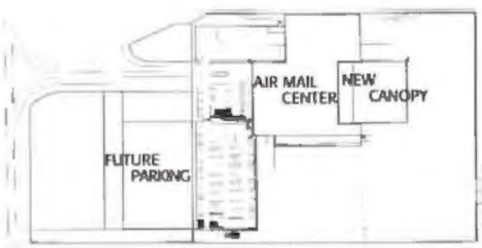
3 A new monitoring center and employee entry vestibule were constructed with a separate monitoring console and badging area. State of the art fire and protection monitoring devices and audible alarms were included in the work. Turnstiles control the doors to the center, and gates control vehicle access.



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4 plan of the revamped facility

RESOURCES

Fences, gates, and hardware: Federal Signal (barrier gate), B&B Electromagnetic (swing and sliding gates); **fascia and soffit panels**: MBCI Metal Roof and Wall Systems; **entrances and storefronts**: Atlas Architectural Metals, Inc.; **tile**: Armstrong; **stucco**: Lone Star Stucco; **fire alarm**: Harrington Signal, Inc.; **security access/control**: ITI, Ultraprox (integrated secuity technologies), Ringmaster (ring communications), Sentrol, Inc. (exit devices), Alvarado Manufacturing Company (turnstiles), Vicon Industries (cameras, monitors, and electronics)

"Practice Q&A" continued from page 19

What are your client's typical security concerns?
Elliott: Safety of employees and customers, and, in addition, vehicle and property protection. The overriding concern is the desire to provide a secure workplace and minimize disruption of the work process.

Bortnick: Again, the concerns vary with project type. For example, as I stated above, court projects now require special screening of visitors and users of the building as well as more control over the courtroom itself. With projects like hospitals, the concerns have to do with things like controlling access to the facility or to specific parts of the facility like a parking garage. Although these are issues everywhere, they are particularly crucial in areas where poverty-driven crime may be a problem.

How do you respond to those concerns in your designs for their projects?
Elliott: The architect must be a resource to balance design with function, public access with secure operation, and technical performance with facility needs. It is a balancing act that coordinates the owner, contractor, security consultant, and code officials to complete the security installation.

Bortnick: In the new courthouse projects, we are designing a formal space at the entry where visitors check into the building. Those spaces typically provide for the magnetometer [a security screening device like those at airports] as well as an area for examining briefcases and other items visitors might be carrying into the courthouse. We also design courtrooms with various electronic elements at the bailiff's seat or judge's bench that allow control over access to the courtroom. With courthouse projects, particularly at the federal level, we are also making exterior provisions, often disguised, to protect the building from approaching vehicles.

With jails, we are making provisions for separating population groups, including provisions for housing populations with contagious diseases. And as I stated above, in hospital projects, we are seeing a growing demand for video surveillance, a lot more than 15 years ago and even more acutely in the last 10 years. **TA**

This is the first issue of *Texas Architect* to deal with the topic of sustainability. Instead of focusing on projects—although we do present several—or technology, we tried to present a higher-level look at the subject: an introduction of sorts rather than a primer.

Pliny Fisk III of Austin, one of the country's best-known advocates of sustainable design, starts the issue off with a call to arms: Design, he says, can be the key to an understanding of our impact on the natural world.

We also present a case study of two projects, both government-funded, that are setting a new example of the possiblities of sustainable technology.

These stories, along with the others included in the issue, give us a starting point for talking about sustainability, a beginning to a conversation we intend to pursue.

Susan Williamson

1

Pliny Fisk III is the co-director of the Center for Maximum Potential Building Systems (CMPBS). Richard MacMath is the project architect for the CMPBS.

Information for this article was drawn from a number of sources, including the Center for Building Performance and Diagnostics at Carnegie Mellon University (the intelligible workplace/open building systems); Alton DeLong (conceptual space); Greg Norris, Sylvatica Inc. (CO_2 data); Hal Levin (water data); and Our Ecological Footprint *by Mathis Wackernagel and William Rees, University of British Columbia, Vancouver (ecological footprints).*

1 The Advanced Green Building Demonstration project in Austin was designed by the Center for Maximum Potential Building Systems and funded by various regional and local entities, including the city of Austin, the state, and the Lower Colorado River Authority.

Anybody There?

Architects, Design, and Responsibility

by Pliny Fisk III and Richard MacMath

HUMAN ACTIVITY HAS ENCROACHED upon every realm of nature. Consequently, nature is no longer completely natural. The natural world is now under the domain of human planning and management policies. Even policies that direct minimal or no human intervention in nature require management decisions. Given this human role as stewards of nature, it would behoove us to understand the natural world's life-support processes and the ways those processes affect human health and well-being. To sustain ourselves, we must constantly maintain the conditions and processes of the natural world while simultaneously deriving from it our means of sustenance. That is what sustainability means.

The built environment in which almost all humans reside occupies only a small portion of the world's land area. However, in response to an increasing world population and increasing per capita demands for a better quality of life, the industries that provide the materials and products that constitute the built environment have had a far-reaching impact upon the natural world. The result is visible in our air, in our water, and on our land—a condition of global ecological stress.

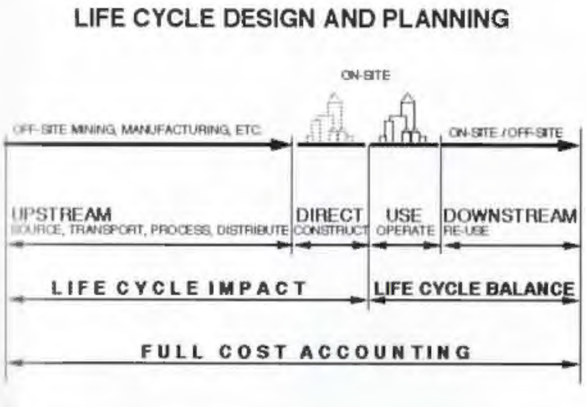
The first step toward a solution is to be aware of the magnitude of the problem. The impact of human activity in the industrial age has recently (in geological time) increased in scale spatially and temporally, reaching far beyond individual settlements or regions and affecting the well-being of future generations and all other living things. Perhaps there are specific principles that can guide the design of the built environment while accommodating *both* natural life-support processes and human needs.

As designers of the built environment, architects, engineers, and planners bear a particular responsibility. The artifacts and land-use patterns they design have enormous and, to date, undocumented and ignored impact. Although the impact of building design and construction is significant, the Earth's current ecological condition is not, of course, entirely due to the actions of this group of individuals. The lifestyle of every citizen in the developed world has a major impact and the values that this late 20th-century lifestyle has engendered are driving us in the direction of major ecological degradation—soon. We are fast approaching a situation where humankind's economic "progress" is straining the carrying capacity of the Earth's productive ecosystems. Humankind's total ecological footprint is fast outgrowing all productive land on Earth.

What is a per capita ecological footprint?

A PER CAPITA ECOLOGICAL FOOTPRINT is the amount of productive land required to support indefinitely one person at a particular level of resource consumption and waste assimilation. In an age of global markets, the productive land needed to sustain a population usually extends well beyond the boundaries of the town, city, or region. The ecological footprint of human settlement no longer directly coincides with geographic location, but is dispersed worldwide.

Ecological footprint size varies with lifestyle (i.e., a person's level of consumption). A typical American, for example, needs more than 10 acres of productive land somewhere on Earth to support just his or her domestic needs. At



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present, the global average is less than four acres of productive land per person. Thus, for every person alive today to live the lifestyle of an average American would require at least two and a half Earths, not including the needs of all other living species.

To live the "American dream" requires an even larger ecological footprint. For example, a professional couple living a lifestyle similar to most of us writing and reading this article requires almost 30 acres per person. This is typical of a household that includes two cars, an average number of airplane flights per person per year, and two heads of household working (i.e., both professionals). After a little arithmetic, one realizes very quickly that the productive land in the U.S. can support only about 76 million individuals like us. That is approximately 30 percent of our total present population.

What is the upstream ecological impact?

To DATE, EFFORTS TO MINIMIZE the ecological impact of the built environment have focused on the use phase (operation and maintenance) of buildings (e.g., energy-efficient lighting and the impact of interior finishes on indoor air quality). However, the use phase represents only one chapter in the building life-cycle story. The procurement of design services and the production of building materials and products causes enormous off-site ecological impacts prior to the building's use. These impacts occur upstream, during the source (mining), transport, process (manufacturing), and distribution life-cycle stages of building materials and products for all building components (e.g, structure, exterior closure, utility services).

Consider the building industry's share of total upstream greenhouse gas (CO_2) emissions for all sectors of the U.S. economy. The building industry accounts for roughly 20 percent of total annual industrial emissions of CO_2 and seven percent of the U.S. total; it is the largest sector of the U.S. economy in terms of CO_2 emissions. Also, upstream emissions are five times direct emissions—those produced during construction—and 10 to 20 times greater than annual operation, or use phase, emissions. Within the building industry, the largest single material contributing to CO_2 emissions is portland cement-based ready-mix concrete.

Upstream impacts are obviously not limited to atmospheric emissions. For example, water de-

2 Diagammatic representation of the life cycle of building materials and products starting prior to the building's construction and use and continuing through the building's demolition, remodeling, and/or reuse. Specifying products upstream can minimize life-cycle impacts, while decisions made during the use phase may balance those impacts by, for example, generating more power than the building can use; full-cost accounting refers to the process of balancing impacts over the life cycle.

3 The Advanced Green Building Demonstration project includes a rainwater harvesting system; on-sight wastewater treatment; a utility-interface photovoltaic system; and a variety of exterior shell infill materials including straw bale and pressed earth block, both stucco-covered.

all photos these pages by Paul Bardagjy

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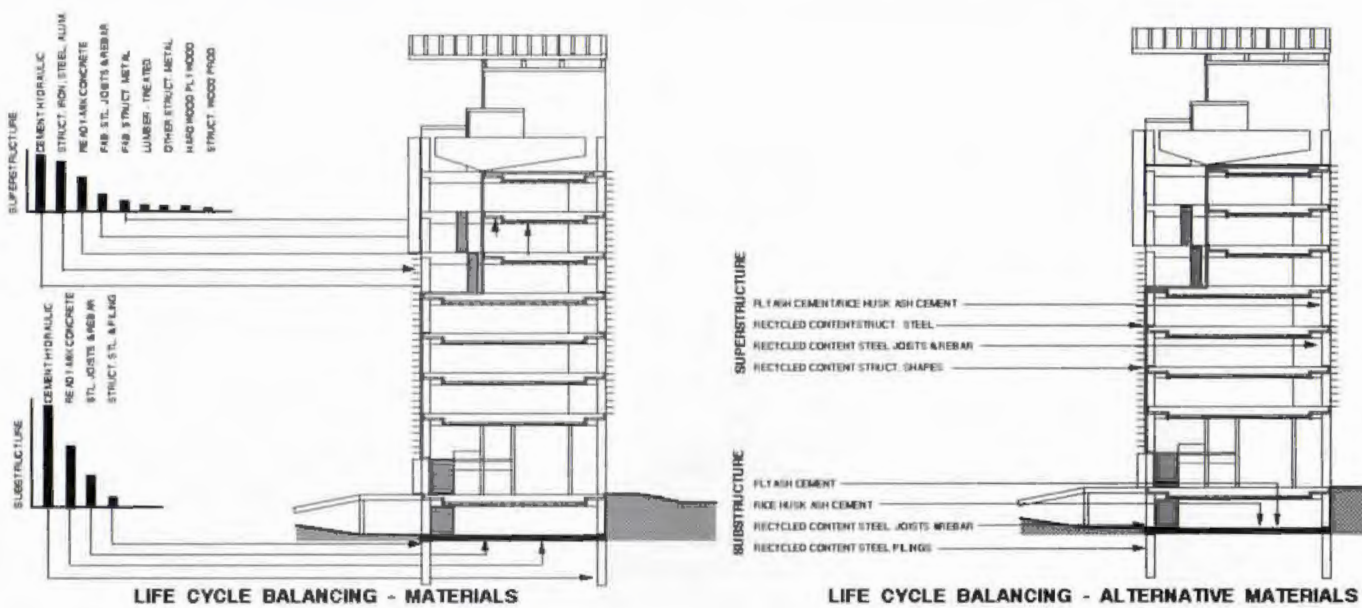

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1 Drawings such as these schematic sections were developed for the Nursing and Biomedical Science Building project to provide a visual record of the environmental impacts of products and materials in various parts of the building; here, at left, relative impact of various substructure and superstructure building materials on CO_2 emissions; schematic at right shows possible alternative materials that could reduce or even eliminate emissions to approach the design goal of a zero-impact building.

mands and water quality during the upstream life-cycle stages are also critical. The building industry's share of U.S. water use is approximately 20 percent of the U.S. total volume. This figure includes the water necessary for the manufacturing of all the products that go into buildings.

It is clear that the practices of the design and construction professions contribute significantly to a range of global ecological problems. As a profession, architecture can point to a number of reasons for its lack of leadership in the realm of sustainable design: We do not have a substantial research arm; we are not taught anything about ecological issues in our schools; and, even if research is done, we do not have a procedure to incorporate its findings into educational programs or professional practice. These are plausible explanations. However, with a crisis approaching and the likelihood of sustainable practices being imposed through legislation, now is the time for architects and planners to become leaders rather than followers in developing new approaches to the design of the built environment.

Design as Communication

Architects are communicators, trained to translate the sometimes abstract needs and desires of a client into physical space, to absorb information, and transform it into the built environment. Architects need to expand upon that role to increase the client and user's sphere of experience to include the ecological impact of the entire life cycle of a building.

The power of humans to think beyond what child psychologists calls "object permanence"—the idea that something exists not only when we see it but when it is hidden as well—is in some ways central to our ecological dilemma. In a complex world where we are overwhelmed with more information than we can process, an "out-of-sight, out-of-mind" outlook has created a condition of irrespon-

courtesy UT Health Science Center

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sibility concerning the key processes that need to be understood. Comprehending the life cycle of the resource flows that comprise the built environment may bring human activity into closer harmony with nature's processes. Expressing abstract information about ecological concerns in ways that clients and users can understand, even participate in and interact with, is an important step toward enabling us to be stewards rather than plunderers of the natural world. This could be our most important professional role. So, how do we do it?

The Center for Maximum Potential Building Systems (CMPBS) has formulated a number of design tools that allow professionals to visualize the ecological impact of their design decisions and, in turn, to communicate that information to their clients and users. Some of these tools are finding a place in land-use planning as well as in the design of several significant buildings. The techniques fall

Paul Bardagjy

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into four categories: upstream footprinting of environmental impacts; designing the building as an information-feedback system; designing open building systems; and establishing shared principles that define sustainability goals early on in a project.

Upstream Footprinting

UPSTREAM FOOTPRINTING is a process whereby specification decisions are linked directly to a hierarchy of environmental impacts according to Construction Specification Institute code. Then, using geographic information systems (GIS), those impacts are displayed county by county across the United States. This procedure is being used for the EpiCenter, a demonstration campus building at Montana State University in Bozeman, Mont. The process enables the designer to see not only a detailed explanation of the impact of materials and products used, but also to see where and how many times in the U.S. that impact occurred. The software literally links a specification decision to a spatial display of the ecological consequences of that decision across the country. Thirty-nine basic building types are covered, such as residential, commercial, office, academic, and medical. It is quite disturbing to realize, for example, that the way we build single-family residential buildings contributes to 23 of the Environmental Protection Agency's air quality non-attainment zones.

Information Systems

DESIGNING A BUILDING to perform as an information system is based on the supposition that if people are informed about the quantity of resources they are using, they will alter their use patterns. The Nursing and Biomedical Science Building (NBSB) at the University of Texas Health Science Center in Houston, currently in the pre-design stages, will include monitoring and feedback devices so that both individual and group resource consumption is understood during the use phase of the building. Several methods of design communication are being investigated, including monitoring and reporting of heating, cooling, and lighting energy costs; water consumption; and solid-waste recycling at both the individual workstation and floor levels.

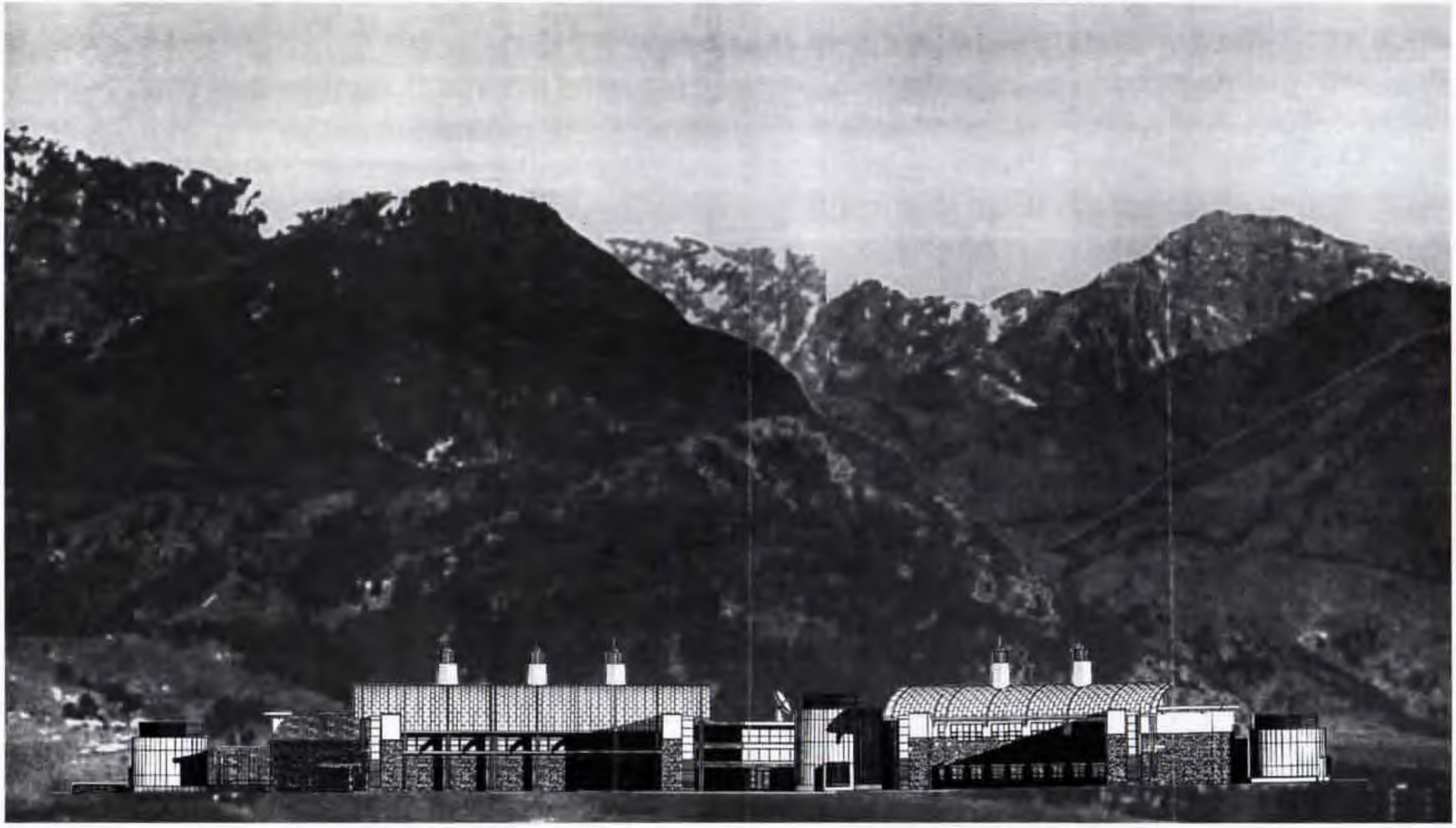
At the Houston project, the limits of a resource's availability are determined by spatial boundaries increasing in scale from the workstation, to the floor, to the building, to the site, to the Houston metropolitan region, and finally to the U.S. The objective is to balance resource use within the smallest possible boundary. For example, all non-potable water use is limited by what the building roof rainwater catchement system can provide. The goal with the NBSB project is to design a zero-impact, or resource-balanced, building. To come close to that goal, architects have to rely heavily on the users' motivation and ability to vastly reduce resource consumption and not depend on technology alone.

Open Building Systems

OPEN BUILDING SYSTEMS are structures designed in such a manner that they can change function. The building itself becomes an armature so that users can modify and personalize space. Many studies have documented the improvements in productivity that occur when building users are given some degree of personalized control of the spaces they occupy. Occupant control of such systems as HVAC and lighting has been proven to actually save energy when compared to large-zone systems. A raised floor in an office building for HVAC reconfiguration and power/data/voice networking is an example of an open building system component. However, building design in general has not incorporated many of these techniques, nor has it considered disassembly methods such as those now common in office-furnishing systems. Often, change and repair of buildings to accommodate newer and more efficient and responsive technologies has not been possible because many buildings cannot adapt to either spatial or utility system modifications and upgrades.

2 Rendering of competition-winning entry for the Nursing and Biomedical Science Building at the University of Texas Health Science Center in Houston; the 245,000-square-foot project is currently in design. Patkau Architects, Vancouver, British Columbia, was the competition winner; Watkins Hamilton Ross Architects of Houston is the architect of record; and the Center for Maximum Potential Building Systems is the sustainable design consultant.

3 The Advanced Green Building Demonstration project features a recycled-steel-content post-and-beam armature structure.



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1 The EpiCenter at Montana State University in Bozeman, Mont., is being designed by BNIM of Kansas City, Mo.; the architect of record is Place Architects of Montana; the CMPBS is sustainable design consultant. The $65-million project was partially funded by the National Institute of Standards and Testing and the State of Montana.

Housing, in particular, is notorious for the waste resulting from remodeling of structures that are difficult to rearrange spatially. In response to this problem, we are designing an open-system housing prototype for the Building America program of the U.S. Department of Energy, similar to our Austin office, which is a state-funded demonstration "green building." The prototype house/office is part industrialized—a recycled-content steel post-and-beam armature—and part regional—non-bearing infill materials such as strawboard or other material available locally. The armature structure allows retrofitting of a range of support technologies, such as water-harvesting systems and solar and waste-treatment technologies, at the home or workplace scale.

Shared Guidelines

CENTRAL TO THE IDEA of design as communication is the development of a shared vision of what the building design team wants to accomplish. Establishing a set of guidelines at the beginning of the architecture and engineering process is essential if any major gains are to be made in sustainable building design. As developed for the EpiCenter and NBSB projects, these guidelines range from design strategies to economic procedures to basic laws of system dynamics; they are summarized on page 48. There will probably be many questions about what some of them mean. This list as an ongoing endeavor open to feedback, suggestions, or improvements.

Design has a crucial role to play in communicating the vital functions and relationships of the built environment and connecting them to the natural world. In fact, it could well be that our most important role in the design of buildings is to make compatible the needs of the users—which are always changing—and the functions of the environment—which are always being encroached upon. In a sense, our task is to make the invisible visible, or to manifest those things that, in the past, we paid little attention to. Such a vision about the purpose of our profession may make good architectural design more commonplace and give it a pivotal role in shaping our global future.

Psychologists tell us that the increase in humans' conceptual space—our understanding of the world—has gone through several revolutions. The time will come, they say, when each individual will understand the basic conditions and processes that determine our long-term survival; at that point, a world union or a global compassionate society could occur. This might happen, they suggest, when the world's population reaches nine to ten billion people. Many ecologists have predicted that global ecological collapse could occur at a population of around 12 billion people. It seems as though our role is clear. Architects have the ability to promote—through design—the conceptual evolution of humans: to increase our understanding of the world around us so that we reach global understanding before we reach global collapse. **TA**

Sustaining the City

by Laurence Doxsey

Growth in cities like Austin has placed increasing pressure on both fiscal and natural resources. The need to address the issues of declining resources and increasing environmental concerns has led to development of an approach to sustainability that goes beyond single buildings. Implicit in the idea of a sustainable community is a consideration of issues on a regional basis as well as an acknowledgment of the interrelationships among all the pieces of the regional puzzle.

The United Nations Brundtland Commission in 1987 proposed a definition of sustainable development as that which meets "the needs of the present without compromising the ability of future generations to meet their own needs." Meeting current and future needs requires evaluating problems from the perspective of their impact on the environment, on the economy, and on social equity. The three perspectives are often referred to as the three legs of a stool—lacking just one means the stool will not stand; emphasizing one over the other puts you on uneven ground. This understanding serves as a base concept toward creating a community with long-term viability—a sustainable community.

In 1996, based on the recommendations of a citizens' planning committee, the city

Sustainable development meets "the needs of the present without compromising the ability of future generations to meet their own needs."

of Austin created a program called the Sustainable Communities Initiative (SCI). SCI is designed to link Austin's existing programs in waste reduction, recycling, and energy conservation; reinforce additional sustainable initiatives; and, most importantly, spur a unified approach to the creation of many more programs.

Characteristics of a sustainable community include long-range planning, involvement from all community stakeholders, stewardship of the environment, and community self-reliance. Examples of ways to acquire these characteristics include participatory, comprehensive, long-term, and integrated planning; resource use that builds toward renewables and stresses efficiency; use and development of technology that facilitates sustainability goals; governance that is responsive, proactive, and systems-based; education that supports diversity; and collaboration across traditional political boundaries to address problems on a region-wide scale.

A few of the many projects the SCI has

Long-range planning, involvement from all community stakeholders, stewardship of the environment, and community self-reliance are hallmarks of a sustainable community.

undertaken in pursuit of these goals include a sustainability evaluation matrix that provides a "sustainability lens" through which to view and prioritize capital improvement plans; a three-county sustainable-community indicators plan that will establish benchmarks to provide a road map for reaching sustainable development goals; and a region-wide visioning process to establish common goals for the future. One of SCI's most important roles is to share information to advance sustainable development at many levels by providing sustainability materials and technical assistance to regional planning efforts; forming partnerships with businesses, chambers of commerce, and regional governments; conducting sustainability assessments in all city departments; and setting up a comprehensive internet site.

To date, one of the most potentially comprehensive sustainable development projects undertaken in Austin is the redevelopment of the Robert Mueller Airport site. The city's existing airport is being replaced in mid-1999 by a new airport at a former air force base, and redevelopment

Austin's goal is to create a place where people want to live now and in the future.

plans call for the 719-acre Mueller site to include mixed-use development, abundant green space, and neighborhood-friendly transportation. The city and state, as well as neighborhood groups and consultants, have worked closely over a number of years to develop a master plan for the project.

The city council is expected to act this fall on a plan for the development that, as currently defined, would include single-family homes and townhomes as well as apartments, mostly in a middle price range; up to 200,000 square feet of retail space, possibly including a grocery store and entertainment venues; and as much as 1.6 million square feet of office space. The development will also include a five-million-square-foot office complex for about 25,000 state workers, to be built by the state on part of the site.

The goal is to develop a community that offers a range of employment opportunities and housing choices, eases (rather than adds to) transportation problems, integrates with the diverse surrounding neighborhoods, and offers a mix of businesses within walking distance. In addition, the project is intended to demonstrate resource efficiency and green building techniques, enhance air and water quality, and protect and enhance green space. In short, the goal at Mueller is the same as it is city wide: We want to create a place where people want to live now and in the future. **TA**

Laurence Doxsey directs Austin's Sustainable Communities Initiative and is the City of Austin's Sustainability Officer.

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FIRST FLOOR PLAN
1 EXPANSION AREA
2 LOBBY
3 FAST FOOD SERVICES
4 WAR ROOM
5 ENTRANCE
6 RETAIL SERVICES
7 RECREATION
8 THEATER
9 RESTROOM
10 STAGING AREA
11 SOUNDSTAGE
12 PHOTOGRAPHY
13 RECORDING SUITE
14 WAREHOUSE
15 RECEPTION
16 AUTOMOTIVE SERVICES
17 AV ROOM
18 INTERACTIVE
19 FINANCIAL SERVICES

Making Do

by Susan Williamson

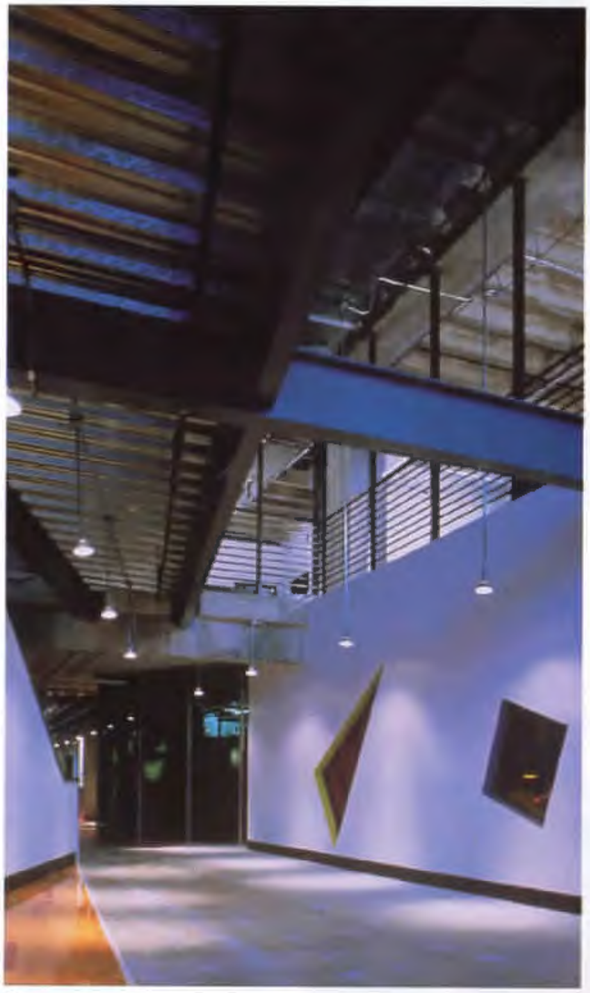
ALTHOUGH THE CLIENTS for a new corporate headquarters project in Dallas were more interested in creating a marketable identity than in protecting the environment, they and their architects succeeded in doing both. Meyer and Johnson, a media corporation, hired Good Fulton & Farrell Architects of Dallas to evaluate the relative costs of purchasing vacant land and constructing a new building versus renovating an existing building. Although the economics were relatively even, according to architect David Farrell, a decision was made to purchase the vacant Foremost Dairy building in Dallas' Stemmons Freeway industrial corridor and transform it into corporate offices, a sound stage, and electronic production facilities.

The dairy facility had no value as a building (the corporation bought the property at land cost and sold part of the site to finance the retrofit), but the inherent structure was all there, Farrell says; rather than tearing down and starting over, the architects worked with what they had: "a super-strong building with a massive concrete frame." The low budget—about \$25 per square foot—drove the use of discarded and salvaged materials throughout: recycled basketball court flooring in several areas; salvaged steel joists and wafer-board paneling in the two-story sound stage walls; army surplus metal desks outfitted with wheels to facilitate flexible office arrangements; lighting fixtures created from junkyard steel and recycled computer boards. Architects and contractors searched local salvage yards for materials and improvised with what they found, Farrell says.

The 45,000-square-foot space (another 15,000 square feet is available for expansion) was gutted and new mechanical systems installed. The high-bay milk bottling area was transformed into a sound stage while the low-bay warehouse areas were converted into offices and digital editing studios for approximately 75 employees.

The clients were interested in renovating the old building because of the potential "wow factor," Farrell says, and the chance for a near-downtown location at a relatively low cost. Although their decisions may have been driven more by economics than altruism, the result was the same. Something that could have been thrown on the junk pile was transformed—treasure from trash. **TA**

PROJECT *Meyer & Johnson Corporate Offices, Dallas*
CLIENT *Meyer & Johnson*
ARCHITECT *Good Fulton & Farrell Architects, Dallas (David Farrell, Monty Stark, Tony Eeds, Brian Kuper, Kathryn Ladoulis)*
CONTRACTOR *Westcliffe Construction*
CONSULTANTS *Mullen and Powell Technistructures (structural); BL&P Engineers, Inc. (MEP); Star Landscape Architecture (landscape)*
PHOTOGRAPHER *Craig Blackmon*



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1 entrance after renovation

2 Salvaged basketball court flooring was installed in a recreation area.

3 reception desk

4 Variously shaped windows penetrate interior walls.

5 Low-bay spaces were converted into offices.

6 conference room

RESOURCES
Masonry units: Spectra Glaze; **metal materials**: Allpro Acoustics; **laminates**: Pionite; **plastic fabrications**: Acrylite; **metal doors, frames**: Raco; **specialty doors**: Overhead Door; **entrances, storefront**: Kawneer; **glass**: PPG; **plastic glazing**: Acrylite; **gypsum board framing, accessories**: HSG; **acoustical ceilings**: Armstrong; **paints**: Devoe, Pratt & Cambert

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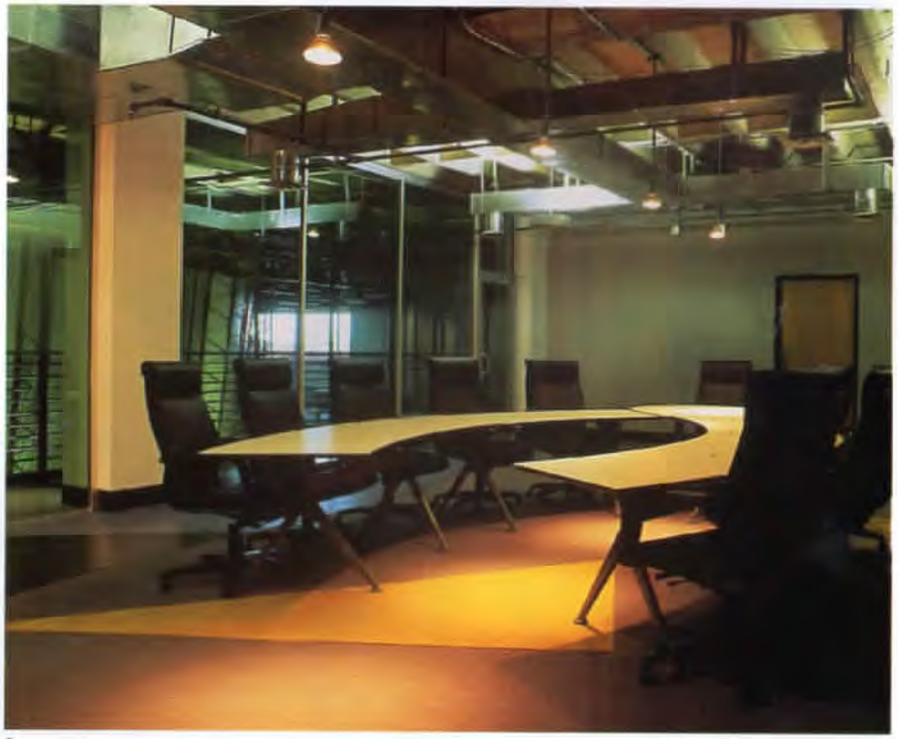

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Sustainable Models

by Jay Yowell

"SOUNDS GREAT, DON'T CHANGE A THING!" says the client. "But can you show me where it's been done before?" the client continues.

"Aghhh!!" you scream as you awaken from a cold sweat. You've experienced one of an architect's worst nightmares: You have developed a revolutionary sustainable design that meets the client's goals, will save him money, and will maybe even make his business more profitable. And on top of all that, it will not only help protect the environment, but may actually enhance it. There's just one slight problem: You will be the first to do it. Most design ideas you can either drive or fly the client to see, but not this one. Without an existing prototype, even your best salesmanship may not be enough to get the project off the ground.

Two projects in Texas, one completed this fall and the other still under construction, may make it easier for architects to convince their clients of the viability of a range of sustainable technologies and methodologies. The two buildings are touted by their clients as models of sustainability and prototypes for future construction. And adding to their credibility as examples are the clients themselves: the federal government in one case and the State of Texas in the other. Besides your own family members, there may be no tougher client than the state and federal governments. With regard to sustainable design, these projects begin to eliminate the excuses.

8th Avenue Station

WHEN THE UNITED STATES POSTAL SERVICE (USPS) decided to build a new post office in Fort Worth, it presented the architect with an unusual charge: design a building that showcases environmental awareness, committment, and material qualities while using standard design modules. Quorum Architects of Fort Worth and a team of consultants responded with a project that not only met this charge, but also provided the community with a building it can be proud of.

The intention was for the project to convey its sustainable elements to all customers who enter the building as well as to the surrounding neighborhood. In addition, the client asked that customers be given a sense of arriving at someplace unique when they visit the facility. Architects at Quorum designed a dramatic freestanding wall—a veneer of limestone over compressed-straw panels—that extends at an angle, marking the entrance. A planting bed in the entrance plaza is meant to act as a symbolic creek of native plants. This planting area was originally planned as a water feature that would flow from the east side under the plaza around to the south face. Although the water feature was omitted for cost reasons, the spirit was preserved when the team decided to use the same configuration for the xeriscaping educational area.

Most of the sustainable approaches employed at 8th Avenue are hidden, beginning with the rehabilitation of the site itself. The Texas Natural Resource Conservation Commission (TNRCC) had identified the area as a brown site, meaning it was contaminated in some way (in this case, the site had been used as a maintenance facility for locomotives but was not considered hazardous). The site was made usable for the postal facility through a partnership with TNRCC and a firm that specializes in soil recycling. Even during construction, environmental procedures were implemented. This included construction waste management and another more uncommon step: The architects specified pre-ventilation procedures and developed a schedule of finishing procedures to improve indoor air quality during construction and thus reduce the exposure of construction personnel to possible toxins. An often overlooked step, this planning is vitally important to the health and safety of the construction crew.

Consideration was also given to the environmental impact of materials and systems used. As much as possible, the number of materials used was reduced and materials chosen were evaluated in terms of both negative environmental impact during manufacturing and installation and resources used during occupancy of the building. As an example of the former, wood used on the project was obtained from sustainably managed forests; of the latter, zones and motion sensors were installed to control interior lighting systems and HVAC and thus reduce energy usage. To improve the lighting in the mostly closed building, the team fitted the bulbs with light filter sleeves to change the color to a natural light more pleasing to the eye. These sleeves can be reused when the bulbs are changed out.

Additionally, the site is designed to contain rainfall: Rather than allowing it to run off to the city sewer system, rainwater is directed to flow back down to the natural aquifer. In addition, a rainwater harvesting system that includes two 12,000-gallon holding tanks was installed; one inch of rain completely refills the tanks.

The use of compressed-straw wall panels was a sustainable decision that affected the aesthetics of the building. "The [panels] basically generated the concept of the entrance wall," says architect Doug Moon, adding that using the straw panels

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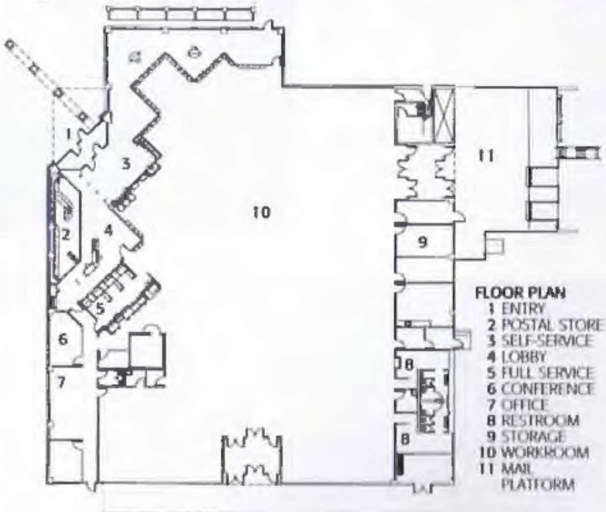

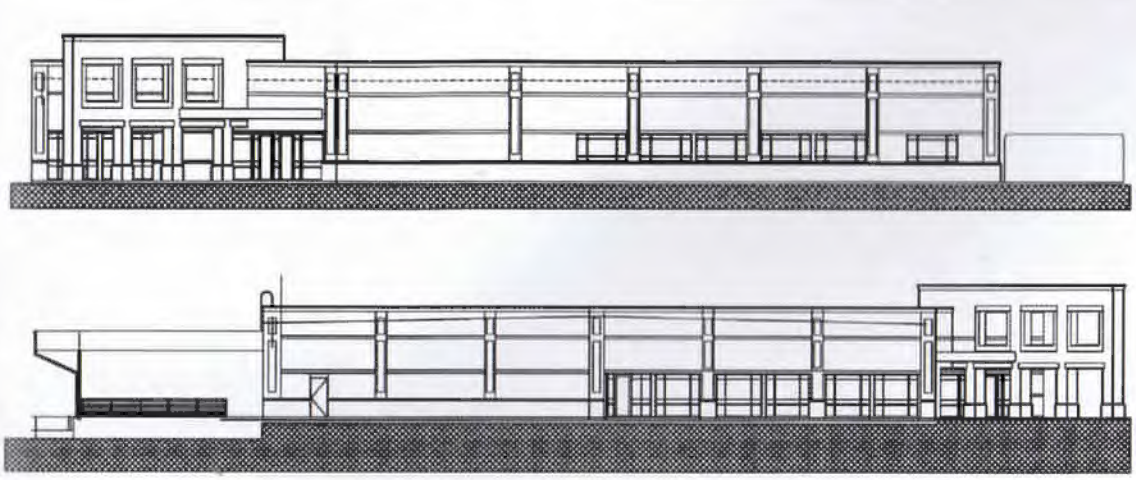

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PROJECT *USPS 8th Avenue Station, Fort Worth*
CLIENT *United States Postal Service*
ARCHITECT *Quorum Architects, Inc., Fort Worth; BSW International, Tulsa, Okla. (consultant architect)*
CONTRACTOR *Penntex Construction Company, Inc.*
CONSULTANTS *Hector Gomez Engineers, Inc. (MEP); Land Resource Design (landscape); Baird, Hampton & Brown, Inc. (civil)*
PHOTOGRAPHER *Doug Moon*

1 The 8th Avenue Station in Fort Worth by Quorum Architects utilized compressed-straw panels in a wall system; the panels were covered with stucco over much of the exterior.

2 A dramatic wall marks the entry; the wall was also constructed of straw panels, here covered with a veneer of limestone.

3 Low-emission glazing reduces the impact of sunlight on the interior of the post office.

4 east elevation (top) and south elevation (bottom)

8th Avenue Station: Sustainable Materials and Systems

- **Construction waste management**: Approach was to reduce, reuse, and recycle to minimize waste stream to landfills.
- **Transportation impact**: The project will partner with Lone Star Gas to provide a natural gas refueling station for USPS vehicles. Bicycle racks were included to encourage alternative forms of transportation.
- **Rainwater harvesting**: The system is designed for easy conversion to a potable water system.
- **Energy efficiency**: Natural vegetation shades east exposure in summer; low-emission glazing was used and a high-efficiency HVAC system installed.
- **Sustainable materials**: Compressed-straw wall panels, soy-based concrete forms, fly-ash concrete, among many others.
- **Low volatile organic compound (VOC) and non-toxic products**: curing compound for concrete, EPDM bonding adhesive and seam sealer, adhesive for ceramic tile and linoleum flooring, and interior paint.

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RESOURCES (8th Ave.)
Unit pavers: Pave Stone; **wheel stops**: Hammer's Plastic Recycling; **tree grates**: Structural Plastics Corp.; **bicycle racks**: Brandir; **cast stone**: Advanced Cast Stone, Inc.; **metal materials**: Red-I-Steel, Inc.; **steel joists**: Vulcraft; **wood polymer lumber**: Trex Company, LLC; **sound insulation**: Manville Fiberglass Batts; **exterior insulation**: Certain Teed; **membrane roofing**: JPS Elastomerics Corp.; **metal roofing**: VicWest Steel; **roof hatch**: Bilco; **metal doors and frames**: Tex-Steel Corporation; **wood doors and frames**: Weyerhaeuser Wood Doors; **coiling door and impact**: Dynaflair Corp.; **carrier and mailing vestibule doors**:

continued on page 37

on the wall gave it a more substantial feel than standard metal stud and sheathing would allow. Most of the exterior of the building is stucco over the straw panels, and Moon says that "the panels are also expressed in the joint pattern of the stucco finish. No one had detailed these panels on a commercial application like this. However, the erection of the panels went very smoothly."

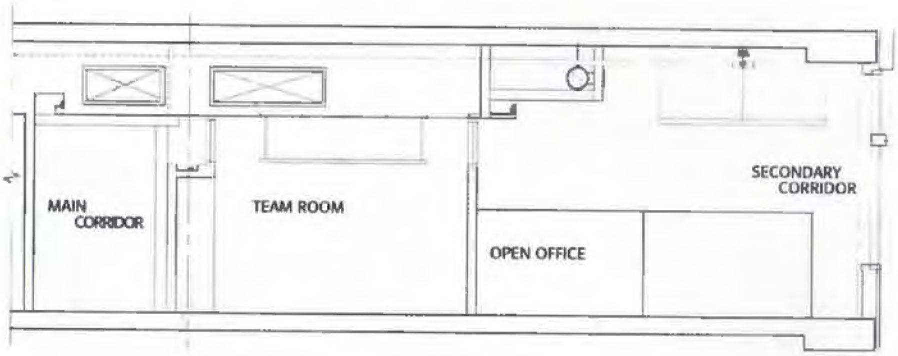
Packing this wide range of sustainable elements into a 26,000-square-foot building is quite an impressive feat. The team's objective was to design this project as a "green" showcase and demonstration to test green materials and systems for viability (cost, availability, performance, and aesthetics) relative to standard construction materials and systems. One sign of the team's success was shown this past May at the Postal Service's national convention where the project received design recognition.

Robert E. Johnson Legislative Office Building

THE STATE'S LEGISLATIVE service agencies will soon have a new home in the Robert E. Johnson (REJ) Legislative Office Building in Austin, recently designed by Page Southerland Page (PSP) of Austin. PSP worked with the Texas State Energy Conservation Office and a number of nationally recognized sustainability consultants, including the Center for Maximum Potential Building Systems (CMPBS) of Austin. Not only has the Rocky Mountain Institute identified REJ as one of only five national models for sustainable architecture, but the state of Texas has selected the project to serve as a model for all future state office buildings.

Although the client was the state's General Services Commission, eight agencies will occupy the building (which is scheduled for completion early next year). Each of those agencies had their own management teams and decision makers, the members of which changed several times during the design process. As a result, the design team found itself having to resell ideas again and again. Wendy Dunnam of PSP suggests that the success of the project can be attributed to the team concept that was maintained throughout the process. It helped that PSP's core design group stayed intact, she says, and that the firm had its own in-house engineers. Another key was the material matrix used by PSP; the same person from PSP maintained the matrix throughout the project. The matrix was used to analyze a material based on where it came from (from a shipping standpoint and an extraction standpoint); whether it was toxic (during or after installation); what its recycled content was; and whether it was recyclable. Dunnam also credits the help of Gayle Vittori of CMPBS and EcoTimber of Seattle as vital to the success of the project.

Many project teams can convince their clients to use a certain environmentally friendly product based on its life-cost analysis. However, on a government project the budget and payback periods are strictly set, and therefore the upfront costs become law, literally. So the REJ team had to prioritize their concepts and "pick their fights." For instance, the initial design included exterior shading devices with integrated photovoltaics (PV). However, since the upfront cost of PV technology is



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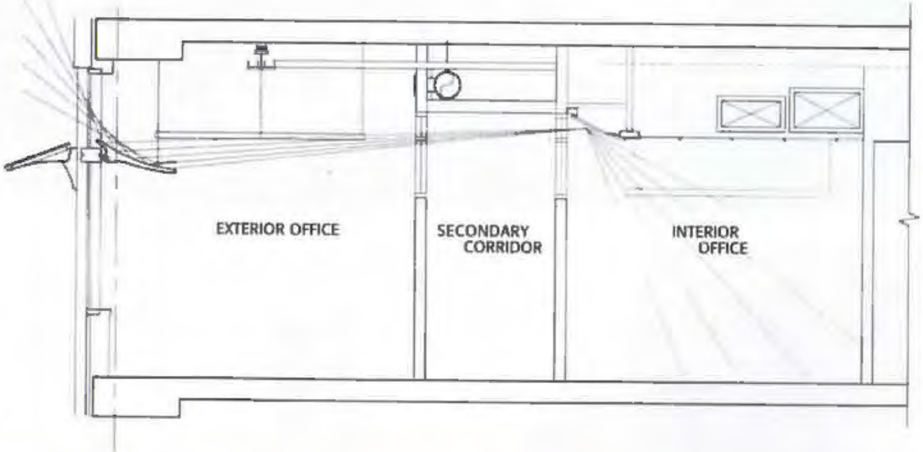

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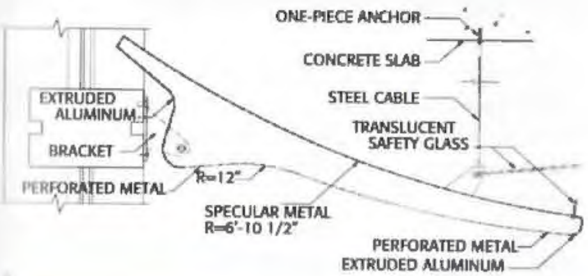

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1 Two 12,000-gallon cisterns hold water collected from a rainwater harvesting system at the post office.

2 post office model

3 REJ light shelf section

4 REJ partial building section showing daylight in main corridor and secondary offices

5 REJ partial building section showing light shelf and light baffle

6 The REJ state office building wraps around an interior courtyard.

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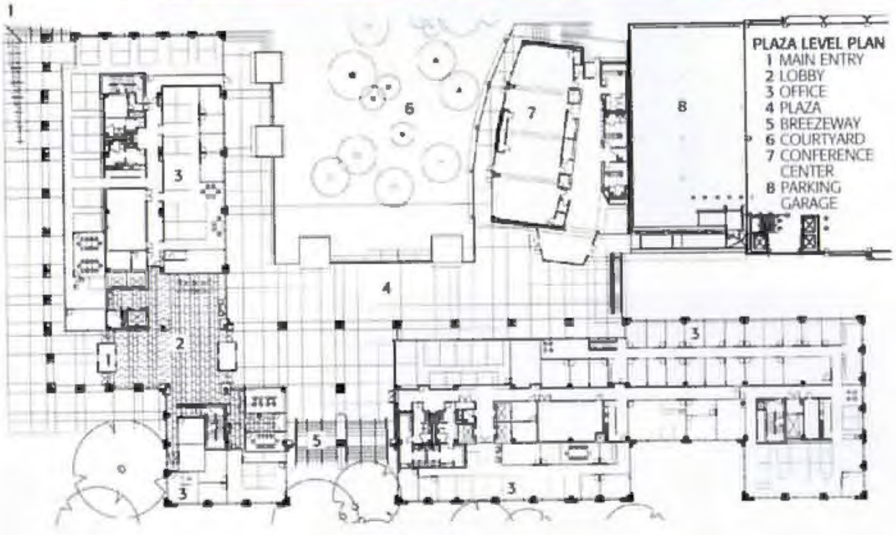

Spec Note: Zinc Panels at the REJ

When the design team was detailing the REJ facade they looked for a spandrel material to contrast with the precast concrete used elsewhere. The material needed to be non-toxic, long-lasting, and low-maintenance. They found what they were looking for in zinc panels. According to Wendy Dunnam of PSP, zinc met all their criteria: It weathers to a beautiful silver gray, has an extremely long life, and requires no finish—thus no toxic paint and no maintenance is needed. The panels are more expensive than painted aluminum, but, factoring in lifespan and maintenance requirements, the payback fell within state guidelines.

high, and maintenance costs are high as well, the payback period was deemed to be too long and the entire integrated shading system was eliminated. Also, rainwater harvesting and graywater recycling systems were removed due to the high cost of implementing such systems—which require a great deal of space—on the congested urban site.

Many of the initial goals were met, especially the one most important to the design team: daylighting of the interior spaces. Although the photovoltaic shading devices were not constructed, the south and west sides of the project have ultraviolet protective glass from the floor to eight-feet six-inches and vision glass above that to the ceiling. There is a large mullion at this eight-foot six-inch line containing mini-blinds that are individually controlled by the users. This individual control concept is widely used in new sustainable, high-tech projects in Europe, but less common in the U.S. The thin section of the building and its north/south orientation allow light to penetrate deep into the interior. The flow of natural light is enhanced by the use of light shelves, also at the eight-foot six-inch level on each floor, which bounce light across and through the building. The walls parallel to the exterior glazing have interior clerestories between seven-feet and ten-feet-three-inches high, allowing further distribution of the natural light. Another technique was to keep ceiling equipment close to the interior core, exposing the ceiling at the outer

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perimeter of each floor. As a result, exterior glazing is maximized from floor to ceiling, allowing a large amount of natural daylight into the building. The large amounts of glazing, coupled with dimmable ballast fixtures, drastically increased the efficiency of the lighting.

The exposed concrete ceiling was one implementation of the team's desire to eliminate unnecessary finishes. Another example is the use of local granite. Rather than just being a finish material clipped over some other system, it is composed of stacked pieces. Sustainable because it used fewer materials, this detail is also true to the material and cost-effective.

The 8th Avenue Station and the Robert E. Johnson Legislative Office Building should serve as models for future building projects not only because they utilize sustainable materials and concepts, but also as a demonstration of the importance of a team approach to the success of this type of design process. The team must be involved from concept to opening day to ensure that these cutting-edge ideas are realized. So, with buildings like these as examples, you will be able to say to that doubting client, "Sure that system has been done before, let's go see it." But remember to add, "And let's take the rest of the team along." **TA**

Jay Yowell is an architect with RTKL in Dallas; he is currently developing a sustainability guide for the firm.

Robert E. Johnson Building: Sustainable Materials and Systems

- **Materials**: Number of materials used reduced as much as possible, i.e. stained concrete floors instead of other floorcoverings; natural materials available locally also used when possible; all materials researched for recyclability, non-toxicity, and overall environmental sensitivity.

- **Energy efficiency**: Fixture and equipment selections, along with calibration of the generated heat load output, allowed reduction in required cooling tonnage and quantity of electrical lighting. Performance-monitoring systems will allow fine-tuning of energy consumption. In addition, dimming and sensor devices will eliminate energy consumption when possible.

- **Lighting**: Indirect lighting, high ceilings, natural daylighting, and open vistas are predicted to enhance productivity.

8th Avenue Station Resources, continued from page 34
Perma Tech, Inc.; **vinyl windows**: Naturalite Skylight Systems; **grey/low-E glazing**: AFG Industries; **gypsum board framing and accessories**: Delta Metal Products, Inc.; **gypsum panels**: United States Gypsum Co.; **tile**: American Tile Supply, Inc.; **cirrus/fire guard**: Armstrong; **linear metal soffits**: Interfinish, Planar Macro; **linoleum flooring**: Forbo; **carpet**: Designweave; **plaster/lathe**: Texas Industries, Amico; **paint**: Sherwin-Williams; **structural wall panels**: Agriboard Industries; **special coatings**: Cerama-Tech; **plastic toilet compartments**: Santana; **flag pole**: Concord Concealed Halyard; **parcel lockers**: American Laker Security Systems; **toilet accessories**: Bradley Corp.; **dock levelors**: Kelly Atlantic Ltd.;

RESOURCES (REJ Building)

Unit pavers: PAVEX; **concrete materials**: Texas-Lehigh Cement Company; **concrete formwork**: BoMetals, Inc., DUOGARD; **concrete reinforcement**: ERICO Products, Inc.; **architectural concrete**: Sunbelt Cement; **masonry units**: Featherlite Building Products; **stone**: New England Stone Industries, Inc.; **steel deck**: VULCRAFT; **gales, stairs, and handrails**: Wilborn Steel Co.; **metal roof and wall panels**: Kovich, Inc. (Wade Architectural Systems, U.S.), Wilborn Steel Co.; **architectural woodwork**: NEVAMAR, Formica, Pionite; **dampproofing**: Sonneborn; **membrane roofing**: GAF Materials Corporation; **modified bitumen roofing system**: RUBEROID; **wood doors**: Heritage Hardwoods of Kentucky, Buell Door Company; **glazing**: Viracon; zinc spandrels: PROCLAD Enterprises (Wade Architectural Systems, U.S.); **aluminum curtain wall/window**: Sonolastic Sealant Systems, Skyfab, Inc.; **painting**: Polomyx (Surface Protection Industries), Porter Paints; **resilient flooring**: Roppe Corporation; **carpet**: Interface Flooring System, Inc., ReSource Americas; **curved light baffle with light shade**: Decoustics; **interior translucent glass**: Viracon; **exposed cable trays**: Wiremold

1 rendering of the REJ Legislative Office Building; the state required that the project be clad in pink granite

2 looking toward the Capitol along the west façade of the state office building

PROJECT *Robert E. Johnson Legislative Office Building, Austin*
CLIENT *General Services Commission, State of Texas*
ARCHITECT *Page Southerland Page, Austin (Matthew F. Kreisle, III, project principal; Charles L. Tilley, project manager; Lawrence W. Speck, FAIA, project designer)*
CONTRACTOR *SpawGlass Contractors, Inc.*
CONSULTANTS *Cotera Kolar & Negrete Architects (architectural team); Jaster-Quintanilla & Associates, Inc. (structural); BNIM Architects (sustainability); OTM Engineering (communications); The Landscape Collaborative (landscaping); Project Cost Resources (cost estimating); Hick & Company (archaeological); Fuller Dyal & Stamper (graphics); Wes Henderson (student intern program)*
PHOTOGRAPHER *R. Greg Hursley*

all photos courtesy of Dick Doughty/Aramco World

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1 A 500-square-foot, very low-cost house in Ojinaga on the Mexican side of the Rio Grande was Simone Swan's first adobe project along the border.

2 The sun-fired adobe is made on-site from locally available dirt, sand, straw, and manure for viscosity.

3 The adobe bricks are covered with a thin layer of the same adobe mixture, applied by hand, giving the buildings their smooth finish.

Hands On

by Frank D. Welch, FAIA

SIMONE SWAN TELLS OF RIDING with friends through Texas's Big Bend country for the first time in 1991, and passing old Fort Leaton outside of Presidio. She asked the driver to stop. She went in the thick-walled, adobe structure, and before her friends coaxed her back into the car, in an intuitive flash she had asked if she could have a job in the landmark. In a few weeks she came back, rented a room with a Mexican family in Presidio, and was working at Fort Leaton as a volunteer demonstrating how to make adobe bricks.

Thus began Swan's love affair with that dry, hot land along the meandering Rio Grande, and with the towns of Ojinaga (pop. 25,000) and its sister city Presidio (pop. 5,000). Since 1995, she has built—with dweller-owner labor—low-cost, energy-efficient dwellings of great presence and elegance from sun-fired adobe, which is made from dirt, sand, water, straw, and manure for viscosity.

The Big Bend was an unlikely place for Swan, a woman of beauty and intensity then in her mid-60s, to make a career change. Born in Brussels, Belgium, to American parents, she was raised in Europe and Africa observing the "pyramids and temples of Egypt and vernacular housing in the Sudan, Uganda, and the Congo." Fluent in several languages and long associated with cultural organizations like the Menil Foundation (for which she served as founding director from 1972 to 1977), Swan also found time to build Houston's first Tin House at Roy and Blossom streets in 1972 with Eugene Aubry, FAIA, and Swan House on Long Island in Southold, New York, with Charles Moore, FAIA, in 1975. She now "winters in Presidio and summers at Swan House."

In 1973, Swan was having dinner with friends in Paris; one of the guests told her she should read Egyptian architect Hassan Fathy's *Architecture for the Poor, An Experiment in Rural Egypt.* Inspired by her reading, she wrote Fathy and received a gracious letter in return. Swan then took a leave of absence from the Menil Foundation, went to Cairo, and spent a month in Fathy's studio absorbing his philosophy and methodology. Until his death in 1990, Fathy was Swans' mentor in her quest to learn about adobe architecture—how to design with the material—especially vaulted roofing "with no wood whatsoever, no forms, no centering, no beams," says Swan, with the aim of developing low-cost housing in arid climes. In 1977, with a grant from the Menil Foundation, she established the Fathy Project in New York, which promoted low-cost, energy-efficient housing, and was congruent with the foundation's interest in helping achieve social justice for the world's poor. Her public information system and educational materials, which the Fathy Project issued, won the Aga Khan Award in Architecture in 1980.

Swan's first venture into adobe was a house built in Ojinaga, Chihuahua, just across the Rio Grande from Presidio. The house was built in 1995 with the owner-dweller Daniel Camacho and the assistance of Maria Jesus Jimenez, Swan's talented assistant. It featured, as in subsequent models, high, gracefully proportioned adobe vaults and domes; the quoted unit-cost for the 550-square-foot prototype was $11-per-square-foot, "three-quarters of which went to salaries," says Swan. The smooth exterior surface was finished by hand and sponged with the same adobe mixture as the bricks, created with materials close at hand—in this case with "fine" earth mined from a nearby roadside embankment. The little structure continues to receive visitors from across the country and Europe.

Recently completed is Swan's own residence on a 430-acre mesa east of Presidio, with a view of the winding Rio Grande, the 8,000-foot peak of Chinati Mountain, and the pleated grey mountains of the steep Sierra Matas Aguas in Mexico. At 1,700 square feet, the house, which is equipped with solar power that pumps water 750 feet up from a creek below the mesa, is more complex than the small dwelling she built across the river, but has the same language of articulated domed and vaulted forms. Due to a higher wage scale, Swan has projected a $44-per-square-foot cost for her structures on the Texas side of the river. She plans to grant a limited number of parcels at La Mesa to friends and allies who will respect the landscape and adobe architecture.

Today, Swan continues to seek approval for low-cost financing for her adobe prototype from the United States Department of Agriculture's Rural Housing Service, based in El Paso. Her goal is not simply sustainable and do-able, inexpensive construction, but an architecture of quiet, compact nobility for those who usually cannot afford such. It is not a dream; she has already made it a reality. **TA**

Frank Welch, FAIA, practices in Dallas; he is a TA *contributing editor.*

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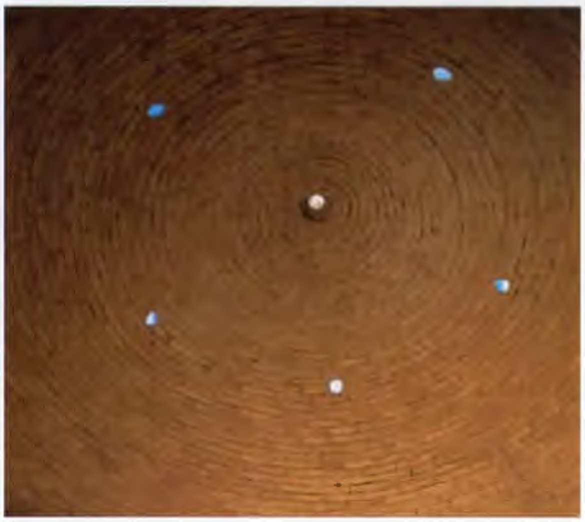


6

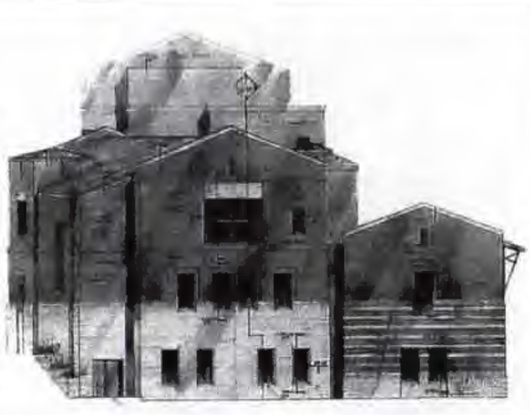
4 Simone Swan stands beside her house near Presidio; the house in Texas is the second adobe project Swan has undertaken.

5 a small domed outbuilding at Swan's complex near Presidio

6 Swan says the vaulted roofs are built "with no wood whatsoever, no forms, no centering, no beams."

Coming in the next *TA*:

Campus Planning & New Construction



Pictured: Texas School for the Deaf, Austin, Barnes Architects

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Survey

Lifting the Mystique

EDUCATION According to myth, architecture students learn in a cloistered, self-referential environment—slaving away long hours in studio and seeing the outside world wistfully through a window or only briefly between classes. Typically, academic projects lack the reality of clients, construction, and team-based design. However, programs like Rice University's Building Workshop (*TA*, January/February 1998) and Auburn University's Rural Studio challenge that myth and take students out of the studio and into the world, introducing them to the particulars of site and materials and the reality of clients and economic constraints. In 1997, Lori Ryker, then an assistant lecturer in Texas A&M University's Department of Architecture, ran a Remote Studio with a similar goal: to remove the students from the academic environment and place them in the real world with a real project. In the summer, five Texas A&M architecture students joined Ryker for five weeks at Fort Davis in West Texas, near Marfa's Chinati Foundation. A grant from the American Architectural Foundation partially funded the studio.

Ryker searched for a project with "specific relevance to the community and its relation to the landscape in which it lives," a project that had not only clients and a budget, but also discussed man's relationship to his natural surroundings. The project, a quail-watching shelter, was designed for Davis Mountains State Park. Although similar projects are common in the traditional studio context, Ryker believes that the "particularity of the students' ideas and designs for a unique community such as Fort Davis were exponentially clearer" because of the immediacy of and the students' involvement with the site; a hands-on design/build project by its very nature requires that students learn to interact differently with one another and the process of architectural design.

Besides getting students out of the closed-door studio, "the focus of the Remote Studio was to study and experience firsthand the relationships that exist between small towns and their natural landscapes," says Ryker. This was achieved through a process that introduced the students to client relationships, team-based design, and hands-on construction, demystifying the process of design realization and creating a concrete legacy of the Remote Studio for the Texas A&M students and the community of Fort Davis. The built shelter goes beyond a mere studio project in its material presence and existence outside of drawings and the imagination.

Choosing from three projects already in

1

all photos courtesy of Lori Ryker

2

1 The shelter is built into the hillside with areas of differing floor levels.

2 Most of the construction, which used student labor, required only circular saws, drills, wrenches, and screwdrivers.

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3 The ocotillo roof changes pitch as it approaches the hillside.

4 The students harvested local stone for the retaining walls.

5 A metal roof shades the picnic area at the entrance to the shelter.

the park's budget, park manager David Bischofhausen asked that the students design a shelter for watching the montezuma quail, a species located only in the Fort Davis area. The studio drew materials from vernacular construction, including harvested native stone, concrete, rough cedar, recycled galvanized metal, and ocotillo, a desert shrub of the southwestern U.S. and northern Mexico characterized by thorny branches and used locally as fencing and thatch. An ocotillo roof covers the quail-watching area, which looks back toward the hill, while a metal roof protects the picnic area. The shelter, built into the hillside, provides a level surface and allows easy accessibility.

The five-week studio began with a camping trip to nearby New Mexico and a hiking excursion into Big Bend National Park. The studio filled the following two weeks with walks, observations, discussions, and small individual charettes in which the students created objects in response to the landscape. "Much of the discussion of our relationship with the natural environment emerged in discussions about the small projects," says Keith Randolph, a member of the studio.

Design also moved forward on the quail-watching shelter, and the students learned how the design process involves give-and-take between architect and client, design and budget. Randolph notes, "I feel I benefited the most from the opportunity to work with a client and the experience of designing and building something in a group—all things I had not done in previous studios." The students had to specify and quantify all of the necessary materials so that the park could procure them. Construction took two and a half weeks, and the students provided all of the labor.

On its face, Texas A&M's Remote Studio may lack the explicit social agenda of Rice's Building Workshop or Auburn's Rural Studio. However, notes Ryker, "lessons from small communities and their surrounding environment are rich with experiences due to their cohesiveness and strong sense of identity." Fort Davis is an example of one such small community whose livelihood and identity is intimately tied to its environment. Ryker says, "These small communities—borders of communing and natural—and the undeveloped landscape form a rich ground from which students and the profession can understand what builds community, gain lessons for land use, and foresee the necessity of these considerations in the realm of urban and suburban environments." As at Rice and Auburn, students gained valuable lessons on design realization and the complexities of the world outside of studio. ***Jonathan Hagood***

Jonathan Hagood graduates in December 1998 from the University of Texas at Austin with a B.Arch and a B.A. in Latin American Studies; he is a frequent contributor to Texas Architect.

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Instructions to Publishers

Code of Ethics for a Life Cycle Approach to Sustainable Architecture

1. Visualization of the life cycles of resource flows is the key to a sustainable future.

2. Life-cycle analysis is emerging as the new global language of design—use it.

3. Life-cycle accountability always begins at the smallest functional scale and seeks not to overwhelm larger scales where resource flows aggregate.

4. Decreasing the number of stages of the life cycle can increase resource efficiency and aid in educating others about the life cycle of a resource in a building.

5. A high degree of integration, rather than conservation, in use and function must be shown when analyzing a resource that has a large, subsidized resource flow.

6. Reduce a building's ecological footprint by specifying locally derived products, services, and a small material palette.

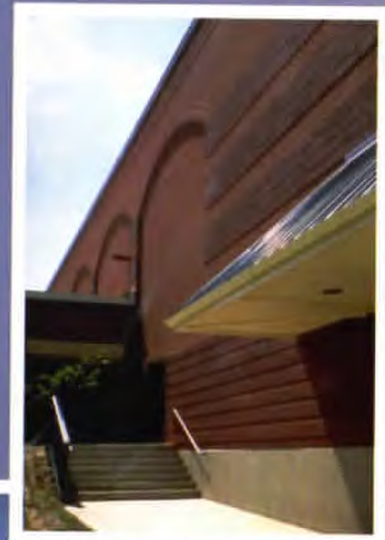
7. Extend a building's life by specifying and designing with "open" building practices that maximize the adaptability and reusability of a building and its components.

8. Utilize life-cycle analysis as the basis for modeling design decisions that change a building's performance and impact on other systems.

9. Know the baseline life-cycle performance and impact data for all of a building's resource flows before demonstrating where improvements should begin.

10. Use full cost accounting as the standard procedure when assessing the economic, environmental, and/or social impacts of an activity or system.

These principles were developed by the Center for Maximum Potential Building Systems in connection with the EpiCenter and Nursing and Biomedical Science Building projects (see story, pages 24-28). The icons are part of an information system developed for the same projects; the system visually identifies and monitors each component of the various building systems.



"Masonry Success Stories"

Economics

Feature Project:
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Garland Independent School District

Architects: WRA Architects, Inc., Dallas, Texas

Masonry Contractor:
Skinner Masonry, Inc.

Masonry Supplier: ACME Brick

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