

A Broad View of Sustainability

Austin Bergstrom International Airport



Lecture for PES International

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In the late 1960s Paul Rudolf who was, at the time, the most respected American architect of his generation and who was dean of the School of Architecture at Yale University wrote the following: "In architecture all problems can never be solved. . . . Indeed it is a characteristic of the 20th century that architects are highly selective in determining which problems they want to solve. Great architects make wonderful buildings only because they ignore many aspects of a building. If we solved more problems, our buildings would be far less potent."

This quotation seems to me to epitomize one of the most powerful aspects and one of the most disturbing problems of 20th century thinking. Rudolf overtly favors narrowing the broad scope of an architectural problem in order to make it clearer and more manageable. He advocates concentration in order to obtain power and potency. He favors exclusion as a means to achieve intensity.

This attitude in architecture is consistent with 20th century notions in many disciplines where reductivism, oversimplification, and single-mindedness have led to negative consequences which we must now address in crisis proportions. In science, in politics, in education, even in art, we have sought clear, singular models, resisting complications as "static" in the system. In our frustration with the inability of those models to produce success we have jumped from one model to another sequentially, searching for that one clear, distilled direction.

In architecture this attitude has produced a whole series of movements—Modernism, Post-Modernism, Late-Modernism, Neo-Modernism, Metabolism, Historicism, Brutalism, Deconstructivism, etc.—each concentrating on one or a few aspects of building, but none taking a really broad, synoptic view. The current interest in Sustainability could be viewed as just another one of those movements—something that will be "hot" for a while but will soon go out of fashion as some other set of interests supplants it.

But perhaps the destiny of this movement is different. Perhaps in the 21st century there is another kind of thinking developing that is more broadminded, that is not content to "ignore many aspects of a building," in Rudolf's words, in order to concentrate on a narrower band of

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interests. Perhaps Sustainability is, in fact, precisely about seeing architecture as a broad, multifaceted endeavor which is greatly diminished when its scope is constricted.

I was very encouraged recently by reading an article written by two British researchers in an issue of the *Journal of Architectural Education* edited by Kenneth Frampton and Steven Moore. It was titled "Reinterpreting Sustainability Architecture" and it did a wonderful job of describing the full breadth of what Sustainability currently means to various constituencies. Six different "logics" of sustainable architecture are described therein which cover issues as diverse as social equity, community participation, quality of life, health factors, expression of local cultures, regionalism, ecological consciousness, biodiversity, compact cities, energy conservation, etc. The authors suggest abandoning "the search for a true or incontestable definition of sustainable buildings" in favor of just embracing its whole messy range of concerns under the broad umbrella of Sustainability. They suggest that the pursuit of "consensus that has hitherto characterized sustainable design and policy making should be translated into the search for an enlarged context in which a more heterogeneous coalition of practices can be developed."

It is actually this inclusive attitude toward diverse design concerns that makes the notion of Sustainability particularly appealing to me. Here is a way to look at architecture in the very largest frame of reference. How does it perform socially, functionally, aesthetically and technically? How does it perform over a multi-generational time frame? How does it embody timeless human values like responsibility, intelligence, perceptiveness, creativity, and ingenuity?

For me, the beauty and the challenge of architecture is that, in the end, it is about life—all of life. Sustainability seems to accept that notion. Architects must be concerned with how many watts of electricity per square foot the building is consuming, but they must also be concerned about whether the lighting produced by that electricity is creating an atmosphere supportive of the functions that occur within the building. Designers must deal with conserving natural resources in the construction process, but they must also be sure they are producing a building which will have a long, productive functional life—which will not become obsolete and requires premature replacement, negating the original efforts to conserve. Architects must avail themselves of opportunities to recycle and provide the option for future recycling in the choice

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of building materials, but they must also pay attention to whether the materials they select are contributing to promoting employment stability, developing craft and local culture and engendering a sense of identity and community pride.

The broadest agenda of Sustainability can never be fully satisfied or even fully optimized. Its range is so inclusive that some issues will inevitably even conflict with others. In the recent exhibition "Ten Shades of Green," sponsored by the Architectural League of New York, ten exemplary buildings were chosen from around the world to represent the best of green architecture. Though each embodied great strengths in terms of Sustainability, there was also room for criticism in every case. In sustainable design, perfection is not a realistic possibility. Balance, appropriateness, ingenuity, synergy, inventiveness, intelligence, and sensitivity are better criteria for evaluation.

In our own work in my studio over the last twenty years these have been our watchwords. We have always sought to make buildings which are appropriate to their place, their purpose, and to the people who use them. We try to make buildings that are poignantly expressive of the local values and culture of the populace they serve. To do this in a sophisticated way requires a strong degree of community involvement and community participation which we sincerely enjoy.

We pride ourselves in our ability to site buildings well so that they make a positive impact on the urban condition or on the landscape around them. We worry a lot about the building's interaction with the sun, the wind, and the local ecology. We are trying, in every project to create a symbiotic relationship between indoors and outdoors—between man-made and natural.

We love building materials and we have always researched them thoroughly—where they come from, how they are made, how they might be used in a particularly evocative and sensible way. We have tried desperately, no matter what the budget, to build well—to make places that will last a long time and have real durability—technically, functionally and aesthetically.

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We did all of these things long before the term Sustainability came into common usage. But as this broadest definition of Sustainability has emerged, we have embraced it and have benefited enormously from the dialogue it has provoked.

I was asked to show one of our buildings in some depth in this lecture—the recently completed Austin-Bergstrom International Airport—and to describe how it embodies issues of Sustainability. First I should describe the project. This is a 25-gate "start from scratch" airport which has 680,000 square feet of space on three levels in the terminal building and cost \$140 million. It is the first major passenger facility to be constructed in the U.S. since Denver International Airport opened in 1994. It took 2-1/2 years to design the project and three years to build it.

Over the next few minutes I would like to outline eight sets of issues in terms of Sustainability that we explicitly addressed. These are not comprehensive by any means, but I hope they will give a flavor of the way in which this broad, inclusive notion of Sustainability might impact design. The first set of issues had to do with treatment of the site.

The site is a former U.S. Air Force base. The new airport was located here in order to reuse a very high quality 12,250 ft. existing runway, so that even the decision about locating the airport was an act of recycling. Every effort was made to reuse as many buildings on the Air Force base as possible. The main administrative building was converted to a hotel and other ancillary buildings were used for Aviation Department offices. Homes for military personnel on the base were moved to become city-owned low-income housing. Mature trees were carefully surveyed and retained where possible, but over 30 large live oak trees which could not be kept were successfully moved and replanted.

All demolished concrete on the site was recycled as sub-base material on other airport paving projects. All demolished asphalt was recycled as fill. All excavation materials were reused for other projects on the site. Insofar as possible the invested resources on the site were respected and utilized to the fullest extent possible. Two basic tenets of Sustainability—reuse and recycle—led decisions about the site throughout the project.

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A second set of Sustainability issues we dealt with had to do with shaping the footprint and massing of the building on the site. Initial studies for the location and shape of the building were dominated by a pair of important environmental concerns. First, we were intent on keeping the amount of site regrading to an absolute minimum. We also want to avoid dramatic changes in patterns of site runoff and rainwater evacuation. Though this was a relatively flat site, there was still a significant fall across the enormous footprint necessary for the terminal apron and runways. The long, thin shape of the terminal and its orientation was conceived to cut across as few contours as possible requiring dramatically less cut and fill than the initial master plan had called for.

The natural fall of the site was used to our advantage by making the long, thin terminal building a retaining wall and creating a section which nestled into the slope. The airplane apron could then be higher than the baggage claim area, providing a very efficient path for baggage conveyor belts.

Another significant environmental factor shaping the footprint of the building was sun orientation. We knew from the beginning that daylighting would be a very important factor for us in achieving both energy efficiency and the appropriate "feeling" and "spirit" for the terminal. The building was, therefore, stretched very long on the north/south faces and very short on the east/west faces. In our climate, north light is gentle, relatively benign and very useful. South light, if properly shaded, can be beneficial for maximizing light in the winter and keeping out direct sun in the summer. East, and west sun is more difficult to control and west sun especially contributes problematic heat gain in late afternoon in the summer when it is most harmful. So, in the end, the building is almost ten times as long as it is wide in its thickest part. It is an almost perfect sun and light catcher for our climate.

A third critical set of Sustainability issues had to do specifically with heating, cooling and otherwise providing technical systems for the terminal. Natural light is a very important theme for the building and an essential element in conserving energy. In this internally loaded building type where heat is normally generated primarily by artificial lighting, machines and people, rather than from heat gain from the exterior skin, we sought to minimize heat produced

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by light fixtures. By maximizing the benefit from cooler natural light we were able to significantly reduce reliance on artificial light.

Utilizing readily available insulated glass technology we could employ the natural light without excessive heat gain. We have over 102,000 square feet of glass of three different types. One has a ceramic frit. The others are varieties of low-emissivity glass. Windows on the south have 6-foot-deep horizontal sun shades as well as a concentration of the higher-performance low-emissivity glass. Windows on the north side need no sun shades and can even have a somewhat less protective glass. The various glass types and sun shades make a subtle, but complex pattern on the south building facade facing the airfield which contributes visual interest as well as energy performance.

Many other energy saving strategies are employed in the building—a reduction of evening ambient light levels with concentration on task lighting in hold rooms and eating areas; sophisticated automated controls including occupancy sensors, photocells and timers on both lighting and heating/cooling systems; a large ice-storage capability which allows off-peak energy usage; and high-efficiency motors with variable frequency drives in mechanical systems to name a few. The building was conceived from its siting to its massing to its skin to its technological systems as a great efficient machine which first relies on full utilization of natural forces and then supplements these with the most resource-conscious mechanical means possible.

But I certainly do not want to leave the impression that the airport building was viewed simply, or even largely, as a technological machine. Our primary goal was to make it a very personal, user-friendly place which would be embraced by the citizens of Austin as an important public place and a powerful symbol of the city.

In this regard, a fourth set of Sustainability issues in the project had to do with design process and incorporating a broad range of input and involvement. Our client was, in fact the citizens of Austin who voted the bond money for construction. We worked very closely, of course, with the Mayor and City Council, who as elected officials, represented the citizenry. In addition a

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committee of 22 people was appointed to work with us in a much more detailed way. This committee worked very hard over a period of almost two years. As representatives of many diverse constituencies in the city, they helped us understand various points of view. In addition to working with this special committee, we also made dozens of presentations to a range of other groups and committees in the city, so there was very broad community participation.

But the client for the airport was not just the public and their representatives. The building had to respond to very specific needs of the airlines, the rental car companies, concessionaires and various other contractors and vendors who operate out of the terminal. Literally hundreds of hours were spent in meetings with the airlines and other private business ventures trying to understand their specific needs in this building. Going through such an elaborate and complicated input process is essential in order to fully embrace a fifth set of Sustainability issues that have to do with building function.

Virtually everyone we spoke with were not happy with most other airports they had visited or worked in. They strongly emphasized the importance of convenience for passengers. Austin is an origin and destination airport—not one where people are changing planes, but a place where more than 95% of passengers are going from ground transportation to the gate or vice-versa. This means our challenge was to create the very shortest and most direct path possible between the curb and the gate. The basic diagram of the building optimizes that path.

Two entrances at the curb place passengers at the most central access point for all the gates. The building is divided into two distinct parts—landside and airside. As one enters the landside, ticket counters are immediately visible on either end. Baggage claim is in the center in an open well. Straight ahead are security check points, and just beyond that, concessions and the gates.

The nine gates in the crescent-shaped portion of the terminal are used for commuter flights—short hops, often to nearby Houston or Dallas, which depart every hour. The distance from the curb to these gates is just as efficient as possible. Many business people in Austin take these flights two or three times a week for day trips and such ease and efficiency is greatly

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appreciated. Concessions are located immediately adjacent to the hold rooms in the great central space we call the "Marketplace." The process of going through security, checking in at the gate, grabbing a bite to eat or a magazine while waiting to board and then loading the plane is greatly facilitated by this easy, convenient orientation of parts. The atmosphere in the "Marketplace" is lively and urbane. There is café seating dispersed casually throughout the space. A live music stage is in the center of the crescent where Austin's famous music scene is on display in an easy, unpretentious way. There is a good feeling here—friendly, warm, open and inviting.

Another prominent functional concern in the design of the airport was wayfinding. We tried very hard to make the building very transparent and legible to users. We talked a lot about "intuitive wayfinding" where people could see or just have an intuitive sense of where they need to go through cues given by the building. From the entry points we tried to make as many airport functions as possible visible immediately so as to aid in orientation.

Ticketing lobbies are clearly available to one side. Security check points are straight ahead. Concessions and gates are visible just beyond that. Even baggage claim can be easily located down below—not in the kind of low-ceiling basement common in many terminals, but in a bright, open room which contributes to the liveliness and "action" of the larger building.

As you move through the terminal, the notion of "intuitive wayfinding" continues. The crescent shape helps to locate you in the large central room. Even when you first exit off the airplane you know where you are in relation to the center and the entry/exit points, just by the shape of the space. Wayfinding is, of course, additionally supplemented by clear, well-located signage.

A sixth set of Sustainability issues which helped formulate the airport's design had to do with materials selection. At every stage an effort was made to employ materials which had low levels of embodied energy, came from renewable sources, minimized negative impact on air quality both in the manufacturing process and as installed, and would last a long time with minimum reinvestment in maintenance and replacement. These were tough issues to deal with in an airport where use is both demanding and constant.

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Steel for the project, which is the predominant structural material is 95% recycled. Concrete, which is used primarily for piers providing lateral bracing, employs fly ash to replace part of the cement. The primary finish material both inside and out on the landside portion of the building is a local Texas granite quarried about 50 miles from the site. Its toughness in an environment of carts, baggage and jet fuel exhaust is crucial. It is used in thick slabs to increase durability and longevity. Corners are made of solid L-shaped pieces for protection from impact. Because the granite is local embodied energy from transportation is minimal. We were able to work very closely with the quarry to employ the material in a way which minimized waste in the production process and gave us excellent color and texture consistency.

Inside the terminal, every effort is made to minimize redundant systems with their wasteful duplication of materials. Avoiding hung ceilings wherever possible resulted in a reduction of initial resource consumption as well as elimination of one of the elements of building assembly which deteriorates most rapidly. Steel decking and framing becomes the finish material throughout much of the public space of the building.

Where interior finish materials are required, they are chosen to complement the steel frame and granite piers and walls. Wood is used extensively, but always high on walls or ceilings so as not to be vulnerable to impact damage. All wood products were supplied from controlled growth forests. Much of the warm, wood-feel of the building actually comes from MDF (medium density fiberboard) which is made of waste material from wood processing. It is used frankly with a clear finish which exposes its character as a wood material, but also a modern industrial product.

Another common wall material in public spaces is sisal—a natural fiber which is tough like rope. It can easily take the abuse required, but is also warm and rich in its color and texture. Seams, which are the least durable part of a sisal assembly are avoided by placing sisal panels in a stainless steel framework. The metal angles serve to keep carts and bags from banging against the wall as well as protecting vulnerable joints. The idea, well illustrated in this assembly, is to use natural materials with low embodied energy, detailed in such a way as to last for many years and not require wasteful replacement.

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For areas where eventual replacement is almost inevitable, our emphasis was on recycling. Toilet partitions and benches, for example, are made of recycled materials. Carpet, which is only used in low-traffic areas, is all recyclable. In these and other manufactured products there was great concern with chemical content. We avoided urea formaldehyde, for example, in the MDF. We used paints and other coatings which were water based and have low or no-volatile organic compounds (VOC's).

Throughout material selection we kept a keen eye on where materials came from, how they were manufactured, how long their life-expectancy might be and where they might be reincarnated into future useful products.

The seventh set of Sustainability issues we addressed had to do with the building embodying a sense of place. I was delighted that one of the six "Competing Logics" of Sustainable Architecture described in the *Journal of Architectural Education* article I mentioned earlier focused on buildings responding to "regional context" and adapting themselves to "local physical and cultural characteristics" I strongly believe that, in order for a building to be truly Sustainable, it must become an integral part of its physical and cultural context. It must embody a tangible sense of locality and place.

If we believe in the conservation of the richness and diversity of life on this planet, that should include protecting human cultural diversity. Any model of ecological sustainability must incorporate a retention of meaningful local cultures which enrich and sustain the long-term health and breadth of perspective on the planet. I am, in fact, very fond of the local physical and cultural context in Austin and enjoy very much the opportunity to try to infuse some of its vitality into architecture. The airport was an extraordinary opportunity in this regard. This is the gateway to our city and the one single place where more citizens come and go every day than any other. If any building should embody the culture of Austin, this one should.

We explicitly tried to incorporate several cogent characteristics of our region in the design of the airport. The natural landscape in the central Texas Hill Country is very rich and particular. It is an unusual amalgam of toughness, ruggedness and strength alongside beauty, frailty and

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vulnerability. We dearly love our landscape in Central Texas and we like to spend a lot of time outdoors inhabiting it. Our creeks and rivers and streams especially sometimes take on mythic proportions becoming resources for recreation and social life. We have focused much of our identity as a city on outdoor places like Barton Springs Pool and Town Lake Park where the natural environment has spawned an open, friendly, congenial way of life. We are a real outdoor sports and recreation city but with an emphasis on participating sports rather than spectator sports. We are one of the few cities our size in the U.S. with no professional sports teams, and our big local athletic hero is bicyclist Lance Armstrong.

We have a very diverse population ethnically and, mostly, we thrive on the differences in our backgrounds. We're a pretty tolerant city with a great appreciation for our various heritages and traditions. I think it is partly that same tolerance and appreciation that has generated a very lively and eclectic music and entertainment scene in Austin that ranges from country and western to blues and jazz to pop and rock. The 6th Street historic district downtown is our party room and the focus for a very vital and vibrant public life.

We are also the state capital, home to the state's flagship university and a long-time center for history and government as well as for research and education. In the last few decades we have extended those longstanding roles to become a center for high tech industry. Dell Computers began and is currently headquartered in Austin along with hundreds of other software and hardware firms. But technology in Austin extends well beyond digital and electronic technology. As a city we depend on intellectual capital. We have a highly educated populace with a real bent toward logic, analysis, and creativity. These are all very challenging cultural characteristics to try to incorporate into an airport.

We addressed Austin's love of nature mostly by creating a building that opens generously out to nature and the outdoors. As a local newspaper review noted when the building opened, "It feels like you are outdoors even when you are indoors." This is in stark contrast to many airports which seem to be an interminable maze of corridors and internal rooms. We even thought of the big trusses in the central space as tree-like with lots of complex pieces growing out of a central trunk and providing a canopy for the well-lit space below. We planned that big,

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almost outdoors, space to house the kind of informal social scene we so appreciate in Austin, and that has really happened. There is a very Austin kind of atmosphere—great food provided by local eateries like Salt Lick Bar-B-Que, Matt's El Rancho Mexican Food, and Amy's Ice Cream in a relaxed café kind of setting. It is an unusually relaxing and stress-free airport environment which seems right for a city which prides itself in being "laid-back." There is even a stage in the center of the marketplace for live-music performances and a series of exhibit cases that highlight landmark events, mostly in music and entertainment.

Another tie to nature comes, of course, in the extensive use of the local granite. It delivers the sense of toughness and ruggedness in our landscape, especially when placed in contrast with sleeker, more high-tech materials. We commissioned a series of carved glyphs in the granite executed by local artisan Phillippe Kleinfelter who is a real expert in the carving traditions that are a part of our local Mexican heritage. The glyphs depict leaves and seed pods of local trees—the same series of local trees like live oak, pecan and mesquite that were used to name the original east/west streets in the 1839 plan of Austin. The story of that original plan and its references to nature—not only in naming east/west streets for trees but also in naming north/south streets for the rivers of Texas—is told in a series of terrazzo murals on the floor in the baggage claim area.

Throughout the airport artwork and craftsmanship is used to embody cultural values. Murals depict Enchanted Rock a landmark granite formation made of the same stone as the building, or a lyrical series of scenes of a Hispanic family having a backyard picnic. An outdoor sculpture is based on seed pods of local flora. The grab-bar on stair rails is made of a hand-forged piece of steel made by local artisan Lars Stanley. It gives a softer, more humane, touch where the body comes in contact with the building. The hand-rail in general provides just the kind of high-tech/high-touch combination Austin is known for.

The intellectual/analytical/high-tech ethos of Austin is also present everywhere in the building. There is a clear tectonic nature of the structure which expresses logically how it is put together and how it works in a technical sense. It is also a precise structure, clean and exact. One

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observer described it to me as "mind candy" with lots of interesting pieces and details to be intrigued by.

The eighth and final Sustainability issue we addressed in the airport dealt with security. Certainly one could not imagine creating a building of this type in the current era lasting over a long period of time without providing a range of security options, and this we certainly did. I am very pleased to say that the transition from relatively permissive security measures prior to September 11 to very stringent security measures now was accomplished quite gracefully. In terms of building operation only two significant features were altered. The curbside baggage check-in potential which we had provided was discontinued and all baggage check-in was moved to ticketing counters which had been provided with plenty of capacity to absorb the change. In addition, no one besides authorized personnel and passengers were allowed to go beyond security check-points so that meeters and greeters must now stay on the land side. This has required very little accommodation beyond a bit fuller utilization of commercial spaces which had been designed for the land-side.

Flexibility of this sort is very much a Sustainability issue. Change is inevitable, and in a world where political events can have the kind of worldwide ramifications we have recently observed, we must design for multiple scenarios of use and we must build in capacities that allow change to occur commodiously.

I know it is unusual in a lecture like this to spend so much time on one building and I hope I haven't bored you with this level of detail. Actually, of course, full discussion of any one of these sets of sustainability issues could have consumed the whole time period because each represents a great deal of thought and research.

I think focusing on this one building however and talking about it as a broad, multifaceted design enterprise is very much the point of the lecture. In all of our work we are trying to approach architecture as a pluralistic discipline. We refuse to "ignore many aspects of a building" in order to make our buildings more "potent" as Paul Rudolf's advocated. We revel in the various competing logics of design and enjoy very much grappling with the messy conflicts

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inherent in any full-bodied design process. We pride ourselves in making buildings that are responsive and particular to their circumstances and are not just signature pieces of their designer.

As a body our work is therefore quite varied and diverse. We certainly would not do a hunting lodge that looked anything like a convention center and we would not do a building on a tight urban site that looked anything like a building in a rural environment. From my point of view, it would not make sense to do a building in Japan like you would in Texas. Each building and place must find its own life and vitality, and it is our job as architects to search for that.